2022 OKLAHOMA DEPARTMENT OF TRANSPORTATION HERBICIDE PROGRAM REPORT

ANNUAL PROJECT STATUS REPORT ~ FFY 2022

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Submitted to:

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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1.0 INTRODUCTION

The Oklahoma Department of Transportation (ODOT) uses Integrated Vegetation Management (IVM) practices in the management of its right-of-way. IVM allows for inclusion of changes in priorities as well as adoption of new techniques over time. Properly vegetated roadsides minimize soil erosion and protect paved surfaces. IVM includes selection, establishment, and management of well-adapted plant species through integration of mowing, chemical weed control, and hand removal of weeds in specific circumstances. Proper mowing and herbicide programs favor the selected desirable species and hinder nuisance and noxious weed species. In recent years, reduced mowing frequency has been practiced in some areas outside of the safety zone due to limited budget and in a small number of areas due to an attempt to improve pollinator habitat. Reducing maintenance inputs in certain areas has allowed reinvestment in labor to other areas, such as paved surface upkeep.

The Annual ODOT Herbicide Program Survey was again conducted in 2022. ***The purpose of the survey was to document herbicide use trends as well as the successes, failures, and/or challenges of the IVM weed control program and to use this information in providing recommendations for improvement of future weed control and vegetation management efforts.*** This report can also help identify emerging weed problems and possible needs for future education and vegetation management research.

1.1 OBJECTIVES

The objectives of the 2022 ODOT Herbicide Program Survey were to: document the herbicide treatments used, treatment use rates, weeds targeted, application timing, acreage treated, perceived weed management performance, management practices, and to make suggestions for improvements (where needed) to each field district's IVM program.

1.2 BACKGROUND

Each ODOT field district makes IVM decisions that are somewhat independent of other field districts. Due to this decision-making process, we attempted to minimize comparisons between field districts in this report. We attempted to document the progress of each field district on its own merit, considering the unique management situations and goals within each field district.

We are aware that each field district's herbicide program may have special considerations that are unknown to the authors of this report. If there is disagreement by field district personnel concerning our comments or recommendations, we ask that we can review

those comments and respond, adjusting if appropriate. We encourage suggestions as to how this report can be made more informative and useful to ODOT.

We would like to thank those individuals who supplied information for their participation in this year's survey. Without the survey data they supplied and subsequent meetings with field district maintenance engineers, other maintenance personnel as well as county/unit superintendents, this report would not reflect the entire ODOT herbicide program effort. We would also like to thank the ODOT Office of Implementation and Research as well as the Federal Highway Administration and the staff thereof for the funding that allowed for this annual survey to occur.

2.0 METHODS

For FY2022, the Annual Herbicide Survey was broken into two surveys: Part 1 evaluated the IVM programs from September 1, 2021 to April 30, 2022 and Part 2 evaluated the IVM programs from May 1 to August 31 of the current federal fiscal year. Instead of a physical survey, the survey for FY2022 was developed using Microsoft Forms which significantly decreased the hours spent during survey development and increased the completion compliance of ODOT supervisors. We were also able to gain metrics on the amount of time it took to complete the survey which meant we were able to determine the survey's work burden on ODOT staff. ODOT district maintenance personnel were sent Part 1 of the 2021 Herbicide Program Survey form (found in Appendix A) by email on June 1, 2022. In that email the field district maintenance leaders were asked to distribute a link of the survey to each of their county and interstate maintenance unit superintendents. Page one included general instruction to county superintendents or their appointees and were asked to complete all questions on the document about roadside vegetation management practices from September 1, 2021 – April 30, 2022. We requested submission of the completedsurvey by June 17, 2022.

Part 2 of the Herbicide Survey included questions pertaining to the weed management practices from May 1, 2022 to August 31, 2022. The survey asked questions regarding general management maintenance practices, who and how optimal conditions were determined for herbicide applications, safety practices, number and condition of complaints, quality, problem weeds, mowing conditions and pesticide program for any brush control, bareground, johnsongrass, crack and seam treatments, and applications made using wiper technologies (wiper).

A list of weeds that an herbicide registrant feels that the herbicide will control (at specific rates) is listed on all herbicide labels. For the purposes of this survey, a rating of 'Good' meant 80 – 100% target weed control, 'Fair' meant 50 – 79% control and 'Poor' meant a rating of 0 - 49% control of the target weed species that the user intended to control and that were listed on the herbicide label or combination of tank mix herbicide labels. If 'Fair' or 'Poor' ratings were assigned to a treatment, an explanation was requested for additional information to help identify specific weeds that were not controlled satisfactorily. This information will further help the OSU-

RVM team investigate treatment performance leading to additional recommendations to remedy problems.

Herbicides used by ODOT and recommended by the OSU-RVM team are expected to control the weeds listed as being 'controlled' on their labels as opposed to suppressing their growth. It is important for applicators to note any failures of an herbicide treatment to control species that are listed as being controlled on the herbicide labels. Failures may be an indication of herbicide resistance or specific adjustments that may need to be initiated to application methodology to achieve expected or improved weed control. Only a small amount of weed escapes are expected to be herbicide-resistant weeds. It is not until other possible failures, including calibration, pesticide selection, rate selection, canopy shielding/spray droplet interception, or problematic weather conditions have been excluded as plausible explanations that herbicide-resistance should be considered.

Results of the survey were summarized by field district and unit for this report. Data was then presented in tabular form for each field district and for a state-wide summary. Comments and recommendations were made for each field district to assist field district personnel in solving challenges that became apparent after reviewing the 2021 survey results. In-person interviews with field district personnel were conducted during the Fall of 2021. Discussions and recommendations made at these field district meetings are included in this report following the survey results.

To promote a better understanding of herbicides and their active ingredients, we have listed the product's brand or trade name and the common name of the active ingredients in Table 1a. In our discussions of district herbicide programs, our discussion will focus on the branded products utilized by ODOT. For example, Roundup Pro Concentrate®, Honcho Plus®, and Ranger Pro® are trade names of herbicides that contain the active ingredient glyphosate. Each field district's Summary Table will reference the specific product trade name used by the field district. In the supportive text, the brand name and common name are listed upon first reference in each chapter. In Table 1b we list the adjuvant use-type, adjuvant brand names and their respective manufacturers.

Table 1a. Herbicide Active Ingredient Common Names, Brand Names, and Manufacturers Listed in the 2021 ODOT Approved Herbicide and Adjuvant List (AHAL) That Was Used During the 2021/22 Vegetation Treatment Season.

Product Type	Active Ingredient(s) Common name	Brand Name	Manufacturer/ Distributor
Herbicide	aminocyclopyrachlor	Method® 240 SL	Bayer ES/Envu
Herbicide	aminopyralid	Milestone®	Corteva AgriSciences/ Dow AgroSciences
Herbicide	aminopyralid/metsulfuron	Opensight®	Corteva AgriSciences /Dow AgroSciences
Herbicide	clopyralid	Transline®	Corteva AgriSciences /Dow AgroSciences
Herbicide	dicamba	Banvel®	Arysta
Herbicide	Dicamba + diflufenzopyr	Overdrive®	BASF
Herbicide	diglycolamine salt of dicamba	Vanquish®	Nufarm
Herbicide	diuron	Diuron 80 WDG	Loveland Industries
Herbicide	fluroxypyr	Vista® XRT	Corteva AgriScience/ Dow AgroSciences
Herbicide	fosamine	Krenite® S	Bayer/ Dupont
Herbicide	Foramsulfuron + iodosulfuron-methyl + thiencarbazone-methyl	Derigo®	Bayer
Herbicide	glyphosate	Ranger® Pro	Bayer CropScience LP
Herbicide	glyphosate	Roundup® Pro Concentrate	Bayer CropScience LP
Herbicide	glyphosate	Honcho® Plus	Bayer CropScience LP
Herbicide	glyphosate (aquatic)	AquaMaster®	Bayer CropScience LP
Herbicide	glyphosate (aquatic)	Roundup® Custom	Bayer CropScience LP
Herbicide	glyphosate/2,4-D	Landmaster® BW	Albaugh
Herbicide	glyphosate/2,4-D	Imitator + 2,4-D	Drexel
Herbicide	imazapic	Plateau®	BASF
Herbicide	imazapyr	Arsenal®	BASF
Herbicide	Imazapyr	Imazapyr 4SL	Alligare, LLC
Herbicide	imazapyr (aquatic)	Habitat®	BASF
Herbicide	Imazapyr (aquatic)	Ecomazapyr 2 SL	Alligare, LLC
herbicide	indaziflam	EsplAnade® 200 SC	Bayer ES/ Envu

Table 1a Continued on Next Page

Table 1a (Continued) Herbicide Active Ingredient Common Names, Brand Names, and Manufacturers Listed in the 2021 ODOT Approved Herbicide and Adjuvant List (AHAL) That Was Used During the 2021/22 Vegetation Treatment Season.

Herbicide	metsulfuron methyl	Escort® XP	Bayer/ Dupont
Herbicide	Nicosulfuron + metsulfuron	Pastora®	Bayer/ Dupont
Herbicide	MSMA	MSMA 6.0 Plus	Drexel
Herbicide	MSMA	Weed-Hoe® 108	Albaugh
Herbicide	MSMA	Target® 6 Plus	Luxembourg-Pamol
Herbicide	picloram	Tordon K®	Corteva/ Dow AgroSciences
Herbicide	picloram	Tordon 22K®	Corteva/ Dow AgroSciences
Herbicide	picloram	LANDVisor 22K	Corteva/ Dow AgroSciences
Herbicide	sulfometuron	Oust® XP	Bayer/ Dupont
Herbicide	Sulfometuron + metsulfuron	Oust® Extra	Bayer/ Dupont
Herbicide	Sulfometuron + metsulfuron-methyl	SFM Extra	Alligare, LLC
Herbicide	Sulfosulfuron	Outrider®	Monsanto/ Valent
Herbicide	Sulfometuron	SFM 75	Alligare, LLC
Herbicide	triclopyr amine salt	Garlon® 3A	Corteva AgriSciences /Dow AgroSciences
Herbicide	triclopyr choline salt	Vastlan®	Corteva AgriSciences /Dow AgroSciences
Herbicide	triclopyr ester	Garlon® 4 Ultra	Corteva AgriSciences /Dow AgroSciences
Herbicide	triclopyr ester	Pathfinder® II (RTU)	Corteva AgriSciences /Dow AgroSciences
Herbicide	prodiamine	Prodiamine 65 WDG	Quali-Pro/ Makhteshim Agan of North America, Inc.

Table 1b. Adjuvant Types, Brand Names, and Manufacturers Listed in the 2021 ODOT Approved Herbicide and Adjuvant List (AHAL).

Product Type	Brand Name	Manufacturer/ Distributor
Liquid Non-ionic surfactant (adjuvant)	SurfKing® Plus	Winfield Solutions
	RRSI (Red River 90®)	Red River Specialties
	Timberland 90®	UAP
	AD-Spray 80®	Helena
Liquid non-ionic surfactant aquatic (adjuvant)	Aqua King®	Winfield Solutions
	RRSI NIS (Red River 90)	Red River Specialties
	Timberland 90®	UAP
	Induce®	Helena
liquid drift control (adjuvant)	Control®	GarrCo Products, Inc
	Corral® Poly	Winfield Solutions
	Droplex®	Winfield Solutions
	Pointblank® WM	Helena
	Reign LC	Loveland Products
	LOX	Drexel Chemical Co.
dry ammonium sulfate (adjuvant)	Royal AMS®	Winfield Solutions
	APF AMS®	Winfield Solutions

3.0 SURVEY OF DISTRICT 1 HERBICIDE PROGRAMS

3.1 Herbicide Program Survey Results

3.1.1 September 1, 2021 to April 30, 2022

All ten units completed Part 1 of the herbicide survey. Eight of ten units were able to start their Late Winter/Early Spring Herbicide Program. Adair and Cherokee counties were not able to start their Late Winter/Early Spring program due to a lack of herbicide availability.

Adair and Cherokee counties reported a decline in their right-of-way quality and earlier mowing events during the spring due to the lack of herbicide. Both units reported desirable grasses looked worse, more weeds were present in the spray zone, and their desirable ground cover was covered by more weeds.

Since Adair and Cherokee counties did not make herbicide applications between September 1, 2021 and April 30, 2022 the remaining comments about the herbicide program is related to the eight remaining units who did make herbicide applications.

Proper recordkeeping is a requirement for all certified applicators as written in the *Oklahoma Combined Pesticide Law and Rules*. Those records must be maintained and available upon request by ODAFF for a minimum of two years. All eight units that applied herbicide kept records for each tank load and felt confident all records could be produced if requested by ODAFF. The person(s) who made the pesticide application are responsible for completing the pesticide record. Those records are maintained by a variety of individuals within District 1. Secretaries maintained records for Muskogee County, Adair County, Sallisaw Interstate and Checotah Interstate. Superintendents maintain spray records for Wagoner and Haskell counties. The person(s) who made the pesticide application maintains records in Okmulgee and Sequoyah counties. There are no official guidelines regarding who should maintain those records. It is important that all units recognize who is responsible for those records, can be found quickly if required, and there is a contingency plan in place should that person leave that position.

Precision monitoring decides were used by McIntosh, Muskogee, Sequoyah counties, and the Sallisaw Interstate. Speed monitoring was believed to have the possibility of improving the accuracy of a pesticide application by all units except Sequoyah County and the Checotah Interstate units. Okmulgee and Adair counties believed precision monitoring devices might help their pesticide program. More accurate pesticide applications were mentioned by five units as a positive outcome associated with precision monitoring devices with cost mentioned by Wagoner County and signal reliability mentioned by Adair County as potential outcomes. Five units noted no disadvantages to the use of precision monitoring devices.

Sallisaw Interstate planned on increasing the amount of wiping that was performed during the 2022 growing season. The remaining units had no plans of increasing the amount of wiping performed during the growing season because of the herbicide shortages.

Most units in District 1 were able to begin their Late Winter/Early Spring herbicide program. Cherokee and Adair counties did not begin their Late Winter/Early Spring herbicide program. The remaining units used a Landmaster BW (3 pts/A) + AMS (15.6 – 27.2 lbs/100 gal) herbicide program for the treatment of winter annuals. Sequoyah County used 27.2 lbs/100 gal

tank mix. Although not a significant cost associated with the increased rate, it is not known if using rates higher than 17 pounds/100 gal increases efficacy of Landmaster BW. The industry standard is 8-17 pounds/100 gal. District 1 treated 1,137.52 center lane miles with a total of 3,737.05 acres treated.

3.1.2 May 1, 2022 to August 31, 2022

All units (10 of 10) responded to Part 2 of the Herbicide Survey, which asked participants to consider the period between May 1 and August 31, 2022. Most units were not able to begin an herbicide program of any kind during the surveyed period. Only the Muskogee, Sallisaw, and Checotah units were able to begin any herbicide treatment between May 1 and August 31st of 2022. Furthermore, only Muskogee County was able to begin their broadcast program during the surveyed period.

The broadcast program for Muskogee County treated less than 30% of their intended area using Roundup Pro Concentrate (13 fl oz/A) + Oust Extra (1.5 oz/A) + Escort XP (0.25 oz/A). In total 120 acres were treated across 15.5 lane miles (Table 2b). No other units made a broadcast herbicide application for their summer johnsongrass/broadleaf program.

Superintendents reported pesticide availability and drought conditions continued to play a significant role in limiting the amount of herbicide being applied to the right-of-way.

Although herbicides were not used by all units, the drift risk advisor was still checked by Muskogee, Sequoyah, and Checotah. District 1 was in a unique location to experience excessive rain and significant drought in late spring and into the summer.

Safety mowing events were not conducted by most units. Wagoneer, Haskell, and McIntosh counties did not provide start dates for their safety mowing date. Although most united began their first safety mow in the first or second week of May. Adair was the earliest unit (4/18/2022) whereas Okmulgee was the last unit to begin their safety mow (6/1/2022). Most units mowed about the same amount as they had previously and at a cut height of 4” to 6”.

3.2 Comments and Suggestions from OSU Personnel

An in-person meeting was held between the RVM team (Dr. Connally and Mr. Gerken) and Mr. Jonathan Arps of District 1 October 13, 2022.

A review of the herbicide program did show a substantial decrease in treated area for the Summer of 2022. Much of this was noted to the ongoing drought conditions and a lack of herbicide availability. These conditions were consistent among the other districts throughout Oklahoma.

Drought conditions resulted in significant challenges to every herbicide program being applied throughout the state. By the end of the summer of 2022 over 80% of the state was in Severe or Exceptional drought; the two most extreme categories of drought with very little water being plant available.

Although herbicide was not readily available to District 1, the potential negative impact of that lack of herbicide program was buffered due to the significant drought. Under drought conditions herbicides are not absorbed as readily by the plant. Plants should be green and actively growing to be absorbed herbicide most effectively.

During the meeting the impact of the CCA Agreement on District 1's management program was discussed. It is our understanding that the agreement has prescribed windows for mowing based on latitude; however, those limitations do not exist of herbicide applications for invasive species. Although not a noxious weed, therefor it does not require immediately eradication, johnsongrass can infest a Monarch Habitat CCAA area rapidly. It would be highly advised to have a management program in place specifically for the Monarch Habitat CCAA areas, which may include the use of wiper technologies.

The final topic that was discussed was the cable barrier treatments and their rotation modes of action. At this time Mr. Arps and Dr. Connally are in close contact to formulate the best time to apply Esplanade 200 SC as a pre-emergent based on 3-d average soil temperatures taken at 2 inches using the Oklahoma Mesonet stations. Soil temperatures are more stable over a wide area. To lessen potential of development of herbicide resistance, District 1 has been using Milestone herbicide. A new product was discussed with Mr. Arps on October 19 which includes Promenade herbicide (active ingredient fluroxypyr) and imazapyr. This combination could provide better control of weeds along the right of way. Product is being sent to OSU to test its use in the right-of-way. This is a year in which District 1 will being using Milestone to treat their cable barrier. Mr. Arps agreed to find section of road to test this product for its potential use as a cable barrier/guardrail treatment as a herbicide rotation.

Keeping employees away from dangerous situations such as string trimming around guardrails and cable barriers has been an expressed concern over the last several surveys. To achieve the expressed goals of a bareground treatment in millings while keeping employees from needing to string trim areas around the cable barrier support posts the use of a pre-emerge herbicide was suggested and has been used over the last three years. It was felt the new program was successful and would be continued.

Table 2a. Summary of District 1 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Winter Annual Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Adair	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Checotah Interstate	Landmaster BW (3 pts/A) + AMS (15.6 lbs/100 gal) Fair	245	600	60 A 25 GPA	03/16/2022 03/28/2022	Prior to Greenup
Cherokee	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Haskell	Landmaster BW (3 pts/A) + AMS (17 lbs/100 gal) Fair	65	360	60 A 25 GPA	04/14/2022 04/21/2022	Prior to Greenup
McIntosh	Landmaster BW (3 pts/A) + AMS (17 lbs/100 gal) Good	11.52	445	40.5 A 37 GPA	04/13/2022 04/26/2022	Prior to Greenup
Muskogee	Landmaster BW (3 pts/A) + AMS (17 lbs/100 gal) Good	36	960	60 A 25 GPA	03/31/2022 03/29/2022	Prior to Greenup
Okmulgee	Landmaster BW (3 pts/A) + AMS (17 lbs/100 gal) Good	60	180	60 A 25 GPA	04/19/2022 05/12/2022	Prior to Greenup
Sallisaw Interstate	Landmaster BW (1.5 fl oz/A) + AMS (17 lbs/100 gal) Good	220	220	60 A 25 GPA	03/03/2022 03/29/2022	Prior to Greenup

Table 2a Continued on Next Page

Table 2a. (Continued) Summary of District 1 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Winter Annual Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Sequoyah	Landmaster BW (3 pts/A) + AMS (27.2 lbs/100 gal) Good	360	560	62 A 38 GPA	04/01/2022 04/06/2022	Prior to Greenup
Wagoner	Landmaster BW (1.8 pts/A) + AMS (17 lbs/100 gal) Fair	245	412.05	60 A 30 GPA	04/18/2022 05/03/2022	Prior to Greenup
	TOTALS[6]	**1,242.52**	**3,737.05**			

[1] Treatment location of herbicide application is noted below tank mixture for winter annual weed control as a broadcast treatment. AMS = Ammonium Sulfate, a water conditioning agent. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 2b. Summary of District 1 Herbicide Survey Results for Brush, Guardrail, and Cable Barrier Control.

County/ Interstate Unit	Brush, Guardrail, or Cable barrier Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Adair	Not Treated	0	N/A	N/A		
Checotah Interstate	Not Reported Fair	NR			08/01/2022	
	Roundup Pro Concentrate (13 fl oz/A) + Oust Extra (1.5 oz/A)	NR		NR 25 GPA		
Cherokee	Not treated	0	N/A	N/A		
Haskell	Not treated	0	N/A	N/A		
McIntosh	Landmaster BW (3 pt/A) + AMS (17 lbs/100gal) Guardrail: Good	11.65			04/13/2022 04/26/2022	
	Landmaster BW (3 pt/A) + AMS (17 lbs/100gal) Cable barrier: Good	17			04/13/2022 04/14/2022	
Muskogee	Not treated	0	N/A	N/A		
Okmulgee	Not treated	0	N/A	N/A		

Table 2b Continued on Next Page

Table 2b. (Continued) Summary of District 1 Herbicide Survey Results for Brush, Guardrail, and Cable Barrier Control.

County/ Interstate Unit	Brush, Guardrail, or Cable barrier Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Sallisaw Interstate	Roundup Pro Concentrate (11.25 gal/tank) Guardrail: Good	15			04/08/2022 04/25/2022	
	Roundup Pro Concentrate (11.25 gal/tank) Cable barrier: Good	68			04/18/2022 04/25/2022	
	Roundup Pro Concentrate (10.67 fl oz/A) + Oust Extra (8 oz/A) Fair	48	58	60 A 25 GPA	02/15/2022 02/16/2022	
Sequoyah	Not Treated	0	N/A	N/A		
Wagoner	Landmaster BW (16 fl oz/A) + AMS Guardrail: Fair	10	N/A		04/18/2022 05/03/2022	
	Landmaster BW (16 fl oz/A) + AMS Cablebarrier: Fair	5	N/A		04/26/2022 04/26/2022	
	TOTALS[6]	**174.65**	**58**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 2c. Summary of District 1 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Percent control[2]	Center-Lane Miles Treated (CLM)	Broadcast Treated Acres	Wiper Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[3]	Treatment Window, Start to End mm/dd/yyyy	Suggested Window Start to End[4] (mm-dd)
Adair	Not Treated	0	0	0	NA	NA	
Checotah I-40	Not Treated	0	0	0	NA	NA	
Cherokee	Not Treated	0	0	0	NA	NA	
Haskell	Not Treated	0	0	0	NA	NA	
McIntosh	Not Treated	0	0	0	NA	NA	
Muskogee	Roundup Pro Concentrate (13 fl oz/A) + Oust Extra (1.5 oz/A) + Escort XP (0.25 oz/A) Good	15.5	120	0	60 A 25 GPA	06/20/2022 06/20/2022	
Okmulgee	Not Treated	0	0	0	NA	NA	
Sallisaw I-40	Roundup Pro Concentrate Wiper	N/A	0	NR	NA	NA	05-01 09-01
Sequoyah	Not Treated	0	0	0	NA	NA	
Wagoner	Not Treated	0	0	0	NA	NA	
	TOTALS[5]	**15.5**	**120**	**NR**		**District Total Treated Acres[6] 3,915.05**	

[1]Johnsongrass treated using a broadcast application method unless otherwise stated below the tank mixture. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3] Carrier rate is reported in gallons per acre (GPA). [4]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [5]Total treated acreage for johnsongrass. [6]Cumulative total of all acres treated for weeds in District 1 from Tables 2a, 2b, and 2c.

4.0 SURVEY OF DISTRICT TWO HERBICIDE PROGRAMS

4.1 HERBICIDE PROGRAM SURVEY RESULTS

4.1.1 September 1, 2021 to April 30, 2021

All units (10 of 10) completed Part 1 of the IVM survey. Proper recordkeeping is a requirement of all certified applicators as defined in the *Oklahoma Combined Pesticide Law and Rules*. The individual who completes the spray record is the person(s) who made the application. For most units, the person(s) who made the application is responsible for maintaining those records. For Bryan and Pushmataha counties, the superintendent was responsible for record maintenance. McCurtain County placed that responsibility with the secretary. All units felt confident they could produce all spray records over the last 2 years should those records be requested by ODAFF.

Speed monitoring devices have been used by ODOT for several decades but fallen into disrepair and not replaced. Bryan, Leflore, and Marshall counties were the only counties who have operational speed monitoring devices. Only Atoka County did not feel a speed monitoring would aide their herbicide program. Choctaw, Leflore, Marshall, McCurtain, and Pushmataha counties felt speed monitoring devices would aide their herbicide program. Units mentioned more accurate speed monitoring, even distribution, controlling speed, and distance monitoring. Negative impacts mentioned included possible distraction, cost, user friendly interface, and lose power if not charged.

Knowing the weather is a label requirement for all herbicides. This is generally seen as wind and/or temperature restrictions. All units used the Oklahoma Mesonet to monitor their weather conditions. The Drift Risk Advisor was used by all units except Atoka County. The Drift Risk Advisor was included with the spray records of all units except Atoka County and Talihina. All units who used the Drift Risk Advisor checked after 24 hours to get updated conditions. As a result of weather monitoring, all units modified their actions. This could occur as delaying or cancelling an intended spray event.

Cleanup mowing events began after September 1st in Choctaw, Latimer, Leflore, and Pushmataha counties. Bryan County listed the start of their cleanup mow as June 14, 2022 (which was outside the survey window). Pittsburg and Pushmataha County began their clean up mows on 10/1/22 and 10/3/22, respectively. Latimer County began their cleanup mow 9/13/2022. Safety mowing events were performed by Choctaw, Latimer, Leflore, and Pushmataha counties. Choctaw, LeFlore, and Pushmataha counties performed 1 safety mowing event on 9/2/2022, 10/29/2021, and 12/3/2022, respectively. Latimer County performed 2 safety mows on 9/13/2021 and 10/22/2021.

All units in District 2 were able to begin their Late Winter/Early Spring herbicide program. All units used a Landmaster BW (2-2.3 pts/A) + AMS (15.9 – 17 lbs/100 gal)

herbicide program for the treatment of winter annuals (Table 2a). Atoka County also applied Roundup Pro Concentrate (1 pt/A) for the treatment of winter annuals. Although not all units were at exactly 17 lbs/100 gal as recommended in the E-958, they were well within industry standards of 8-17 pounds/100 gal to increase the performance of lower use rates of glyphosate. District 2 treated 1,680.2 center lane miles with a total of 9,920 acres treated for winter annuals.

4.1.2 May 1, 2021 to August 31, 2021

All units in District 2 completed their annual IVM program survey. District 2 was less affected by industry-wide herbicide shortages that had affected other units due to the supply methodology used by the District's warehouse. Due to weather, total treated acres were lower than in previous years. LeFlore and Marshall counties did not treat their right-of-way and Bryan treated very little of their acres resulting in 5,348 acres of District 2 spray zone being treated for johnsongrass. The primary tank mix used was Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (0.8 – 1.64 oz/A) with Talihina also using 1 pint of Garlon 4 Ultra per acre with their broadcast application targeting johnsongrass and summer broadleaf weeds. The use of a wiper was lower than in previous years. Only McCurtain County reported using their wiper. Everyone except Pushmataha County reported good control with their herbicide program. Pushmataha County reported the ragweed was 'out of control'.

Every unit consulted the drift risk advisor and monitored weather conditions. Weather factors that most negatively impacted the ability to make herbicide applications were primary win and drought. All units except Atoka County printed off the Drift Risk Advisor and included it as part of their spray records.

Mowing events began in District 2 were first as safety mowing events that started in the second week of June for most units but as early as 31 May in McCurtain County and as late as 15 June in Marshall County. Only one safety mow was performed by most of District 2. Pittsburg and Pushmataha counties did not report any safety mowing events. All units mowed at least 7".

4.2 COMMENTS AND SUGGESTIONS FROM OSU PERSONNEL

The 2021-22 Post Herbicide Survey meeting with Oklahoma Department of Transportation (ODOT) District Two was held via Zoom on October 31, 2022.

The meeting was led off by Dr. Connally discussing current drought conditions for Oklahoma and how this has impacted herbicide application programs throughout the state. There was further discussion on soil moisture conditions followed by three-month outlook graphs where temperatures and rainfall amounts are predicted to return to more normal seasonal patterns.

Data from the 2021-22 Post Herbicide Survey revealed that limitations due to the ongoing supply shortage did not affect District 2. All units indicated weed pressure

stayed the same or increased but ground cover quality was the same over that same period. For the summer herbicide program, which targets the control of johnsongrass, there were a total of 5,348 acres treated (Table 3c).

The use of weed wipers was discussed in detail as ODOT districts throughout the state have designated eight percent of mow able acres to be set aside for the Candidate Conservation Agreement with Assurances Program (CCAA). With the limited mowing window, the use of a weed wiper could be more widely used for the control of johnsongrass and other undesirable weeds in these areas. In 2022, one county units used a weed wiper although there are more located throughout the district. For those areas where the CCA Agreement acres are located, a special johnsongrass program that meets the criteria set forth in the agreement should be developed.

The upcoming treatment of Diuron herbicide this upcoming fall were discussed. Proposed Diuron rates by the district looked appropriate based on the discussion

In 2022, a total of 110 miles of guardrail and cable barrier were treated (Table 3b). During this year the Oklahoma State University Roadside and Vegetation Management (OSU RVM) team has put out several demonstration plots for bareground weed control using a combination of Plainview and Roundup Pro Concentrate. Plainview is listed on the ODOT Approved Herbicide and Adjuvant List (AHAL).

We briefly discussed the demonstration of Derigo herbicide along State Highway 64 between Perry, Oklahoma, and State Highway 177.

The group discussed upcoming Certified Pesticide Applicators CEU training topics and the possibility of break-out sessions. The consensus was that break-out sessions were a good idea that allowed for more detailed training of advance herbicide management strategies. Other suggestions included more hands-on approach to herbicide calculations and calibration.

Table 3a. Summary of District 2 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Winter Annual Treatment[2] ---------- Control[3]	Center Lane Miles Treated	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Atoka	Landmaster BW (2.29 pts/A) + AMS (15.9 lbs/100 gal) Good	330	800	64 A 17 GPA	04/05/2022 04/28/2022	Prior to Greenup
	Roundup Pro Concentrate (1pt/A) Good		120	60 A 30 GPA	04/27/2022 04/28/2022	Prior to Greenup
Bryan	Landmaster BW + AMS (17.9 lbs/100 gal) Fair	50	1120	80 A 25 GPA	04/14/2022 05/07/2022	Prior to Greenup
Choctaw	Landmaster BW + AMS (17 lbs/100 gal) Good	343	1184	64 A 25 GPA	04/05/2022 04/11/2022	Prior to Greenup
Latimer	Landmaster BW + AMS (17 lbs/100 gal) Good	0	720	64 A 25 GPA	04/14/2022 04/26/2022	Prior to Greenup
LeFlore	Landmaster BW (2 pts/A) + AMS (17.9 lbs/A) Good	315.2	643	60 A 25 GPA	04/13/2022 04/25/2022	Prior to Greenup
Marshall	Landmaster BW + AMS (17 lbs/100 gal) Good	216	832	64 A 25 GPA	06/15/2022 06/10/2022	Prior to Greenup
McCurtain	Landmaster BW (2 pts/A) + AMS (17.9/100gal) Fair	16	1280	80 A 25 GPA	04/04/2022 04/28/2022	Prior to Greenup

Table 3a Continued on Next Page

Table 3a (Continued). Summary of District 2 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Winter Annual Treatment[2] ---------- Control[3]	Center Lane Miles Treated	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Pittsburg	Landmaster BW (2 pts/A) + AMS (17.9/100gal) Good	0	1377	90 A 20 GPA	04/26/2022 05/16/2022	Prior to Greenup
Pushmataha	Landmaster BW + AMS (17 lbs/100 gal) Good	130	920	80 A 25 GPA	04/07/2022 04/18/2022	Prior to Greenup
Talihina	Landmaster BW (2 pts/A) Good	280	924	66 A 25 GPA	04/26/2022 05/11/2022	Prior to Greenup
	TOTAL ACRES TREATED FOR WINTER ANNUAL WEEDS	**1,680.2**	**9,920**			

[1]RM = Road miles treated with herbicide; MCB = Miles of Cable Barrier treated with herbicide. [2]AMS= Dry Ammonium Sulfate (adjuvant). [3]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [4]Carrier Rate is expressed in gallon per acre (GPA) [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6] NR = Not Reported.

Table 3b. Summary of District 2 Herbicide Survey Results for Cable barrier, Guardrail, and Brush Control.

County/ Interstate Unit	Brush, Guardrail, or Cable barrier Treatment[1] ---------- Control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Atoka	Roundup Pro Concentrate (1.7pt/A) + Garlon 4 Ultra (.336pt/A) + Oust (1.1oz/A) Cable barrier: Good			30 GPA	04/27/2022 04/28/2022	
	NR Cable barrier: NR		NR		NR NR	
Bryan	Landmaster 20 gal + AMS 357 Cable barrier: Fair			25 GPA	04/14/2022 04/15/2022	
	Roundup Pro Concentrate (13 fl oz) + Oust Extra (1.5 oz/A) Guardrail: Good	80	400	80 A 25 GPA	07/13/2022 07/15/2022	
Choctaw	Roundup Pro Concentrate (1 pt/A) + Oust Extra (1 oz/A) Cable barrier: Good	NR	480	64 A 25 GPA	NR NR	
Latimer						
LeFlore	Roundup Pro Concentrate (19oz/A) + Oust (1oz/A) Guardrail: Fair	NR	246	82 A 40 GPA	06/22/2022 06/27/2022	
Marshall						

Table 3b Continued on Next Page

Table 3b (Continued). Summary of District 2 Herbicide Survey Results for Cable barrier, Guardrail, and Brush Control.

County/ Interstate Unit	Brush, Guardrail, or Cable barrier Treatment[1] ---------- Control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
McCurtain	Roundup (19 floz/A) + Garlon 4 Ultra (12.8 fl oz/A) + Oust Extra (1.6 lbs/A) Guardrail: Good	20	60	60 A 40 GPA	06/29/2022 06/29/2022	
Pittsburg	Landmaster (2 pt/A) + AMS (2.04lbs/A) Cable barrier: Good				05/12/2022 05/16/2022	
Pushmataha	Roundup Pro Concentrate (1.5 pt/A) Guardrail: Good	10	NR	60 A 40 GPA	NR 05/10/2022	
Talihina						
	TOTAL ACRES TREATED	**110**	**2,372**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicate cumulative total miles or acres treated, which may result in multiple treatments over the same area.

Table 3c. Summary of District 2 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[3] ---------- Percent control[4]	Center Lane Miles	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[5] (mm-dd)
Atoka	Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (1.1 oz/A) Good	360	1080	80 A 25 GPA	06/27/2022 07/08/2022	
Bryan	Roundup Pro Concentrate (12 floz/A) + Oust Extra (1 oz/A) Good	48	4	60 A 25 GPA	07/13/2022 07/15/2022	
Choctaw	Roundup Pro Concentrate (16 floz/A) + Oust Extra (1 oz/A) Good	130	480	64 A 25 GPA	06/23/2022 06/30/2022	
Latimer	Roundup Pro (1pt/A) + Oust Extra (1.2oz/A) Good	NR	960		04/14/2022 07/01/2022	
LeFlore	Not Treated	0	0			
Marshall	Not Treated	0	0			

Table 3c Continued on Next Page

Table 3c (Continued). Summary of District 2 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[3] ---------- Percent control[4]	Center Lane Miles	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[5] (mm-dd)
McCurtain	Roundup Pro Concentrate (12 floz/A) + Oust Extra (1 oz/A) Good	175	880	80 A 25 GPA	06/20/2022 06/29/2022	
	Roundup Pro Concentrate Wiper	0	NR			
Pittsburg	Roundup Pro Concentrate (0.75 fl oz/A) + Oust Extra (1.64 oz/A) Good	NR	320	80 A 20 GPA	06/28/2022 07/13/2022	
Pushmataha	Roundup Pro Concentrate (14.4 fl oz/A) + Oust Extra (0.8 oz/A) Fair	160	920	80 A 25 GPA	06/15/2022 07/13/2022	
Talihina	Roundup Pro Concentrate (13 fl oz/A) + Garlon (1 pt/A) + Oust Extra (1.5 oz/A) Good	280	704	64 A 25 GPA	06/21/2022 06/21/2022	
	Total[6]	**1,153**	**5,348**	**District Total Treated Acres[7] 17,640**		

[1]Johnsongrass treated using a broadcast application method unless otherwise stated below the tank mixture. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3] Carrier rate is reported in gallons per acre (GPA). [4]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [5]Total treated acreage for johnsongrass. [6]Cumulative total of all acres treated for weeds in District 2 from Tables 3a, 3b, and 3c.

5.0 SURVEY OF DISTRICT THREE HERBICIDE PROGRAMS

5.1 HERBICIDE PROGRAM SURVEY RESULTS

5.1.1 September 1, 2021 to April 30, 2022

All 13 units of District 3 completed Part 1 of the herbicide survey (Table 4a). Only Shawnee I-40 was able to start their Late Winter/Early Spring Herbicide Program. Counties not able to start their Late Winter/Early Spring program listed a lack of herbicide availability and cost as he primary reason they were not able to start. As a result of not beginning their herbicide program, five units began their mowing events earlier than normal, four units had no effect on their mowing program, and two units began their mowing events later than normal. For most units, quality of the desirable grasses in the spray zone was not affected; however, Pontotoc and Coal counties had better looking desirable grasses.

Coal, Garvin, Johnston, Lincoln, and McClain counties did perform some brush control using backhoe, bulldozers, and other mechanical means of removal. No unit used herbicide as part of their brush control (Table 4b).

There was limited weather surveillance due to the limited amount of herbicide used within District 3 during the survey period. Shawnee did use the Drift Risk Advisor and rechecked if applications took more than 24 hours to complete. Due to findings from the weather information obtained, Shawnee did make changes to their herbicide treatments to stay label compliant. Even though Shawnee did treat the right-of-way a limited amount of area was treated. Shawnee treated 48 miles of road and 149.1 acres of right-of-way area were treated with Landmaster BW (1.9 pts/A) + AMS (17 lbs/100 gal) [Table 4a].

For many units a final fence-to-fence mowing event occurs near the first heavy frost. This decreases the amount of dry plant material that can serve as a source of tinder for wildfires. Additionally, aesthetics, site safety, and decreasing weed pressure is also achieved from this final mowing event. Pottawatomie, Seminole, Cleveland, Coal, Garvin, and Johnston counties began their cleanup mowing event. If a cleanup mowing event began prior to September 1, 2021, the person filling out the survey was asked to not include that since it was supposed to be counted in the IVM Survey that was included as part of the FY2021 Herbicide Survey. Johnston County was the first to begin their cleanup mow within the survey window (August 31, 2021) and Seminole County was the last beginning their cleanup mowing November 1, 2021. McClain and Pontotoc counties performed one mowing of the safety zone within the survey period; however, neither listed a start date. Neither McClain nor Pontotoc listed a cleanup mow during the survey period.

In general, District 3 units appeared satisfied with the appearance of their safety zone responding to that question ('My safety zone looked good this year') as Absolutely True or Mostly True but also giving the entire right-of-way an average score of 6.2 (data not shown). This is the lower end of being satisfied with the appearance of their ROW. Improvement in the IVM program was suggested in both brush control and cable barrier/guardrail treatment although each unit appeared overall satisfied with their IVM program. One request was made for a chemical rotation to a different treatment for their spring treatment due to the amount of time the Landmaster BW + AMS treatment has been used.

5.1.2 May 1, 2022 to August 31, 2022

District 3 has been at the center of the areas experiencing some of the most extreme drought conditions in the state (Figure 1). As of the end of September, much of District 3 was experiencing an Exceptional Drought according to the drought monitor. Due to these drought conditions Cleveland, Coal, Pontotoc, and Purcell did not make their broadcast application specifically due to the ongoing weather conditions. Over the previous 6 months, Most of District 3 saw less than 20" of rain.

Only Hughes and Johnston counties began their summer broadcast program. Roundup Pro Concentrate (16 fl oz/A) +Outrider (1-4 oz/A) was used by both units to treat a total of 597 lane miles and 1,543.6 acres (Table 4c). Additional herbicide treatments were made to a limited area of guardrail and cable barriers throughout the district (Table 4b). Cleveland, Coal, Hughes, and Johnston counties all started their programs, but none were completed. Herbicide programs for guardrails included Roundup Pro Concentrate being applied alone at 0.8% or unknown concentrations across 4.05 miles of guardrails or Roundup Pro Concentrate + Outrider across 7 miles of guardrails. Most units felt they had good control except Coal county who had difficulty managing Morning glory and pigweed. Cleveland County noted cable barrier was treated; however, no treatment was listed.

Weather monitoring was performed by all units, although due to the limited about of herbicide used, few printed the drift risk advisor and used it as part of the spray record.

5.2 Comments and Suggestions from OSU Personnel

A meeting was held with Mrs. Wendy Ross, Field Maintenance Engineer, several superintendents, Dr. Andrea Payne Connally, and Mr. David Gerken on October 11, 2022 at the District 3 Headquarters in Ada, OK. A PowerPoint presentation was given to the group that included a review of the annual herbicide program, some desired equipment requested by the superintendents requested in the survey, and the current

drought conditions. Topics brought up by the ODOT personnel for District 3 included a significant portion of time on employee safety and changes that can be made to the herbicide program to allow for great safety and lowered risk of injury while performing IVM tasks.

Superintendents were asked if employees were using a string trimmer along guardrails and cable barrier. Most units answered that they had used a string trimmer along the cable barrier/guard rail. Besides the significant level of danger this entails it also entails a significant portion of employee time to string trim a unit's required areas that takes away from other tasks and results in an effective cost of several hundred dollars per acre to manage weeds in the area. This could include guardrails, cable barrier, and signposts. The herbicide program being used by District 3 uses herbicide with no long-term residual control. Residual herbicides are necessary to prevent the emergence or spread of weeds to an area.

There are several options that can be tailored to provide a specific result in areas where there is a desire to limit the amount of string trimming. If a complete bareground is expected the development of a program that would include indaziflam with a rotation of aminopyralid (Milestone or TerraVue) or prodiamine (numerous generics available now) can be developed to achieve those results. Herbicides that contain the active ingredient indaziflam do have a significantly higher price tag than Roundup (glyphosate); however, use rates are lower, weed suppression occurs past the initial application, and per acre costs are still significantly less expensive than the use of a string trimmer as a mechanical means of weed management. If bermudagrass encroachment is desired there are yet other programs that can be developed in conjunction with proper timing to allow specific plants to thrive while minimizing non-desired weed species.

Table 4a. Summary of District 3 Herbicide Survey Results for Winter Annual Weed Control.

County/ Interstate Unit	Winter Annual Treatment[3] ---------- Percent control[4]	Miles Treated	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate	Treatment Window, Start to End (mm/dd/yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Cleveland	Not Treated	0	0			
Coal	Not Treated	0	0			
Garvin	Not Treated	0	0			
Hughes	Not Treated	0	0			
Johnston	Not Treated	0	0			
Lincoln	Not Treated	0	0			
McClain	Not Treated	0	0			
Okfuskee	Not Treated	0	0			
Pontotoc	Not Treated	0	0			
Pottawatomie	Not Treated	0	0			
Purcell/I-35	Not Treated	0	0			
Seminole	Not Treated	0	0			
Shawnee/I-40	Landmaster BW (1.9 pts/A) + AMS (17 lbs/100 gal) Fair	48	149.1	50 A 30 GPA	04/26/2022 05/13/2022	Prior to Greenup
	Totals[6]	**48**	**149.1**			

[1] Treatment location of herbicide application is noted below tank mixture for winter annual weed control as a broadcast treatment. AMS = Ammonium Sulfate, a water conditioning agent. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 4b. Summary of District 3 Herbicide Survey Results for Brush, Cable Barrier, and Guardrail.

County/ Interstate Unit	Cable Barrier, Guardrail, or Brush Treatment[1] ---------- Percent control[2]	Treated Acres	Miles Treated[3]	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm/dd/yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Cleveland	Roundup Pro Concentrate Guardrails: Good	1	NR	NR[6] 100 GPA		
Coal	Roundup Pro Concentrate Guardrails: Fair	0.25	NR			
Garvin	Not Treated	0	0			
Hughes	Roundup Pro Concentrate (10 gal) + Outrider (10 oz/A) Guardrail: Good	7	NR	100 GPA		
Johnston	Roundup Pro Concentrate (0.8%)	2.8	NR			
Lincoln	Not Treated	0	0			
McClain	Not Treated	0	0			
Okfuskee	Not Treated	0	0			
Pontotoc	Not Treated	0	0			
Pottawatomie	Not Treated	0	0			
Purcell/I-35	Not Treated	0	0			
Seminole	Not Treated	0	0			
Shawnee/I-40	Not Treated	0	0			
	Totals[6]	**149.1**	**48**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area such as are shown in Tables 4b and 4c in the case of the Shawnee/I-40 unit.

Table 4c. Summary of District 3 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[3] ---------- Percent control[4]	Miles Treated	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[5] (mm-dd)
Cleveland	Not Treated	0	0	N/A	N/A	
Coal	Not Treated	0	0	N/A	N/A	
Garvin	Not Treated	0	0	N/A	N/A	
Hughes	Roundup Pro Concentrate (16 fl oz/A) + Outrider (4 oz/A) Good	279	751.6	50 A 30 GPA	06/09/2022 07/22/2022	
Johnston	Roundup Pro Concentrate (16 fl oz/A) + Outrider (1 oz/A) Good	318	792	48.9 A 30 GPA	06/16/2022 06/20/2022	
Lincoln	Not Treated	0	0	N/A	N/A	
McClain	Not Treated	0	0	N/A	N/A	

Table 4c Continued on Next Page

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Table 4c (continued) Summary of District 3 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[5] (mm-dd)
Okfuskee	Not Treated	0	0	N/A	N/A	
Pontotoc	Not Treated	0	0	N/A	N/A	
Pottawatomie	Not Treated	0	0	N/A	N/A	
Purcell/I-35	Not Treated	0	0	N/A	N/A	
Seminole	Not Treated	0	0	N/A	N/A	
Shawnee / I-40	Not Treated	0	0	N/A	N/A	
	Totals	597	1,543.6 A	**District Total Treated Acres[7]** 1,692.7		

[1]Johnsongrass treated using a broadcast application method unless otherwise stated below the tank mixture. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3] Carrier rate is reported in gallons per acre (GPA). [4]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [5]Total treated acreage for johnsongrass. [6]Cumulative total of all acres treated for weeds in District 3 from Tables 4a, 4b, and 4c.

6.0 SURVEY OF DISTRICT 4 HERBICIDE PROGRAMS

6.1 HERBICIDE PROGRAM SURVEY RESULTS

6.1.1 September 1, 2021 to April 30, 2022

Of the nine maintenance facilities in District 4 all responded to Part 1 of the survey for 2022 (Table 5a). No unit was able to start their Late Winter/Early Spring herbicide treatment due to a lack of availability. Cost was also noted by Kingfisher and Payne counties. Grant County also noted they would be increasing the use of a wiper in summer due to not spraying for winter annuals.

Grant County did treat their guardrails with Arsenal but the acres/lane miles were not reported. Grant County's superintendent is responsible for maintaining the spray records, which are completed by the person who makes the herbicide application. Speed monitoring system was neutral in desire by Grant Co. Accuracy was mentioned as a possible benefit, but breakdowns was noted as a potential negative (data not shown). Grant County did use the Drift Risk Advisor and Oklahoma Mesonet to help determine a label compliant spray window. This table was printed and included as part of their spray window. The other counties did not check the Drift Risk Advisor since they did not spray herbicide.

The general quality of the spray area was affected by the lack of herbicide application. All units noted that there were more weeds in the safety zone than they normally do. Guthrie and Tonkawa I-35 as well as Payne and Grant counties noted their desirable grasses looked worse.

Only Grant County and Tonkawa I-35 were able to perform a safety mow. This mowing event started later than normal. A cleanup mow was begun within the survey window by all units except Grant and Payne counties and Tonkawa I-35. The earliest begun day was 8/24/2022 by Guthrie and the latest was Logan County with 12/1/2022. Garfield and Kingfisher noted a safety mow occurred during the last half of December.

For the overall quality there were several mixed reactions. When asked if the safety zone looked good some units respond with Absolutely False (Payne County) or Mostly False (Guthrie I-35 and Kay County) while others responded with the remaining saying Mostly True. Logan and Noble County responded with Neither True nor False. Improved were desired by Guthrie, Tonkawa, and Garfield County.

6.1.2 May 1, 2022 to August 31, 2022

All nine units of District 4 completed Part 2 of the IVM survey. Herbicide availability continued to be the primary limiting factor for District 4. As a result of no spring herbicide treatments being made, all units reported more weeds were present in the safety zone and a general increase in weed population during the summer months.

The johnsongrass program in District 4 consisted of a broadcast treatment and wiper applications. The broadcast herbicide treatment consisted of Roundup Pro Concentrate (16 - 22.17 fl oz/A) + Oust XP (1-1.05 oz/A) and treated 4,062.94 acres. Tonkawa I-35 reported poor

performance of their herbicide program for its failure to control Mare's Tail, pigweed, and kochia. The rates used by Tonkawa were not noted but the products used were Roundup Pro Concentrate + Oust + AMS. Herbicide programs were begun at a reasonable time for all units. Tonkawa completed their program 13 July, which is after the end of the suggested application window of 5 May – 15 June. Grant, Kay, Kingfisher, Logan, and Payne counties reported using a wiper to manage johnsongrass.

Herbicide programs made to the guardrails and cable barriers of Arsenal (0.75 fl oz/A) by Grant County and Arsenal (3qts/A) + Roundup Pro Concentrate (4 qt/A) by Kay County. These were made within a reasonable time frame. All treatments were given a control rating of good.

6.2 COMMENTS AND SUGGESTIONS FROM OSU PERSONNEL

The 2022 Post Herbicide Survey meeting with Oklahoma Department of Transportation (ODOT) District Four was held on October 25, 2022 at the district headquarters in Perry, Oklahoma from 9:30 AM to 12:15 PM. Individuals attending the meeting were, Dr. Andrea Connally, David Gerken, Brantley Hendrix, Jay Galbraith, Jonathan Ryan, Jonathan Harrell, Brandt Bolay, and Noah Gonzales.

The meeting was led off by Dr. Connally discussing current drought conditions for Oklahoma and how this has impacted herbicide application programs throughout the state. There was further discussion on soil moisture conditions followed by three-month outlook graphs where temperatures and rainfall amounts are predicted to return to more normal seasonal patterns.

Data from the 2022 Post Herbicide Survey revealed that due to supply chain issues, herbicides normally used for the winter herbicide programs were not available therefore no applications were made during this time. All units indicated an increase in weed pressure and all but two units indicated a reduction in ground cover quality over that same period. For the summer herbicide program, which targets the control of johnsongrass, there were at total of 4,062.94 acres treated.

The use of weed wipers was discussed in detail as ODOT districts throughout the state have designated eight percent of mow able acres to be set aside for the Candidate Conservation Agreement with Assurances Program (CCAA). With the limited mowing window, the use of a weed wiper could be more widely used for the control of johnsongrass and other undesirable weeds in these areas. In 2022, five county units used a weed wiper, an increase of two units from 2021. For those areas where the CCA Agreement acres are located a special johnsongrass program that meets the criteria set forth in the agreement should be developed.

In 2022, a total of 54.5 acres of guardrail and 50 miles of cable barrier were treated. During this year the Oklahoma State University Roadside and Vegetation Management (OSU RVM) team has put out several demonstration plots for bareground weed control using a combination of Plainview and Roundup Pro Concentrate. Plainview is listed on the ODOT Approved Herbicide and Adjuvant List (AHAL). Following discussion of results from these demonstrations it was decided District Four would apply Plainview plus Roundup Pro Concentrate of cable barriers along Interstate I-35.

We briefly discussed the demonstration of Derigo herbicide along State Highway 64 between Perry, Oklahoma, and State Highway 177.

The group discussed upcoming Certified Pesticide Applicators CEU training topics and the possibility of break-out sessions. The consensus was that break-out sessions were a good idea that allowed for more detailed training of advance herbicide management strategies. Other suggestions included more hands-on approach to herbicide calculations and calibration.

Lastly, the group discussed implementing the use of certain navigation systems for wiper applications and flow control devices for herbicide applications along the safety zone. Overall, the group felt these would be useful for the accurate applications of herbicides and could provide cost savings to the program. It was decided that the district would purchase one of each device and install on a trial basis. The RVM team will get current cost associated with the devices.

Table 5a. Summary of District 4 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Winter Annual Treatment ---------- Percent control[1]	Center Lane Miles Treated	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate	Actual Treatment Window, Start to End (mm/dd/yyyy)	Suggested Treatment Window[2], Start to End (mm-dd)
Garfield	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Grant	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Kay	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Kingfisher	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Logan	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Noble	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Payne	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Guthrie I-35	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
Tonkawa I-35	Not Treated	0	0	N/A N/A	N/A N/A	Prior to Greenup
	TOTAL[3]	**0**	**0**			

[1] Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [2]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [3]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 5b. Summary of District 4 Herbicide Survey Results for Brush, Cable Barrier, and Guardrail.

County/ Interstate Unit	Brush, Cable Barrier, and Guardrail Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load --------- Carrier Rate[4]	Actual Treatment Window, Start to End (mm/dd/yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Garfield	Not Treated	0	0	N/A N/A	N/A N/A	
Grant	Arsenal Guardrails: Fair	NR	NR		03/31/2022 06/06/2022	
Kay	Not Treated	0	0	N/A	N/A	
Kingfisher	Not Treated	0	0	N/A	N/A	
Logan	Not Treated	0	0	N/A	N/A	
Noble	Not Treated	0	0	N/A	N/A	
Payne	Not Treated	0	0	N/A	N/A	
Guthrie I-35	Not Treated	0	0	N/A	N/A	
Tonkawa I-35	Not Treated	0	0	N/A	N/A	
	TOTAL[6]	**0**	**0**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated, NR = not reported. [4]Carrier rate is reported in gallons per acre (GPA), N/A = not applicable. [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 5c. Summary of District 4 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County or Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Percent control[2]	Lane Miles (LM) Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate	Treatment Window, Beginning to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[5] (mm-dd)
Garfield						
Grant	Roundup Pro Conc (22.17 fl oz/A) + Oust XP (1 oz/A) Good	290	866	43.3 A 30 GPA	06/06/2022 06/03/2022	
	Roundup Pro Concentrate Wiper					
Kay	Roundup Pro Concentrate (16 fl oz/A) + Oust XP (1 oz/A) Good	240	810	60 A 30 GPA	06/02/2022 06/17/2022	
	Roundup Pro Concentrate Wiper					
Kingfisher	Roundup Pro Concentrate (1 pt./A) + Oust XP (1oz/A) Good	24.5	281.45	43.3 A 30 GPA	05/27/2022 06/06/2022	
			233.19	53.3 A 30 GPA	05/27/2022 06/03/2022	
	Roundup Pro Concentrate Wiper					

Table 5c Continued on Next Page

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Table 5c (Continued) Summary of District 4 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County or Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Percent control[2]	Lane Miles (LM) Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate	Treatment Window, Beginning to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[5] (mm-dd)
Logan	Roundup Pro Concentrate (16 fl oz/A) + Oust XP (1.05 oz/A) Good	84	586.3	53.3 A 30 GPA	05/16/2022 05/19/2022	
	Roundup Pro Concentrate Wiper					
Noble						
Payne	Roundup Pro Conc (22.17 fl oz/A) + Oust XP (1 oz/A) Good	265	756	54 A 30 GPA	06/06/2022 06/09/2022	
	Roundup Pro Concentrate Wiper					
Guthrie I-35						
Tonkawa I-35	ROUNDUP/OUST/AMS- Poor	300	530	53 A 30 GPA	05/16/2022 07/13/2022	
	TOTAL ACRES TREATED FOR JOHNSONGRASS[6]	**1,203.5**	**4,062.94**	**District Total Treated Acres[7] 4062.94**		

[1]Johnsongrass treated using a broadcast application method unless otherwise stated below the tank mixture. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3] Carrier rate is reported in gallons per acre (GPA). [5]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total treated acreage for johnsongrass. [7]Cumulative total of all acres treated for weeds in District 4 from Tables 5a, 5b, and 5c.

7.0 SURVEY OF DISTRICT 5 HERBICIDE PROGRAMS

7.1 HERBICIDE PROGRAM SURVEY RESULTS

7.1.1 September 1, 2021 to April 30, 2022

All thirteen counties in District 5 responded to Part 1 of the survey for 2022. Three units (Harmon, Jackson, and Kiowa counties) did not begin a late winter/early spring broadcast herbicide application (Table 6a). That group was asked a separate set of questions to determine any changes in their IVM practices in the safety zone because the late winter/early spring broadcast herbicide program was not able to be applied. Harmon and Kiowa counties did not spray due to the drought that was being experienced in their area and a lack of green vegetation. This is the exact response to drought we like to see our applicators make. Jackson County lacked a functioning spray truck, and the weather didn't give them a good spray window. Due to the lack of herbicide application, Jackson and Kiowa counties performed their first mowing event of the safety zone earlier than normal. Harmon County had not performed a mowing event as of April 30, 2022.

The quality of the safety zone was not negatively affected to the lack of herbicide, which is likely due to the lack of rainfall seen in the area (data not shown).

For those units that were able to begin their herbicide program questions were focused on the effect of their herbicide program on the spray zone. All other units were able to begin their broadcast program. Each spray event and tank load were recorded. For all units, the person who made the application completed the spray record. In most cases the Superintendent maintained those records. Harmon and Tillman counties have their secretaries maintain those records whereas Dewey County asks the applicator to maintain those records. Maintenance of those records is extremely important since ODAFF may request 2 years of spray records at any moment. All units felt confident they could reproduce those documents should ODAFF request them.

Some districts expressed interest in using new equipment to improve their herbicide treatments using wipers or precision monitoring devices. As a result of the herbicide shortage, Blaine County did plan on increasing the amount of area they wiped to control their tall weeds. Elk City, Harmon County, Roger Mills County, and Tillman County did not plan on wiping, regardless of the herbicide shortage. Precision monitoring devices were requested by all units except Beckham and Roger Mills County. The ability to monitor speed and/or application rate properly was highlighted by all units. The only negative effects noted was if the monitor device broke.

Weather information is of critical importance to any pesticide program. All units monitored weather conditions using different means. Most used the Oklahoma Mesonet to help determine if conditions were appropriate for an herbicide application. Beckham County used AccuWeather. Blaine Co, Dewey Co., and Hydro I-40 used The Weather Channel. Custer County used Local News Organizations and Elk City I-40 used WeatherBug. The Drift Risk Advisor was not used by Roger Mills County, Beckham County, Jackson County, and Elk City I-40. Most units noted that weather monitoring did force them to alter their planned pesticide

applications. Kiowa, Custer, Harmon, and Jackson counties did not alter their programs due to weather monitoring.

Mowing of the right-of-way was likely performed first as a cleanup mow for this survey period. Cleanup mowing began between 8/30/2021 and 11/5/2021 with Dewey County starting this mow first and Hydro I-40 beginning this mowing last. Roger Mills did not report a date. Tillman Beckham, and Harmon County reporting not beginning a cleanup mowing event during the study period. If it began before this study period, respondents were ask to not include it on the current survey because it should have been included on the previous federal year's report.

For District 5, the Late Winter/Early Spring broadcast treatment consisted of Landmaster BW (2.5 pts)+ Milestone (4 oz/A) + AMS (7.8-10.2 lbs/100gal) [Table 6a]. Most units used Reign LC for their drift control adjuvant. For Reign LC a minimum of 24 oz should be used to be within the required label rate of 1.5 oz/100gal. For those units that used GarrCo Control (Washita County, Beckham County and Hydro I-40) a minimum of 48 ounces needs to be used to follow the label. The rate of 3 oz/100 gal or more is the proper label rate when applying Landmaster BW because Landmaster BW is a 2,4-D mixture. Neither Washita Co, Hydro, nor Beckham Co. were label compliant. A full accounting of the Late Winter/Early Spring pesticide application can be found in Table 6a. In total, 2017 center lane miles and 6,583.5 acres were treated with the late winter/early spring herbicide treatment. In addition to the broadcast treatment, Hydro I-40 treated 40 miles of cable barrier with a tank mixture of Esplanade 200 SC (5 fl oz/A) + Roundup Pro Concentrate (1 qt/A) + Oust (2 oz/A) + Milestone (3.2 fl oz/A) + AMS.

For the survey period, units were mostly pleased with the appearance of their safety zone. All units except Kiowa County ('Absolutely False') and Custer County ('Neither true nor false') felt their safety zone looked good. Most units also felt they late winter/early spring did not need improvement except Tillman County and Elk City I-40 who felt improvement could occur. Most units also felt units felt their herbicide programs delayed their first mowing a little over half felt their herbicide programs eliminated a mowing. Overall, most units felt their IVM program was effective except Kiowa County who felt it was very ineffective and Custer and Harmon counties who felt their program was neither effective nor ineffective.

7.1.2 May 1, 2022 to August 31, 2022

All of District 5 submitted Part 2 of the Herbicide Survey [Tables 6b, 6c]. All units began an herbicide program this summer. Jackson, Roger Mills, Tillman, and Washita counties had more weeds in the safety zone than they usually do. None of these units were able to complete both their late winter/early spring and summer programs. Harmon, Jackson, Tillman, and Washita counties began only their summer program whereas Roger Mills only made their Late Winter/ Early Spring.

The use of wipers could help improve areas where johnsongrass have infested larger acreages. Beckham, Blaine, Custer, and Harmon counties did not water to use a wiper. Dewey and Kiowa counties. Terrain would limit use Greer, Hydro I-40, and Jackson counties.

All units calibrated their trucks this summer and reported calibration spray widths of 20-30 feet. A 20-30 feet wide spray width could be appropriate spray width for the 437-R Boombuster nozzle.

The summer herbicide program consisted of a treatment of MSMA or Roundup Pro Concentrate + Oust Extra. Only Jackson County made two herbicide applications; the first being Roundup Pro Concentrate + Oust Extra followed by MSMA.

7.2 COMMENTS AND RECOMMENDATIONS FROM OSU PERSONNEL

The management of Kochia and Russian thistle continue to be a difficult plant to manage along the right-of-way in Western Oklahoma and throughout many states in the Western United States. Mowing was mentioned as the primary management strategy employed by District 5. Mowing can be an effective means of management if timed correctly. Mowing should occur prior to seed set to prevent production of seeds in the upper plant. Seeds can continue to be produced below the mow line. For chemical control the use of Roundup Pro Concentrate + Oust has been met with limited success. Fluroxypyr (Vista® XRT) and Dicamba (Banvel® and Vanquish®) are suggested for the management of kochia, whereas Dicamba and 2,4-D are suggested for the management of Russian Thistle. Due to the similarity of the plant species and need to ensure management using a spot treatment of dicamba (Vanquish® or Banvel®) at a rate of 1-2 pt/A would be suggested. This rate should prove sufficient to manage both kochia and Russian thistle while having limited damage to the established bermudagrass stand. If the plant identification is certain, the use of Vista® at 1-2 pt/A should help in the management of kochia.

The 2022 Post Herbicide Survey meeting with Oklahoma Department of Transportation (ODOT) District Five was held on November 8, 2022 at the district headquarters in Clinton, Oklahoma from 800 AM to 11:00 PM. Sixteen Individuals from District Five county units attending the meeting lead by Dr. Andrea Connally and David Gerken.

The meeting was led off by Dr. Connally discussing current drought conditions in Oklahoma and how this has impacted herbicide application programs throughout the state. There was further discussion on soil moisture conditions followed by three-month outlook graphs where temperatures and rainfall amounts are predicted to be slightly above average for temperatures and slightly below average for rainfall.

Data from the 2022 Post Herbicide Survey indicated a majority of the units were able to apply both the winter and summer herbicide programs. Of the units that applied herbicides, 6226 acres were treated with the winter program and 5933 acres treated with the summer program. Although no herbicides were applied to the cable barrier in 2022, data from previous cable barrier studies conducted in 2020-2021 was presented and discussed.

In the survey several respondents indicated they did not want to use a weed wiper, however during discussion, most superintendents felt wipers would be useful in managing johnsongrass and would consider using them if available. At this current time no county unit has a newer model weed wiper. Following discussion, the county does intend on purchasing 2 to 3 weed wipers for use in the district.

ODOT districts throughout the state have designated eight percent of mow able acres to be set aside for the Candidate Conservation Agreement with Assurances Program (CCAA). With the limited mowing window, management of those area was discussed, and the use of a weed wiper could be more widely used for the control of johnsongrass and other undesirable weeds in these areas.

We briefly discussed the demonstration of Derigo herbicide along State Highway 64 between Perry and State Highway 177. The group discussed upcoming Certified Pesticide Applicators CEU training topics in 2023 and the possibility of break-out sessions. The consensus was that break-out sessions were a good idea that allowed for more detailed training of advanced herbicide management strategies.

Table 6a. Summary of District 5 Herbicide Survey Results for Winter Annual Weed Control.

County/ Interstate Unit	Winter Annual Treatment[1] ---------- Control[2]	Center Lane Miles[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm/dd/yyyy)	Suggested Treatment Window, Start to End (mm-dd)[5]
Beckham	Landmaster BW (1.94 pts/A) + Milestone (1.25 fl oz/A) + AMS (10.2 lbs/100gal) Good	16	950	50 A 30 GPA	03/28/2022 04/05/2022	Prior to Greenup
Blaine	Landmaster BW (2.56 pts/A) + Milestone (4 fl oz/A) + AMS (10.2 lbs/100gal) Good	190	650	50 A 30 GPA	04/01/2022 04/11/2022	Prior to Greenup
	Landmaster BW (2.44 pts/A) + Milestone (3.9 fl oz/A) + AMS (10.2 lbs/100gal) Good		357.5	32.5 40 GPA	04/01/2022 04/09/2022	Prior to Greenup
Custer	Landmaster BW (2.5 pts/A) + Milestone (4 floz/A) + AMS (7.96 lb/100gal) Good	300	720	40 A 40 GPA	03/25/2022 04/01/2022	Prior to Greenup
Dewey	Landmaster BW (2.5 pts/A) + Milestone (0.307/A) + AMS (7.84 lbs/100gal) Good	9	715	32.5 A 40 GPA	03/23/2022 04/05/2022	Prior to Greenup
Greer	Landmaster BW (2.5 pts/A) + Milestone (4 floz/A) + AMS (9.8 lbs/100gal) Fair	265	640	40 A 40 GPA	04/04/2022 04/14/2022	Prior to Greenup
Harmon	Not Treated	0	0	N/A	N/A	
Jackson	Not Treated	0	0	N/A	N/A	
Kiowa	Not Treated	0	0	N/A	N/A	

Table 6a Continued on Next Page

Table 6a. (Continued) Summary of District 5 Herbicide Survey Results for Winter Annual Weed Control.

County/ Interstate Unit	Winter Annual Treatment[1] ---------- Control[2]	Center Lane Miles[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm/dd/yyyy)	Suggested Treatment Window, Start to End (mm-dd)[5]
Roger Mills	Landmaster BW (2 pts/A) + Milestone (3.84 floz/A) + AMS (10.2 lb/100gal) Good	320	800	50 A 30 GPA	03/24/2022 04/01/2022	Prior to Greenup
Tillman	Landmaster BW (2.5 pts/A) + Milestone (4 fl oz/A) Fair	180	520	40 A 40 GPA	03/28/2022 04/14/2022	Prior to Greenup
Washita	Landmaster BW (2.46 pts/A) + Milestone (4 floz/A) Good	351	910	32.5 A 40 GPA	05/16/2022 06/03/2022	Prior to Greenup
Elk City I-40 W	Landmaster BW (3.1 pts/A) + Milestone (4 fl oz/A) + AMS (9.5 lbs/100gal) Fair	142	400	50 A 40 GPA	04/11/22022 04/18/2022	Prior to Greenup
Hydro I-40 E	Landmaster BW (2.25 pts/A) + Milestone (3.5 oz/A) + AMS (9.56 lbs/100gal) Good	244	636	53 A 30 GPA	03/15/2022 04/14/2022	Prior to Greenup
	TOTALS[6]	**1237**	**7298.5**			

[1] Treatment location of herbicide application is noted below tank mixture for winter annual weed control as a broadcast treatment. AMS = Ammonium Sulfate, a water conditioning agent. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 6b. Summary of District 5 Cable Barrier, Guardrail, and Brush Programs.

County/ Interstate Unit	Brush, Guardrail, or Cable barrier Treatment[1] ---------- Control[2]	Center Lane Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm/dd/yyyy)	Suggested Treatment Window, Start to End (mm-dd)[5]
Beckham	Not Treated	0				
Blaine	Not Treated	0				
Custer	Roundup Pro Concentrate (1 gal/A) + Oust Extra (12.8 oz/A) + Arsenal (51.2 fl oz/A) Fair	NR				
Dewey	Not Treated	0				
Greer	Not Treated	0				
Harmon	Not Treated	0				
Jackson	Not Treated	0				
Kiowa	Not Treated	0				
Roger Mills	Not Treated	0				
Tillman	Not Treated	0				
Washita	Not Treated	0				
Elk City I-40 W	Not Treated	0				
Hydro I-40 E	Esplanade 200 SC (5 floz/A) + Roundup Pro Concentrate (32 floz/A) + Oust (2 oz/A) + Milestone (3.2 fl oz/A) + AMS (2.5 lbs/A) Cable barrier: Good	40			4/11/2022 04/26/2022	
	TOTALS[6]	**40**	**0**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 6c. Summary of District 5 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Control[2]	Lane Miles (LM)[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Actual Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[5] (mm-dd)
Beckham	MSMA (64 oz/A) Good	280	650	50 A 40 GPA	06/27/2022 07/07/2022	
Blaine	Roundup Pro Concentrate (14 fl oz/A) + Oust Extra (1.5 oz/A) Poor	86	552	32.5 A 30 GPA	05/13/2022 06/28/2022	
Custer	Roundup Pro Concentrate (9.6 fl oz/A) + Oust Extra (1.6 oz/A) Fair	308	600	40 A 40 GPA	05/14/2022 05/18/2022	
Dewey	MSMA (2 qt /A) + OUST Extra (1.5oz/A) Good	237.5	617.5	32.5 A 40 GPA	06/02/2022 06/22/2022	
Greer	MSMA (1.75 qt/A) Fair	NR	600	50 A 40 GPA	05/16/2022 07/07/2022	
	Roundup (64 fl oz /A) + Oust Extra (0.5oz/A) Good		560	40 A 40 GPA	05/16/2022 07/07/2022	
Harmon	Roundup Pro Concentrate-(5 pts/A) + Oust Extra (1.5 fl oz/A) Good	205	600	40 A 40 GPA	05/10/2022 05/13/2022	

Table 6c Continued on Next Page

Table 6c (Continued) Summary of District 5 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Percent control[2]	Lane Miles (LM)[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Actual Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End (mm-dd)[5]
Jackson	Roundup Pro Concentrate (56 fl oz/A) + Oust Extra (1.49 oz/A) Good	26	795	53 A 30 GPA	06/09/2022 07/07/2022	
	MSMA (2 qt /A) Good		412	37.5 A 40 GPA	07/20/2022 08/04/2022	
Kiowa	Roundup Pro Concentrate (10 fl. oz/A) +Oust Extra (1.5 oz /A) Poor	112	600	40 A 40 GPA	05/16/2022 06/10/2022	
Roger Mills	Not treated	0	0			
Tillman	Not Treated	0	0			
Washita	MSMA (2 qt/A) Good	350	280	40 A 40 GPA	07/11/2022 08/18/2022	
Elk City I-40 W	Roundup Pro Concentrate (4 gal) + Oust Extra (4.69 lb) Poor	192	78	39 A 40 GPA	05/16/2022 06/07/2022	
	TOTALS[6]	**654**	**6344.5**		**District Total Treated Acres[6] 13,643.0**	

[1]Johnsongrass treated using a broadcast application method unless otherwise stated below the tank mixture. [2]Control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Center lane miles of treated length of highway. [4]Carrier rate is reported in gallons per acre (GPA). [5]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total treated acreage for johnsongrass.
[6]Cumulative total of all acres treated for weeds in District 5 from Tables 6a, 6b, and 6c.

SURVEY OF DISTRICT 6 HERBICIDE PROGRAMS

8.1 HERBICIDE PROGRAM SURVEY RESULTS

8.1.1 September 1, 2021 to April 30, 2022

All nine units responded to Part 1 of the IVM survey. Five of nine units were not able to make an application due to herbicide not being available (Texas, Beaver, Ellis, and Harper counites) or severe drought/weather (Cimarron County) [Table 7a]. For those units who didn't spray herbicide, none had performed their first mowing of the safety zone during the survey period, and all noted the safety zone looked about the same or had more weeds in the safety zone than usual. All units except Cimarron County felt their desirable grasses looked better, whereas Cimarron County felt their desirable grasses looked worse.

For those units who did perform an herbicide application, each unit recorded each pesticide application, each tank load for the broadcast application and felt confident they could reproduce the last two years record if ODAFF requested them. Spray records were completed by the person(s) who completed the pesticide application. Maintenance records were maintained by the Superintendent in Woods, Woodward and Major counties and the secretary in Alfalfa County.

Regarding new equipment use this season, among those who used pesticide this survey period one unit planned on increasing the among of wiping because of herbicide shortages and all units believed a digital speed monitor/ precision device would help with their herbicide program. All four units believed it aided their herbicide program and cons were associated with equipment failure.

The monitoring of weather is a critical responsibility for any pesticide applicator, regardless of the industry. Most units used the Oklahoma Mesonet as their primary means of determining when weather conditions are appropriate for a pesticide application; however, Major County used Accuweather. For those units who made pesticide applications during the survey period, all used the Drift Risk Advisor available through the Oklahoma Mesonet. Only Woods County did not include the output of the Drift Risk Advisor as part of their spray records. In general, the weather information found using the Mesonet or Drift Risk Advisor or other weather monitoring means did modify actions concerning pesticide applications.

Pesticide applications can be considered the tip of the spear for any IVM program. In conjunction with an herbicide program are mowing programs. If we constitute September 1 as the opening of a new growing season, for this survey period most units will begin their mowing program with a cleanup mow initiated to remove excess vegetation that had been treated during the summer and reduce fire load during the winter months. Woodward, Major, Alfalfa and Harper counties began their cleanup mow as early as September 7, 2021 (Harper County) and as late as December, 2, 2021 (Major County). Mowing of the safety zone occurred in all units except Woods and Ellis County during the survey period.

All units seemed relatively happy with their IVM program (chemical, mechanical, mowing). Most felt their IVM program was somewhat or very effective. Woods, and Cimarron counties felt their program was neither effective nor ineffective.

Three units were able to begin their late winter/early spring herbicide program (Alfalfa, Woods, Major, and Woodward counties) [Table 7a]. Treatments consisted of Landmaster BW (3pts/A) + AMS (17-18.5 lbs/100gal). Reign LC was used as the drift control agent for those who broadcast herbicide. The minimum rate of Reign LC is 1.5 oz/100 gal. Woods, Major, and Alfalfa counties were below labelled rates based on their reported tank size. We are assuming trucks are running between 20 and 40 psi, which would be an industry standard for the 437-R Boombuster nozzle or something similar. For 1500 spray gallons, a minimum of 22.5 fl oz of additive needs to be added to reach 1.5 floz/100 gal. Woods, Alfalfa and Major counties used 16 fl oz per 1500-gal tank. Woodward County was at the minimum labeled rate using 24 fl oz for a 1625-gal tank. In total, 337.75 center lane miles and 3334.9 acres of right-of-way were treated with herbicide.

8.1.2. May 1, 2022 to August 31, 2022

All units in District 6 were able to complete Part 2 of the Annual IVM Survey. Herbicide availability was still limited throughout 2023 although there was some improvement in availability. As a result, Alfalfa, Ellis, Woods, and Woodward counties were able to begin their herbicide programs completing greater than 90% of the intended treated area. For this survey, the completion of greater than 90% of the intended treated area is considered a completed spray program. For the summer broadcast program, 594 center lane miles were treated with herbicide. This is an underestimation since Ellis County responded 0 miles were treated; however, Ellis treated 946.18 acres with their summer program (Table 7c). With a reported spray width of 25 width, approximately 312 center lane miles were treated by Ellis County. This gives an estimated 906 center lane miles treated within District 6 during their summer broadcast program. All programs were completed between June 2 and June 17, which is within recommended treatment window. The remainder of the herbicide program was fairly limited consisting of 2 mile of guardrail treated with Roundup Pro Concentrate by Ellis County and a wiper application treatment being made by Woodward County.

The lack of herbicide during the spring appears to have resulted in earlier mowing of the safety zone for Beaver and Ellis County. Harper and Texas County were able to start their first mowing later than normal. As a result of not making their late winter/early spring herbicide application, Texas and Beaver counties had more weeds in the safety zone than they normally have. Either 1 or 2 mowing events occurred in the safety zone which is what is normally performed. Beaver County mowed twice during the growing season which was more than usual.

8.2 COMMENTS AND SUGGESTIONS FROM OSU PERSONNEL

The 2022 Post Herbicide Survey meeting with Oklahoma Department of Transportation (ODOT) District 6 was held on November 8, 2022 at the Woodward County office in Woodward, Oklahoma from 12:00 PM to 3:00 PM. Eight Individuals from District Six county units attending the meeting lead by Dr. Andrea Connally and Mr. David Gerken.

Dr. Connally began the meeting with a discussion of the current drought conditions in Oklahoma and how this has impacted herbicide application programs throughout the state. There was further discussion on soil moisture conditions followed by three-month outlook

graphs where temperatures and rainfall amounts are predicted to be slightly above average for temperatures and slightly below average for rainfall.

Due to the significant drought experienced throughout the state several units limited their herbicide applications that could otherwise make it. Significant drought has resulted in bermudagrass that is under drought stress throughout much of the state, herbicide damage could negatively impact and cause undo damage that bermudagrass stands might not be able to recover from prior to winter dormancy. Drought conditions also limit the uptake and performance of herbicide into non-desirable plants. Limiting herbicide applications in areas that contain desirable grass species will limit the amount of damage to desirable ground cover.

Data from the 2022 Post Herbicide Survey indicated only four units were able to apply their winter herbicide program. Availability of herbicide was the main reason sited. All but one unit was able to apply the summer program. Of the units that applied herbicides, 3,335 acres were treated with the winter program and 3,535 acres treated with the summer program.

Although District Six does not have any cable barrier within their area, the group did discuss previous cable barrier trials that can be used for guardrails or other bareground weed control applications. Data from previous cable barrier studies conducted in 2020-2021 was presented along with bareground demonstration trials located in District Two.

Most of the group indicated the use of a weed wiper would be beneficial for control of johnsongrass and other weed species. ODOT districts throughout the state have designated eight percent of mowable acres to be set aside for the Candidate Conservation Agreement with Assurances Program (CCAA). With the limited mowing window, management of those area was discussed, and the use of a weed wiper could be more widely used for the control of johnsongrass and other undesirable weeds in these areas. Regardless of the decisions made about the management of johnsongrass in the CCAA areas, a johnsongrass management program specific to those areas that is consistent with the management procedures outlines in the agreement should be developed.

We briefly discussed the demonstration of Derigo herbicide along State Highway 64 between Perry, Oklahoma and State Highway 177.

The group discussed upcoming Certified Pesticide Applicators CEU training topics and the possibility of break-out sessions. The consensus was that break-out sessions were a good idea that allowed for more detailed training of advanced herbicide management strategies.

Table 7a. Summary of District 6 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Winter Annual Treatment [1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Actual Treatment Window (mm-dd-yyyy)	Suggested Treatment Window (mm-dd)[5]
Alfalfa	Landmaster BW (3 pts/A) Good	312	900	50 A 30 GPA	04/13/2022 04/19/2022	Before Greenup
Beaver	Not Treated	0	0	N/A N/A	N/A N/A	Before Greenup
Cimarron	Not Treated	0	0	N/A N/A	N/A N/A	Before Greenup
Ellis	Not Treated	0	0	N/A N/A	N/A N/A	Before Greenup
Harper	Not Treated	0	0	N/A N/A	N/A N/A	Before Greenup
Major	Landmaster BW (3 pts/A) Good	NR	850	50 A 30 GPA	03/31/2022 04/15/2022	Before Greenup
Texas	Not Treated	0	0	N/A N/A	N/A N/A	Before Greenup
Woods	Landmaster BW (3 pts/A)	180	600	50 A 30 GPA	04/14/2022 04/26/2022	Before Greenup
Woodward	Landmaster BW (3pts/A) Good	157.75	984.9	50 A 30 GPA	04/13/2022 04/18/2022	Before Greenup
	TOTAL[6]	**337.75**	**3334.9**			

[1] Treatment location of herbicide application is noted below tank mixture for winter annual weed control as a broadcast treatment. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 7b. Summary of District 6 Cable Barrier, Guardrail, and Brush Programs.

County/ Interstate Unit	Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Actual Treatment Window (mm-dd-yyyy)	Suggested Treatment Window[5] (mm-dd)
Alfalfa	Not Treated	0	0	N/A	N/A	
Beaver	Not Treated	0	0	N/A	N/A	
Cimarron	Not Treated	0	0	N/A	N/A	
Ellis	Roundup Pro Concentrate Guardrail: Fair	2	NR	NR 30 GPA	06/02/2022 06/10/2022	
Harper	Not Treated	0	0	N/A	N/A	
Major	Not Treated	0	0	N/A	N/A	
Texas	Not Treated	0	0	N/A	N/A	
Woods	Not Treated	0	0	N/A	N/A	
Woodward	Not Treated	0	0	N/A	N/A	
	TOTAL[6]	**2**	**0**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 7c. Summary of District 6 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Road Miles	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Percent control[2]	Treated Acres	Acres (A) per Tank Load -------- Carrier Rate[3]	Actual Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start – End[4] (mm/dd)
Alfalfa	313	Roundup Pro Conc. (12.8 fl oz/A) + Oust Extra (1.5 oz/A) Poor	850	50 A 30 GPA	06/02/2022 06/06/2022	05/15 06/30
Beaver	0	Not Treated	0	N/A N/A	N/A N/A	N/A N/A
Cimarron	0	Not Treated	0	N/A N/A	N/A N/A	N/A N/A
Ellis	NR	Roundup Pro Conc. (12.8 fl oz/A) + Oust Extra (1.5 oz/A oz) Fair	946.18	50 A 30 GPA	06/02/2022 06/10/2022	05/15 06/30
Harper	0	Not Treated	0	N/A N/A	N/A N/A	N/A N/A
Major	0	Not Treated	0	N/A N/A	N/A N/A	N/A N/A
Texas	0	Not Treated	0	N/A N/A	N/A N/A	N/A N/A

Table 7c Continued on Next Page

Table 7c. (Continued) Summary of District 6 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Road Miles	Johnsongrass, Broadleaf & Other Treatments[1] ---------- Percent control[2]	Treated Acres	Acres (A) per Tank Load -------- Carrier Rate[3]	Actual Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start – End[4] (mm/dd)
Woods	119	Roundup Pro Conc. (13 fl oz/A) + Oust Extra (1.5 oz/A) Fair	700	50 A 30 GPA	06/02/2022 06/07/2022	05/15 06/30
Woodward	162	Roundup Pro Conc. (12.8 fl oz/A) + Oust Extra (1.5 oz/A) Good	1038.8	49.8 A 30 GPA	06/06/2022 06/17/2022	05/15 06/30
		Roundup Pro Concentrate Wiper	NR	N/A N/A		05/01 09/30
		TOTAL ACRES TREATED FOR JOHNSONGRASS[5] TOTAL ACRES TREATED FOR JOHNSONGRASS (WIPER)	**3534.98** **0**		**District Total Treated Acres[6] 6,878.88**	

[1]Johnsongrass treated using a broadcast application method unless otherwise stated below the tank mixture. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3] Carrier rate is reported in gallons per acre (GPA). [4]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [5]Total treated acreage for johnsongrass. [6]Cumulative total of all acres treated for weeds in District 6 from Tables 7a, 7b, and 7c.

SURVEY OF DISTRICT 7 HERBICIDE PROGRAMS

9.1 HERBICIDE PROGRAM SURVEY RESULTS

9.1.1. September 1, 2021 to April 30, 2022

All units responded to Part 1 of the herbicide survey (Table 8a). All units were able to begin their broadcast herbicide program. Maintaining spray records for a minimum of two years is required of all certified applicator regardless of the amount, location, or use (restricted versus general use). All units recorded spray records for each tank load and the person filling out spray records was the individual who completed that pesticide application. The person who maintains the completed spray records was the Superintendent for Love, Stephens, Caddo, Comanche counties, and Ardmore I-35. For Cotton and Grady counties, the secretary was responsible for maintaining spray records. For Jefferson and Carter counties, the person who made the pesticide application was responsible for maintaining spray records. District Leadership Personnel were responsible for maintaining spray records for Murray County. All units were confident they could produce spray records should ODAFF request that information.

The use and maintenance of relevant technology can improve the performance of the IVM program for ODOT. For this survey, precision monitoring devices and the use of wiper technology was highlighted. Only Caddo and Jefferson counties used a precision monitoring device. In general, the managers in units felt precision monitoring devices would help their IVM programs. Caddo and Jefferson counties also planned on increasing the use of a wiper due to the herbicide shortage.

All units were able to begin their Late Winter/Early Spring broadcast treatments. Most units used Landmaster BW (2 pt – 3pts) + Milestone (4-5.76 fl oz/A) + AMS (15.9-17 pounds/100gal) except Love County who used Roundup Pro Concentrate (7ptsA) + Milestone (2 pts/A) + AMS (17 lbs/100gal). All units noted good control and completed their pesticide program as late as April 14. Although AMS was not applied at the recommended rate of 17 lbs/100gal, 15.9 lbs/100 gal is within the industry recommendation of 8-17 lbs/100 gal.

Only Cotton County began a cable barrier treatment using Roundup Pro Concentrate (3 qts/A) + Oust XP (2 oz/A) starting and completing their treatment April 26 with Good control. Guardrails are very often treated with the same program across ODOT. This was true for Cotton County's guardrail program. Love County also treated 4 miles of guardrail with a treatment of Roundup Pro Concentrate (16 fl oz/A) beginning March 17 and ending April 1 with Good control.

Almost all units except Comanche County used the Drift Risk Advisor. Often, units did not include that as part of their spray records. Love, Stephens, Cotton, Jefferson counties and the Ardmore I-35 unit did include the drift risk advisor as part of their spray records. Stephens, Carter, Cotton, Grady, Jefferson counties and Ardmore did recheck the drift risk advisor where the pesticide application took longer than 24 hours to complete. The primary source of weather information used to determine when an appropriate weather window was forecast used the Oklahoma Mesonet except Jefferson County who used *The Weather Channel*. All units did or may have modified their actions due to the information obtained from their weather source(s).

Mowing can improve the appearance of the right-of-way, reduce burn load, but also manage some weeds. The cleanup mowing event began as early September 7, 2021 or as late

as October 28, 2021. Stephens County, Caddo County, and Ardmore I-35 did not report a date; however, those units who began their cleanup mow prior to September 1 were asked to not include that even since it should have been reported in the FY2021 IVM survey. Love and Cotton counties also performed 2 safety mowing events during the survey period. Love County performed a Safety mow May 17, 2022 and November 4, 2022 (this maybe in error). Cotton County reported their safety mowing event September 15 and October 29, 2021.

All units felt their rights-of-way looked good. The average quality score of 7.6, scale of 1- to 10, is consistent with that statement. Units mostly felt their herbicide program allowed them to eliminate a mowing event and/or delay a mowing event. Brush control improvement was desired by all units except Cotton County. In general, all units were satisfied with the totality of their IVM program (mechanical, mowing, and chemical treatments) during the survey period.

9.1.2. May 1, 2022 to August 31, 2022

Caddo, Grady, Love counties and Ardmore did not perform an herbicide application during the year. The primary cause noted by those units was weather related issues by Love County and Ardmore I-35 and other responsibilities taking precedence by Caddo and Grady counties. Love County specifically noted the drought as its weather-related issue that prevented the start of herbicide applications.

Spray records were made by the person who made the herbicide application in all five units who made herbicide applications (Comanche, Cotton, Jefferson, Murray, and Stephens counties). MSMA was the primary herbicide used during the survey period for the management of johnsongrass in the safety zone (Table 8c). MSMA 6 Plus was applied at a rate of 2-2.5 qts/A. Comanche County also included Oust XP at a rate of 1 oz/A. MSMA 6 Plus and Oust XP can be mixed as part of a proper herbicide application and only needs to be used once instead of a making a follow up application of MSMA if MSMA 6 Plus is used alone for the first application.

Weather was monitored (including use of the Drift Risk Advisor) by all units except Ardmore and Grady County. Neither Ardmore nor Grady made an herbicide application during the survey period. The Drift Risk advisor did change intended behaviors by Carter, Cotton, Jefferson, Love and Stephens counties. Wind was the primary weather parameter that negatively impacted the spray program (data not shown).

Mowing practices were varied across District 7. Murray County did not report any safety mow events during the survey period. Most units began mowing the safety zone in mid-June. Ardmore began earliest (9 May) and Murray County began last (29 August). For those units who did spray their safety zone between 1 and 3 mowing events. Most units mowed about the same as usual whereas Carter reported mowing more than usual. Comanche, Grady, and Murray counties mowed less than usual. Ardmore, Love and Stephens began a fence-to-fence mowing event during the survey period. Ardmore, Carter, Comanche, Cotton, Love and Stephens mowed at 4” to 6” in height. Caddo, Grady, and Jefferson counties mowed at 3” or less. Murray County mowed at 7”- 8”.

9.2 COMMENTS AND SUGGESTIONS FROM OSU PERSONNEL

A meeting with District 7 leadership personnel and superintendents occurred at District 7 Headquarters in Duncan on September 28. From the Oklahoma State University (OSU) RVM team Mr. David Gerken and Dr. Andrea Payne Connally were present.

Several topics were discussed. The meeting was led off by Dr. Connally discussing current drought conditions for Oklahoma and how this has impacted herbicide application programs throughout the state. There was further discussion on soil moisture conditions followed by three-month outlook graphs where temperatures and rainfall amounts are predicted to return to more normal seasonal patterns.

During the meeting, Mr. Tracy Terrill updated the RVM team and his superintendents on the Candidate Conservation Agreement with Assurances (CCAA) Monarch Agreement. Roughly 8% of the mowable acres held within the District would subject to the CCAA Agreement. This would be approximately 1,400 acres if the 8% held uniformly across this district. A discussion was held of the type of areas Mr. Terrill was wanting to use for the CCAA agreement and how to maintain a consistent number of acres while new projects come online. Areas that appear ideal for the CCAA Agreement would not be considered for those areas because of expansion projects expected to begin within the next 5-10 years.

For acres placed under the CCAA Agreement guidelines, it would be highly suggested that a johnsongrass specific program be put in place. Johnsongrass can very quickly move into an unmanaged area. Johnsongrass spreads into new areas via seed and through rhizome movement. Herbicide treatments that are prevent germination or establishment of johnsongrass by seed, johnsongrass that spreads into those areas can do so via rhizomes. Wipers provide the best option under the CCAA guidelines to manage johnsongrass but not damage beneficials including pollinating forb species that are beneficial to pollinators including monarch butterflies.

Table 8a. Summary of District 7 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Center Lane Miles Treated	Winter Annual Treatment[1] ---------- Control[2]	Treated Acres[3]	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window Start to End (mm-dd-yyyy)	Suggested Treatment Window, Start to End (mm-dd)[5]
Caddo	200	Landmaster BW (2 pts/A) + Milestone (4 floz/A) + AMS[3] (17 lbs/100gal) Good	480	60 A 25 GPA[4]	03/25/2022 04/01/2022	Prior to Greenup
Carter	57	Landmaster BW () + Milestone (4 oz/A) + AMS (15.9 lbs/100gal) Good	480	60 A 25 GPA	03/15/2022 03/19/2022	Prior to Greenup
Comanche	414	Landmaster BW (2 pts/A) + Milestone (4 floz/A) + AMS (15.9 lbs/100gal) Good	1150	50 A 30 GPA	03/08/2022 04/01/2022	Prior to Greenup
Cotton	98	Landmaster BW (2 pts/A) + Milestone (4.16 floz/A) + AMS (17lbs/100gal) Good	550	50 A 30 GPA	03/15/2022 04/01/2022	Prior to Greenup
Grady	150	Landmaster BW (2 pts/A) + Milestone (4 floz/A) + AMS (15.9 lbs/100gal) Good	420	70 A 30 GPA	03/25/2022 04/14/2022	Prior to Greenup
I-35 Ardmore	120	Landmaster BW (2 pt/A) + Milestone (4 oz/A) + AMS (17 lbs/100gal) Good	840	60 A 25 GPA	03/16/2022 04/01/2022	Prior to Greenup
Jefferson	127	Landmaster BW (2 pts/A) + Milestone (4 floz/A) + AMS (17 lbs/100gal) Good	854	60 A 25 GPA	03/22/2022 04/01/2022	Prior to Greenup

Table 8a Continued on Next Page

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Table 8a (Continued). Summary of District 7 Herbicide Survey Results for Winter Weed Control.

County/ Interstate Unit	Winter Annual Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window, Start to End (mm-dd)[5]
Love	Roundup Pro Concentrate () + Milestone () Good	210	840	70 A 25 GPA	02/10/2022 02/28/2022	Prior to Greenup
Murray	Landmaster BW (3 pts/A) + Milestone (5.76 floz/A) + AMS () Good	153	450	50 A 30 GPA	03/25/2022 03/31/2022	Prior to Greenup
Stephens	Landmaster BW (2 pts/A) + Milestone (4 floz/A) + AMS () Good	103	770	70 A 20 GPA	03/24/2022 04/26/2022	Prior to Greenup
	TOTAL[6]	**1,632**	**3433.3**			

[1] Treatment location of herbicide application is noted below tank mixture for winter annual weed control as a broadcast treatment. AMS = Ammonium Sulfate, a water conditioning agent. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 8b. Summary of District 7 Cable Barrier, Guardrail, and Brush Programs.

County/ Interstate Unit	Treatments[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End (mm-dd)[5]
Caddo	Not Treated	0	0	N/A	N/A	
Carter	Not Treated	0	0	N/A	N/A	
Comanche	Not Treated		0	N/A	N/A	
Cotton	Roundup Pro Concentrate (3 qts/A) + Oust XP (2oz/A) Guardrail: Good	5	NR	NR	04/26/2022 04/26/2022	05-01 09-01
	Roundup Pro Concentrate (3 qt/A) Guardrail: Good	2	10	5 A 30 GPA	08/11/2022 08/12/2022	05-01 09-01
Grady	Not Treated	0	0	N/A	N/A	
I-35 Ardmore	Not Treated	0	0	N/A	N/A	
Jefferson	Roundup Pro Concentrate (2qts/A) + Oust Extra (2.4oz/A) Guardrails: Good	2	2	2 A 40 GPA	05/19/2022 05/19/2022	05-01 09-01
Love	Roundup Pro Concentrate (16 fl oz/A)	2	NR	NR	03/17/2022 04/01/2022	05-01 09-01
Murray	Roundup Pro Concentrate (3 qts/A) + Oust XP (2 oz/A) Guardrails: Good	1			03/17/2022 04/01/2022	05-01 09-01
	Roundup Pro Concentrate (3 qts/A) + Oust XP (2 oz/A) Cable Barrier: Good	5			04/26/2022 04/26/2022	05-01 09-01

Table 8b Continued on Next Page

Table 8b. (Continued) Summary of District 7 Cable Barrier, Guardrail, and Brush Programs.

County/ Interstate Unit	Treatments[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End (mm-dd)[5]
Stephens	Not Treated	0	0	N/A	N/A	
	TOTALS[6]	**17**	**12**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 8c. Summary of District 7 Herbicide Survey Results for Johnsongrass and Other Weed Control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments[3] ---------- Percent control[4]	Miles Treated	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate	Treatment Window Start to End (mm-dd-yyyy)	E-958 Suggested Treatment Window Start to End[5] (mm-dd)
Caddo	Not Treated	0	0	N/A	N/A	
Carter	Not Treated	0	0	N/A	N/A	
Comanche	MSMA (1.88 qt) + Oust XP (1.25 oz/A) Good	396	825	37.5 A 40 GPA	05/16/2022 05/27/2022	05-01 09-15
Cotton	MSMA (2 qt/A) Good	101	375	37.5 A 40 GPA	06/22/2022 06/30/2022	05-01 09-01
Grady	Not Treated	0	0	N/A	N/A	
I-35 Ardmore	Not Treated	0	0	N/A	N/A	
Jefferson	MSMA (2qt/A) Good	79.4	262	35 A 40 GPA	06/16/2022 06/20/2022	04-20 06-30
Love	Not Treated	0	0	N/A	N/A	
Murray	MSMA (5pts/A) Good	153	650	50 A 30 GPA	05/05/2022 05/13/2022	05-10 08-15
	MSMA (5pts/A) Good	153	650	50 A 30 GPA	06/07/2022 06/20/2022	05-10 08-15
Stephens	MSMA 6 Plus (2qt/A) Good	216	720	40 A 40 GPA	05/26/2022 07/08/2022	04-20 07-30
	TOTALS	**1098.4**	**3482.0**	**District Total Treated Acres[7] 6,927.3**		

[1]LM = Lane miles treated. [2]MCB= Miles of cable barrier treated. [3]Johnsongrass treated unless otherwise stated in parentheses. [4]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80%-100%, Fair=50%-79%, Poor=0%-49%. [5]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*.[6]Total treated acreage for Johnsongrass as well as other individual treatments. [7]Cumulative total of all acres treated for weeds in District 7 from Tables 8a, 8b and 8c.

10.0 SURVEY OF DISTRICT 8 HERBICIDE PROGRAMS

10.1 HERBICIDE PROGRAM SURVEY RESULTS

10.1.1 September 1, 2021 to April 30, 2022

All ten units responded with Part 1 of the survey. Four units, Mayes, Nowata, Pawnee, and Craig counties were able to apply herbicide during the study period. Washington County lacked a functioning spray truck, Osage and Creek counties noted the herbicide was too expensive/not available, and Ottawa, Rogers, and Delaware counties did have a good spray window. Most units felt not making a broadcast treatment had no effect on their first mowing event of the spray zone; however, Washington County had not mowed the safety zone and Osage County mowed earlier. Not spraying also didn't help or harm the desirable species in the ROW in all units except Washington County who felt their desirable species looked worse. Osage, Ottawa, and Creek counties had more weeds than usual in their spray zone whereas Washington, Rogers, and Creek counties felt their ROW looked about the same. Washington, Ottawa, Rogers, and Delaware counties felt their desirable ground cover looked about the same. Whereas Osage and Creek counties felt their desirable ground cover was covered with more weeds. Although most units did not treat with herbicide all except Washington County (no functional sprayer) and Delaware County (no appropriate weather window) monitored weather in order to find an acceptable window.

Mayes, Nowata, Pawnee, Craig, and Creek counties were able to start an herbicide program during the survey period. The following statements reflect those counties.

All unit make a pesticide application record for each tank load applied. The person who made the application is responsible for completing the form and the superintendent is responsible for maintaining spray records for each of the five units.

The use of specific equipment by ODOT to maintain their right-of-way can ease the burden and increase the precision of a pesticide application. Craig County used a precision monitoring device during their pesticide application. Nowata, Pawnee, and Creek counties felt a speed monitoring device would help their program by allowing them to keep more accurate records with the major con being the cost associated with the monitoring device.

Mayes, Pawnee, and Craig counties were able to start their late winter/early spring broadcast herbicide treatment. In total 360 center-lane miles were treated with a mixture of Landmaster BW (1.87-2pts/A) + AMS (17 lbs/100 gal). Pawnee County also added Milestone (4.48 fl oz/A) to their tank mixture. 781.8 acres were treated with these tank mixtures.

Along the cable barrier Shoreklear (192 fl oz/A) + Escort XP (0.96 oz/A) was used across 7 miles of cable barrier. Guardrail was treated by Nowata and Creek counties. Nowata Co. treated 7 miles of guardrail with Roundup Pro Concentrate (1.2 at/A) + Garlon 4 Ultra (1 pt/A) between May 11 and May 19 with Good results. Creek Co treated 1 mile of guardrail with Roundup Pro Concentrate (1.6%) between April 26 and April 29 with Good results. Both Nowata and Creek counties used string trimmers around the guardrail. Specific details regarding individual herbicide programs can be found in Table 9a.

The drift risk advisor was checked by Nowata, Pawnee, Craig, and Creek counties but only included with the spray record for Rogers County. The Mesonet was the primary source of

weather information for all units except Rogers County who used their local news organization. The monitoring of weather conditions generally altered the actions of Mayes, Rogers, Pawnee, Craig, and Creek counties and may have altered actions by Nowata County. No other county reported a change in actions due to weather monitoring.

Due to the timing of the survey period, the IVM season can be viewed as beginning with the cleanup mowing event. This mowing event takes place at the end of the year near or after the first freeze event. All units except Osage, Pawnee, and Craig counties began their cleanup mow during the study period. Creek County was the first to begin their cleanup mow on September 27 and Rogers County was the last to begin their mowing event on November 22, 2021. Rogers county was the only unit not able to complete their cleanup mow, which was due to rain. Ottawa, Rogers, and Pawnee counties also performed a mowing of only the safety zone. Pawnee County performed their mowing September 9, 2022 and Ottawa County performed their mowing November 15, 2022. Rogers County did not report a start date.

In general, District 8 was happy with their safety zone with all units except Rogers County and Osage County answering agreeing their safety zone looked good. Osage County felt that statement was 'mostly false' and Rogers County responded, 'neither true nor false'. Rating of the quality of right-of-way reflect these assessments as well. Half the units felt the Late Winter/Early Spring program could use improvement, which included Mayes, Rogers, Nowata, and Pawnee counties. All other units answered 'neither true nor false' or N/A. Most units likewise felt their herbicide program helps to delay and/or eliminate a mowing event. Improvements to the Cable barrier/guardrail and brush control program can be made. District Superintendents did see somewhat satisfied with their complete IVM program (mechanical, mowing, and chemical treatments). Only Pawnee County was dissatisfied with their IVM program but gave their right-of-way a quality score of '7' which was satisfactory. The average score was 6.4 which is a satisfactory score. Most felt their IVM program was 'somewhat effective' with Osage County feeling their IVM program was very ineffective.

10.1.2 May 1, 2022 to August 31, 2022

All units in District 8 completed Part 2 of the herbicide survey. The most significant issue facing District 8 was the limited availability of desired herbicide and the drought that began in June and continued through the end of the survey period.

Generally more weeds were in the safety zone than are usually seen. Generally speaking desirable ground cover looked about the same as usual. Pawnee reported their ROW quality looked better and Creek, Osage and Washington counties reported an increase in weed population in their desirable ground cover area.

Guardrail treatments were made at the end of June in Pawnee and Rogers County (Table 9b) with Roundup Pro Concentrate and Roundup Pro Concentrate + Oust Extra. Roundup Pro Concentrate has no residual control and Oust Extra has a limited residual control. Both units reported fair control in the guardrail with mare's tail and Illinois bundle flower being noted specifically as having no been properly managed. Rogers county also noted broadleaf plants more broadly as not being properly managed. Ottawa County did not note an herbicide program but did note that all species were not properly managed.

Weather was monitored by Nowata, Pawnee, and Rogers counties although there were limited herbicide applications being made through the survey period.

10.2 COMMENTS AND SUGGESTIONS FROM OSU PERSONNEL

The 2021-22 Post Herbicide Survey meeting with Oklahoma Department of Transportation (ODOT) District Eight was held on November 3, 2022 at the district headquarters in Tulsa, Oklahoma from 900 AM to 11:00 PM. Individuals attending the meeting were, Dr. Andrea Connally, David Gerken, George Haliburton, and Trapper Parks

The meeting was led off by Dr. Connally discussing current drought conditions for Oklahoma and how this has impacted herbicide application programs throughout the state. There was further discussion on soil moisture conditions followed by three-month outlook graphs where temperatures and rainfall amounts are predicted to return to more normal seasonal patterns.

Data from the 2021-22 Post Herbicide Survey revealed that due to supply of herbicide products and weather-related issues prevent the applications of the summer herbicide program for all units in this district. Seven out of 10 units indicated they were not able to apply their winter herbicide program for the same reasons. Most of the units indicated an increase in weed pressure however six of the units did not see a decrease in the quality of their desirable ground cover as a result.

The use of weed wipers was discussed in detail as ODOT districts throughout the state have designated eight percent of mowable acres to be set aside for the Candidate Conservation Agreement with Assurances Program (CCAA). With the limited mowing window, the use of a weed wiper could be more widely used for the control of johnsongrass and other undesirable weeds in these areas.

In 2022, only Pawnee and Rogers County treated weeds in the guardrail and only Pawnee made cable barrier treatments. During this year the Oklahoma State University Roadside and Vegetation Management (OSU RVM) team has put out several demonstration plots for bareground weed control using a combination of Plainview and Roundup Pro Concentrate. Plainview is listed on the ODOT Approved Herbicide and Adjuvant List (AHAL). We briefly discussed the demonstration of Derigo herbicide along State Highway 64 between Perry, Oklahoma and State Highway 177.

The group discussed upcoming Certified Pesticide Applicators CEU training topics and the possibility of break-out sessions. The consensus was that break-out sessions were a good idea that allowed for more detailed training of advance herbicide management strategies.

Table 9a. Summary of District 8 Herbicide Survey Results for Winter Weed Control.

County or Interstate Unit	Winter Annual Treatment[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window[5], Start to End (mm-dd)
Craig	Landmaster BW (2 pt/A) + AMS (17 lb/100 gal) Good	70	100	50 A 30GPA	04/19/2022 04/26/2022	Prior to Greenup
Creek	Not Treated	0	0			
Delaware	Not Treated	0	0			
Mayes	Landmaster BW (1.87 pts/A) + AMS (17 lb/100 gal) Fair	50	181.8	45.45 A 30 GPA	04/14/2022 04/15/2022	Prior to Greenup
Nowata	Not Treated	0	0			
Osage	Not Treated	0	0			
Ottawa	Not Treated	0	0			
Pawnee	Landmaster BW (2 pt/A) + Milestone (4.48 floz/A) + AMS (17 lb/100 gal) Good	240	500	50 A 30 GPA	04/01/2022 04/08/2022	Prior to Greenup
Rogers	Not Treated	0	0			
Washington	Not Treated	0	0			
	Total Treated[6]	**247**	**781.8**			

[1] Treatment location of herbicide application is noted below tank mixture for winter annual weed control as a broadcast treatment. AMS = Ammonium Sulfate, a water conditioning agent. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of right-of-way treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 9b. Summary of District 8 Herbicide Survey Results for Cable Barrier, Guardrail, and Brush Control.

County/ Interstate Unit	Treatments[1] ---------- Percent control[2]	Miles Treated[3]	Treated Acres	Acres (A) per Tank Load -------- Carrier Rate[4]	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Window, Start to End (mm-dd)[5]
Craig	Not Treated					
Creek	Roundup Pro Concentrate (1.6%)	1			04/26/2022 04/29/2022	
Delaware	Not Treated	0	0			
Mayes	Not Treated					
Nowata	Roundup Pro Concentrate (1.2qts/A) + Garlon 4A (1 pt/A) Guardrail: Good	7	0		05/11/2022 05/18/2022	
Osage	Not Treated	0	0			
Ottawa	Not Treated	0	0			
Pawnee	Shoreklear Plus (192.2 floz/A) + Escort (0.96 oz/A) Cable barrier: Poor	7	10.18		04/26/2022 04/27/2022	
Rogers	Not Treated	0	0			
Washington	Not Treated	0	0			
	Total Treated[6]	**14**	**10.18**			

[1] Treatment location of herbicide application is noted below tank mixture as Cable barrier, Guardrail, or Brush. [2]Percent control rating given to treatment by ODOT unit for control of the weed species listed on the herbicide or combined tank mix herbicide labels, Good=80-100%, Fair=50-79%, Poor=0-49%. [3]Miles of cable barrier or guardrail treated. [4]Carrier rate is reported in gallons per acre (GPA). [5]Recommended treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [6]Total indicates cumulative total miles or acres treated, which may be because of multiple treatments over the same area.

Table 9c. Summary of District 8 Herbicide Survey Results for Johnsongrass control.

County/ Interstate Unit	Johnsongrass, Broadleaf & Other Treatments ---------- Percent control	Miles Treated	Treated Acres	Acres (A) per Tank Load ---------- Carrier Rate	Treatment Window, Start to End (mm-dd-yyyy)	Suggested Treatment Window Start to End[1] (mm-dd)
Craig	Not Treated	0	0			
Creek	Not Treated	0	0			
Delaware	Not Treated	0	0			
Mayes	Not Treated	0	0			
Nowata	Not Treated	0	0			
Osage	Not Treated	0	0			
Ottawa	Not Treated	0	0			
Pawnee	Roundup Pro Concentrate Wiper	0	NR		NR	05-01 09-30
Rogers	Not Treated	0	0			
Washington	Not Treated	0	0			
TOTALS[2]		**0**	**0**		**District Total Treated Acres[3]** **791.98**	

[1]Suggested treatment window is from OSU Pub. E-958: *Suggested Maintenance Practices for Roadside Weed and Brush Problems*. [2]Total treated acreage for johnsongrass. [3]Cumulative total of all acres treated for weeds in District 5 from Tables 6a, 6b, and 6c.

11.0 STATEWIDE SUMMARY AND CONCLUSIONS CONCERNING 2022 ODOT HERBICIDE PROGRAM RESULTS

The 2022 report includes a summary of the annual pesticide treatments, equipment management, and any perceived problems and solutions encountered during the year. The 2022 year offered ODOT a unique situation of herbicide shortages and significant price increases because of those shortage. Several questions were developed during the evaluation of the Fall/Spring and Summer. The annual survey was divided into two parts. In previous years, the RVM team has had limited success differentiating potential issues regarding the different herbicide programs. For simplicity in summarization of what is sometimes a complex vegetation management program, we organized ODOT herbicide use into three categories: a late winter/early spring broadcast herbicide program, a summer annual and perennial program, and a smaller acreage treatment consisting of a composite of cable barrier, guardrail, and brush control with very limited treatments for spot treatments such as thistle. The summer annuals and perennial program have traditionally focused on the management of johnsongrass in the right-of-way. Part 1 concentrated on the herbicide programs implemented between September 1, 2021 and April 30, 2022 whereas Part 2 examined May 1, 2022 to August 30, 2022.

Part 1 of the fall 2021-2022 ODOT herbicide program survey had a 100% response rate (84 of 84 units responding). Canadian, Oklahoma, and Tulsa counties contract their IVM programs to an outside business. Because ODOT is not actively practicing an IVM program those units were not included in the response rate calculation. This rate is the same as reported in 2019 and 2020.

The authors encourage the reader to refer to the individual chapters of this report to obtain insights into the success and challenges faced by each ODOT District. Weather conditions, maintenance philosophies, and equipment availability can vary significantly between Districts creating unique IVM strategies. A detailed discussion of each of these strategies goes beyond the scope of this final 2022 summary although a summary of these parameters is noted within individual chapters. Many ODOT Districts struggled to find herbicide products in time for their late winter/early spring weed control program and summer johnsongrass/broadleaf weed control program. This resulted in 37 of 84 units (44%) not starting a late winter/early spring herbicide program. Herbicide availability and cost were the primary inhibition to starting an herbicide application with 24 of 37 mentioned availability of herbicide and 15 of 37 mentioned Herbicide was too expensive.

Weather

Weather will always be a significant challenge for those conducting IVM programs. Much of the state has remained in some form of drought since 9-28-2021 entering Severe – Exceptional drought conditions during the survey period. According to the Drought Monitor (https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?OK; accessed 9/28/2022 and updated weekly) only 20.56% of the state was under no drought conditions (D0-D4) with 4.62% being in a D2-D4 condition on 9/21/2021 (Figure 1). As of 9/28/2022, only 0.03% of the state was under drought conditions (D0-D4) with 89.25% being in a D2-D4

condition (*Figure 1*). Drought conditions are as follows: D0 – Abnormally Dry, D1 – Moderate Drought, D2 – Severe Drought, D3 – Extreme Drought, D4 – Exceptional Drought. The Drought Monitor outlook is updated every Thursday.

Under these exceptional drought conditions any herbicide program can struggle to produce satisfactory results. Drought stressed weeds do not absorb herbicides as readily and beneficial ground cover may be more susceptible to damage from an herbicide program. Herbicide-damaged desirable vegetation may struggle to recover under drought stress. Nine units specifically mentioned drought as a limiting factor to making their herbicide applications. A decision to not apply, to use lower use rates or to curtail application to certain acreage or before the normal end of the typical window of application can all be appropriate decisions to make under these severe drought conditions.

Broadcast Herbicide Program

The number of treated acres for winter annuals or johnsongrass broadcast programs were significantly lower from previous years. The largest impact that decreased these treated acres was the price increases and shortages in glyphosate and 2,4-D containing products (Roundup Pro Concentrate, Landmaster BW, and Imitator + 2,4-D). The second issue was the beginning of the drought during the summer months. Shortages of these products are not anticipated to continue into 2023 at the same level of shortages we experienced throughout 2021-2022. However, we would still suggest making herbicide purchases as soon as possible for the 2023 application year in order to make sure individual districts are as high on a waitlist as possible if shortages are experienced.

Wiper

Eight ODOT units reported treating tall vegetation with a wiper. During conversations with various managers in the District herbicide meetings, managers indicated that they choose not to use wipers more extensively due to the ongoing drought conditions. This was a correct choice in our opinion when drought limited effective herbicide response. Wiper treatments work best when vegetation is actively growing, and soil moisture is adequate. Measuring adequate soil moisture can be difficult. Generally, if a plant leaf is folded or rolled along its length and/or it appears yellow or brown over a large area of the leaf surface, typically starting at the tip of the leaf and extending back towards the stalk, the plant may be drought stressed and an herbicide treatment will have less than optimal activity. Use of an herbicide product under those conditions may result in a perceived failure. There was still interest among superintendents to use a wiper to apply herbicides in the future when conditions are appropriate. Only 12 units reported that they did not want to use a wiper.

Cable Barrier and Guardrail Treatments

One area of interest within post-survey meetings was the topic of keeping employees away from areas in which they’re vulnerable to accidents on the roadside. This interest included protecting maintenance personnel conducting operations like string trimming around cable

barriers and guardrails. Cable barriers and guard rails pose a significant benefit to drivers on Oklahoma's highways. To maximize that safety benefit, those barriers are installed immediately next to the road shoulder with a diminishing amount of cable barrier being maintained in the center median where maintenance crews are significantly safer and can be 50+ feet from the road's edge. If string trimming of barriers installed adjacent to the roadway is required, the proximity of these barriers (and maintenance thus staff) to the edge of the road may result in increased risk of being struck by a vehicle or debris propelled by passing vehicles. In total, 7% (6 of 84) and 21% (18 of 84) of units performed string trimming around guardrails and cable barriers according to results from Part 1 and Part 2 of the survey, respectively.

Since string trimming is of primary concern during the summer months, a treatment of those areas where a bareground is desired could be targeted during the late winter/early springtime period with products that contain an active ingredient with residual activity like indaziflam. Products like Esplanade 200 SC (indaziflam) or Plainview (indaziflam + aminocyclopyrachlor) do have a higher cost associated with them than a treatment of Roundup Pro Concentrate + Oust XP or Oust Extra; however, using a tank mixture that contains the active ingredient indaziflam will give far superior results where minimizing string trimming is desired. Indaziflam works by killing seedling plants during germination and thus preventing them from establishing. Indaziflam is a root cell division inhibitor or vernacularly referred to as a root pruning herbicide and it is a very effective way of preventing plants from emerging in areas where a "bareground program" is desired.

All residual herbicides do need to be activated by being watered in via rain or irrigation. This washes the herbicide residue from the vegetation canopy into the soil in order to activate it. During periods of significant drought, this may need to be performed using the herbicide spray tank. This is not an ideal situation with the rising cost of diesel. Additionally, during periods of significant drought, once a residual herbicide is properly activated into the soil there shouldn't be a decrease in activity (Moreas Ribeiro and others, 2018).

We did not ask for the number of acres of cable barrier and guardrail acres treated in 2022 by design. We have had limitations in getting accurate acres reported due to the nature of treating these areas. Some of these areas are spot treated and superintendents believe the survey is designed for those areas that only received the actual herbicide treatment. Upon asking superintendents throughout 2022, it was determined that asking how many miles of target area were maintained with either a spot treatment, band or broadcast treatments were used would give us a more accurate survey of the area being treated.

Forbs and Monarch Habitat

For Part of the herbicide survey, Vonceil Harmon contributed a series of questions for ODOT personnel to answer. The following summary is based on responses from those nine questions.

Outside of the clearzone, a very limited number of herbicides are applied. Some 55 of 84 respondents used no herbicides, while 48 of 84 respondents reported using some type of spot treatment (wiper, signage, musk thistle, cut stump, brush removal) outside the clear zone. Two units reported "Other" as a treatment without expanding what treatment was used. Respondents could answer more than one option. The primary means of managing invasive species is

mowing. Mowing alone was noted by 30.9% of respondents (26 of 84) as their management response in managing weeds.

Most units knew monarch butterflies migrated south towards Mexico in September and October. No units noted migration occurring in December, January, or February. Less than 11 respondents answered the remaining months. Some 32% (28 or 84) of respondents noted that no efforts were made to enhance floral areas while the remaining respondents noted altered mowing or designated areas were maintained for pollinator habitat. Brush management for the purpose of expanding pollinator habitat occurring outside the clearzone was occurring in 10 units with the remaining unit not performing any brush removal specifically for monarch habitat. Some 31 of 84 units had plans specifically for monarch habitat improvement whereas the remaining units did not. Exactly half the units believed there were practices available to them to increase flowering plant species that would provide food for pollinators outside the spray zone.

The change in status of the monarch butterfly to Endangered by the International Union for Conservation of Nature (IUCN) was known by 18 of 84 units. It is important to note that this status by IUCN is not associated with action by the US Fish & Wildlife Service (USFW) which has not classified the monarch as Endangered although USFW has stated that the monarch is a worthy candidate for listing but that there are species of higher priority for listing and that USFWS doesn’t have the funding currently to undertake actions upon the monarch and higher priority species.

Table 10. Summary of 2022 ODOT Herbicide Treatments, Target Weeds and Total Acres Treated with Specific Herbicide or Herbicide Combinations in Oklahoma.

Herbicide Treatment(s)	Target Weeds/Site	Districts Using Treatment(s)	Total Acreage Treated[a]
Winter weed post-emergent +/- pre-emergent control			
Landmaster® BW + AMS	winter annual grass and broadleaf control	1, 2, 3, 6, 7, 8	17,302.85
Landmaster® BW + AMS + Milestone®	winter annual grass and broadleaf control	4, 5, 7	14,633.00
Roundup Pro Concentrate	winter annual grass and broadleaf control	2	120.00
Total acres treated for winter weed control acres treated with all combinations			**32,055.35**

Table 10 Continued on Next Page

Table 10. (Continued) Summary of 2022 ODOT Herbicide Treatments, Target Weeds and Total Acres Treated with Specific Herbicide or Herbicide Combinations in Oklahoma.

Herbicide Treatment(s)	Target Weeds/Site	Districts Using Treatment(s)	Total Acreage Treated[a]
Johnsongrass/broadleaf post-emergent control in spring/summer			
Roundup® Pro Concentrate + Oust® XP, Roundup® Pro Concentrate + Oust® XP + Garlon 4 Ultra	johnsongrass, summer annual, and broadleaf weeds	4	4,062.94
Roundup® Pro Concentrate + Oust® Extra, Roundup® Pro Concentrate + Oust® Extra + Escort, Roundup® Pro Concentrate + Oust® Extra + Garlon®	johnsongrass, summer annual, and broadleaf weeds	1,2,5,6	12,788.0
Roundup® Pro Concentrate + Outrider®	Johnsongrass, summer annuals, and broadleaf weeds	3, 7	1,543.6
Roundup Pro Conc. ® + Pastora	Johnsongrass, summer annuals, and broadleaf weeds	None	0
Roundup® Pro Concentrate (wiper)	Johnsongrass	1, 2, 4, 6, 8	NR
MSMA, MSMA + Outrider®, MSMA + Oust® Extra, MSMA + Roundup® Pro Concentrate, MSMA + Oust® XP, MSMA + Oust® Extra	johnsongrass and summer annual, and broadleaf weeds	5, 7	6,041.5
Total acres treated for johnsongrass using all methods			**24,436.04** [b]

Table 10 Continued on Next Page

Table 10. (Continued) Summary of 2022 ODOT Herbicide Treatments, Target Weeds and Total Acres Treated with Specific Herbicide or Herbicide Combinations in Oklahoma.

Herbicide Treatment(s)	Target Weeds/Site	Districts Using Treatment(s)	Total Acreage Treated[a]
Brush Control, Cut-Stump, Basal Bark			
Garlon® 4 Ultra (winter)	basal bark, cut stump, and foliar brush control	None	0
Pathfinder II, Garlon® 4 Ultra, Arsenal + Roundup Pro Concentrate	basal bark, cut stump, and foliar brush control	None	0
Total brush/cut stump acres treated			**0**
Broadleaf Postemergence Treatments			
Transline®; Perspective + Milestone	Thistle	0	0
Other broadleaf post-emergent treatments	Various broadleaf weeds	0	0
Total broadleaf specific control not including areas treated for johnsongrass			**0**
Aquatic use-site weed control			
glyphosate (aquatic) + Imazapyr (aquatic)	vegetation control in aquatic and terrestrial areas	None	0
Total acres treated using Aquatic herbicides			**0**
Total Acres Treated Using All Herbicides and Methods of Application		1, 2, 3, 4, 5, 6, 7, 8	**102,259.74[b]**

[a] Total acres treated are believed to be the absolute total for all herbicide used and/or reported as being used by ODOT in 2022. [b] total acres reported do not include cable barrier and guardrail treatments which were reported as miles of structure (cable barrier or guardrail) that were treated.

Table 11. Comparison of Herbicide Acreages Treated By Field District in 2018 - 2022 for Seven of the More Commonly Used Broadcast Weed Control Tank-mix Treatments.

ODOT Field District	Year	Winter Annual Weed Control		Johnsongrass Control					Total Acres[Y] Treated with Selected Herbicide Applications
		glyphosate +/- 2,4-D +/- AMS	glyphosate +/- 2,4-D + aminopyralid +/- AMS	glyphosate +/- sulfometuron	glyphosate + sulfometuron + metsulfuron-	glyphosate + sulfosulfuron	glyphosate + triclopyr + sulfometuron +/- metsulfuron-methyl	MSMA +/- sulfometuron/ sulfosulfuron	
1	2018	6,548	0	1,214	2,319.10	0	0	0	10,081.10
	2019	6,050	0	660	5,088.00	0	0	0	11,798.00
	2020	5,654	0	0	5,363	0	0	0	11,017.00
	2021	5437	486	569	4,412	0	0	0	10,904.00
	2022	3,737.05	0	0	120	0	0	0	3,857.05
2	2018	8,713.90	0	3,400	2,482	0	0	0	14,595.90
	2019	7,715.00	0	1,690	3,135	0	1090	0	13,630.00
	2020	6,515	0	1,540	3,350	0	150	600	12,155.00
	2021	6812.5	0	2,400	2074	0	2629	0	13,915.50
	2022	9,920	0	0	4,644	0	704	0	15,268.00
3	2018	7,553.80	990.4	0	0	6,211	0	0	14,755.20
	2019	9,255.25	805	0	0	6,502	0	0	16,562.30
	2020	9,390	0	0	0	8,294	0	0	17,684.00
	2021	9975.4	0	0	0	8,815.20	0	0	18,790.60
	2022	149.1	0	0	0	1,543.60	0	0	1,692.70

Table 11 Continued on Next Page

Table 11. (Continued) Comparison of Herbicide Acreages Treated By Field District in 2018 - 2022 for Seven of the More Commonly Used Broadcast Weed Control Tank-mix Treatments.

ODOT Field District	Year	Winter Annual Weed Control		Johnsongrass Control					Total Acres[Y] Treated with Selected Herbicide Applications
		glyphosate +/- 2,4-D +/- AMS	glyphosate +/- 2,4-D + aminopyralid +/- AMS	glyphosate +/- sulfometuron	glyphosate + sulfometuron + metsulfuron-	glyphosate + sulfosulfuron	glyphosate + triclopyr + sulfometuron +/- metsulfuron-methyl	MSMA +/- sulfometuron/ sulfosulfuron	
4	2018	1,905.70	5,067.39	7,230.25	0	0	0	0	14,203.30
	2019	1,655.50	5,710.11	6,301.31	0	0	0	0	13,666.90
	2020	1,506	3,240	5,583	0	0	0	0	10,329.00
	2021	0	6199.7	6422.9	0	0	0	0	12,292.60
	2022	0	0	4,063.65	0	0	0	0	4,063.65
5	2018	0	6,866	0	9,721.20	0	0	0	16,587.20
	2019	10178.5	0	0	8962	0	0	2927.5	22,068.00
	2020	850	9,073	3,528	3,318	0	0	1,010	17,779.00
	2021	0	9603	2290	6054	0	0	3350	21,297.00
	2022	0	7298.5	0	3,785	0	0	2,559.50	13,643.00
6	2018	2,400	0	3,300	4,539	0	0	0	10,239.00
	2019	7,822	0	3,524	2,310	0	0	4,171	17,827.00
	2020	6,774	0	3,150	650	0	0	0	10,574.00
	2021	6071.6	0	1050	5961.37	0	0	300	13,383.00
	2022	3334.9	0	0	3,534.98	0	0	0	6,869.88

Table 11 Continued on Next Page

Table 11. (Continued) Comparison of Herbicide Acreages Treated by Field District in 2018 - 2022 for Seven of the More Commonly Used Broadcast Weed Control Tank-mix Treatments.

ODOT Field District	Year	Winter Annual Weed Control		Johnsongrass Control					Total Acres[Y] Treated with Selected Herbicide Applications
		glyphosate +/- 2,4-D +/- AMS	glyphosate +/- 2,4-D + aminopyralid +/- AMS	glyphosate +/- sulfometuron	glyphosate + sulfometuron + metsulfuron-	glyphosate + sulfosulfuron	glyphosate + triclopyr + sulfometuron +/- metsulfuron-methyl	MSMA +/- sulfometuron/ sulfosulfuron	
7	2018	0	6,593	25	6	0	0	1,705	8,329.00
	2019	0	6,097	1990	0	0	0	0	8,087.00
	2020	1,515	5,372	0	0	0	0	3,961	10,848.00
	2021	0	3433.3	0	0	0	0	5,159	9,529.80
	2022	0	6834	0	0	0	0	3,482	10,316.00
8	2018	4,033	864	1,431	1,375	0	0	0	7,703.00
	2019	4,607	0	0	2,570	0	0	0	7,177.00
	2020	1,191	0	2,050	1,583	0	0	0	4,824.00
	2021	1040	1150	965		0	0	0	3,155.00
	2022	281.8	500	0	0	0	0	0	781.80
All Districts	2018	30,154.40	20,381	16,600.25	20,436.30	6,211	0	1,705	95,488.00
	2019	47,283.49	12,612	14,165.31	22,065.04	6,502	1,090	7,099	110,816.80
	2020	33,395	17,685	15,851	14,264	0	150	5,571	86,916.00
	2021	29,336.50	20,872	13,696.90	18,501.37	8,815.20	2,629	8,809	102,659.97
	2022	17,422.85	14,632.50	4,063.65	12,083.98	1,543.60	704.00	6,041.50	56,492.08

[Y]*Total Acres Treated with Selected Herbicide Applications* show in the right-most column within a District are the total acres treated using only the seven selected treatments listed in the table for that District by year situation. The total acres shown in the 'All Districts' section this page are the total acreage treated across all Districts when considering only the seven most common treatments within the year specified and this value does not include acres treated with herbicides other than the seven most commonly used treatments.

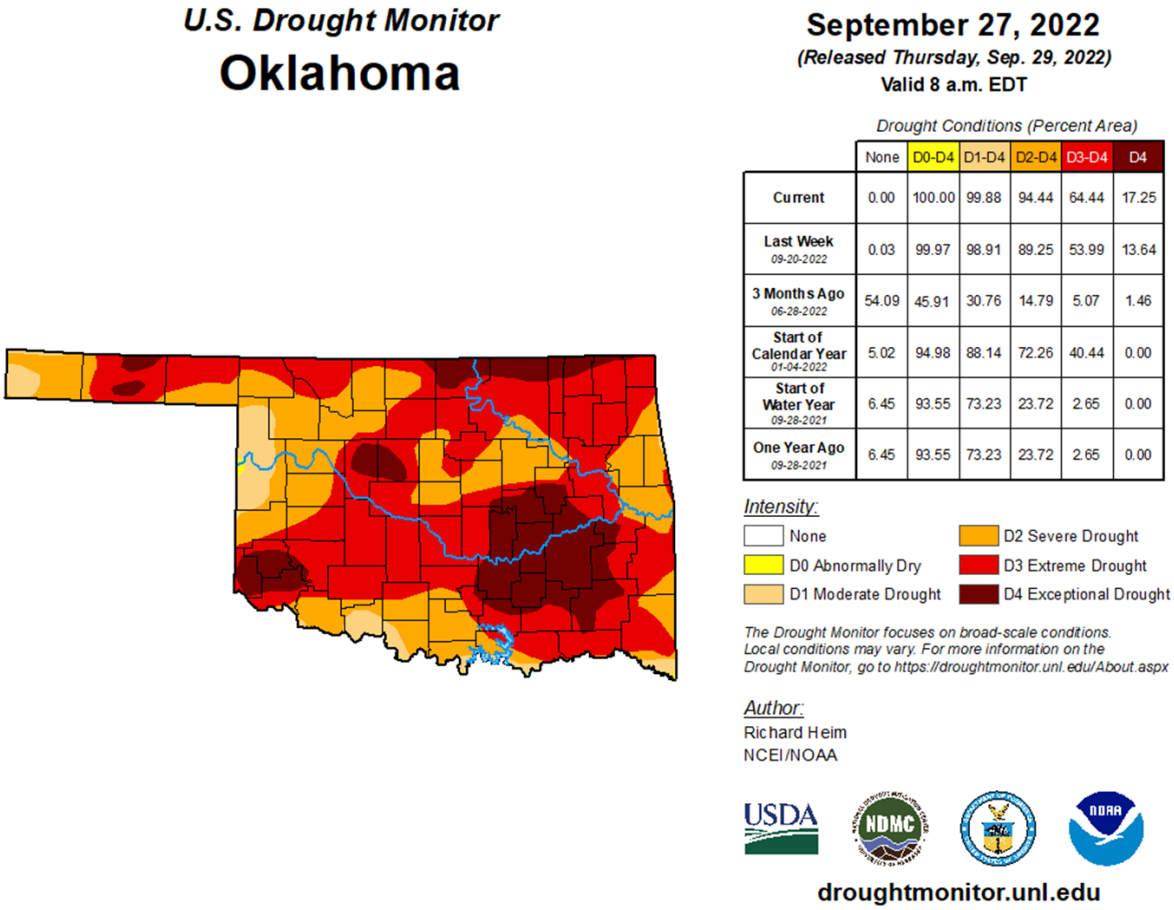

Figure 1: US Drought Monitor from September, 27, 2022. Image is taken from https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?OK which is updated with a new image every Tuesday.

12.0 LITERATURE CITED

Moraes Ribeiro, N., Torres, B. A., Ramos, S. K., Vieira dos Santos, P. H., Simoes, C. T., & Monquero, P. A. (2018). Differential susceptibility of morning glory (’Ipomoea and Merremia’) species to residual herbicides and the effect of drought periods on efficacy. Australian Journal of Crop Science, 12(7), 1090–1098.

APPENDIX A

PART 1: 2021/2022 ANNUAL ODOT HERBICIDE PROGRAM SURVEY

2022 Annual Herbicide Survey for the ODOT IVM Program between September 1 and April 30

The Oklahoma State University Roadside Vegetation Management Team would like to collect information concerning each District's herbicide programs and practices through a web-based survey. The intent of this year's change in survey method is to more efficiently use your time and resources. Through verbal communication, a large portion of ODOT was not able to make herbicide applications this fall and spring due to herbicide shortages. We want to make sure that we're capturing the unique information about spray areas affected by this situation. This survey may be one of the most useful IVM surveys we've been able to conduct in several years due to the lack of herbicide applications caused by shortages and significant cost increases.

You will find this years survey more streamlined especially for those who did not make pesticide applications. Units can complete the form quickly while still providing useful information regarding mowing practices, right-of-way quality, weather monitoring, and use of other equipment practices that do not require herbicide applications. For this electronic version, questions have been written in such a way as to lead you through the survey. Questions may appear odd but have been designed to flow through the survey faster by presenting only relevant questions to capture your Integrated Vegetation Management (IVM) program. This will begin with the fourth question of the survey.

Please do your best to answer every question. If you have additional comments or questions please contact Dr. Andrea Payne Connally or Mr. David Gerken.

Dr. Andrea Payne Connally
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This survey has been designed to take between 30 mins and 2 hours depending on how extensive your IVM program was between September 1 of last year and April 30th of this year. This survey also includes several 'Pages'. There is also a tracker located at the bottom to help identify where you are during the completion of the survey.

When answering the questions please only consider the period between September 1 of last year and April 30th of this year or otherwise stated. Although you may be in the middle of your johnsongrass pesticide program, guardrails/cable barrier summer programs, or additional brush control please wait for Part 2 of the Herbicide program which will come out later this summer.

Thank you.

Required

General Questions

This section identifies your district, unit, and begins moving people past unrelated sections. These questions will also help navigate the remainder of the survey more efficiently.

1. To which district do you belong? *

Select your answer

2. What is your unit? *

Please enter your unit as the County name (Payne County) or Interstate unit (Guthrie I-35).

3. Are you an Interstate Unit? *

Interstate Units operate their Integrated Vegetation Management (IVM) programs slightly differently from County units. Because of this we want to make sure we have your unit classified correctly instead of how we think you should be classified.

- ◯ Yes
- ◯ No
- ◯ Both

4. Were you able to make a Late Winter/Early Spring broadcast herbicide treatment? *

   Late Winter/Early Spring broadcast post-emergent program has also been called the Landmaster BW application.

   - ◯ Yes
   - ◯ No

5. Why was the Late Winter/Early Spring broadcast herbicide application not made?

   Please select all that apply.

   - ☐ Herbicide we wanted to use was not available
   - ☐ The weather didn't give us a good spray window
   - ☐ Other responsibilities were a priority.
   - ☐ We didn't have a functioning spray truck.
   - ☐ Herbicide was too expensive
   - ☐ We didn't have enough personnel
   - ☐ Other

6. **If you answered other**, please provide details.

7. How was the timing of mowing events in the ***safety zone*** (first 30 feet) during February, March, and April affected by the absence of an herbicide application?

   Do not consider mowing events intended to be fence-to-fence or the cleanup mowing event that occurs around the first frost to reduce fire load during the winter months.

   - ◯ Our first mowing event occurred earlier than normal
   - ◯ No affect
   - ◯ Our first mowing event occurred later than normal
   - ◯ We haven't performed any mowing of ***only*** the safety zone (first 30 feet) this Spring.

8. How was quality of only your desirable grasses in the spray area at the of April compared to what you can remember in previous Aprils?

   Please try to not consider the quality of undesirable vegetation in the spray area. We do realize that many desirable grass species were still greening up at the end of April.

   - ◯ Desirable grasses looked better
   - ◯ Didn't help or harm
   - ◯ Desirable grasses looked worse

9. What impact did a lack of broadcast herbicide treatment have on the weed population in the safety zone (first 30 feet)? *

   - ◯ We had more weeds in the safety zone than we usually do
   - ◯ Our safety zone looked about the same as it usually does
   - ◯ We had less weeds in the safety zone than we usually do

10. How was the quality of your desirable ground cover (such as bermudagrass or buffalograss) impacted in the safety zone (first 30 feet) as a result of not spraying herbicide?

- ◯ Our desirable ground cover looked better
- ◯ Our desirable ground cover looked about the same
- ◯ Our desirable ground cover was covered with more weeds

11. Did you apply any herbicides (broadcast, cable barrier, guardrails, brush control, and/or spot treatments) between September 1, 2021 and April 30, 2022? *

- ◯ Yes
- ◯ No

12. Even though you did not make an herbicide application, did you monitor weather conditions in an attempt to find a period of time where weather conditions met label requirements.

- ◯ Yes
- ◯ No

Recordkeeping

The following question are meant to assess recordkeeping practices by ODOT to ensure they are compliant with ODOT policy and Oklahoma law.

13. Was an application record completed for each pesticide application event?

    This would include spot treatments, signage, guard rails, cable barrier, cut stump, basal bark, etc.)

    ◯ Yes

    ◯ No

14. Why was an application record not completed for a pesticide application?

15. For broadcast applications, was an application record completed for each tank load?

    ◯ Yes

    ◯ No

16. Oklahoma Department of Food and Forestry (ODAFF) requires pesticide applicators to keep records of pesticide applications for two years. If ODAFF were to request spray records, do you feel confident you can find all pesticide application records over the last 2 years?

- ◯ Yes
- ◯ No
- ◯ Not Sure

17. Who fills out a spray application record?

- ◯ Superintendent (regardless if they sprayed of didn't spray only the superintendent fills out that record)
- ◯ The person(s) who made that application (this could be either the superintendent, TEO, etc,)
- ◯ Secretary
- ◯ District leadership personnel
- ◯ Other

18. Who is responsible for maintaining spray records?

- ◯ Superintendent
- ◯ The person(s) who made that application
- ◯ Secretary
- ◯ District Leadership personnel
- ◯ Other

Equipment Use

Technologies used by ODOT and available to pesticide applicators have advanced considerably. The following section is designed to assess if and how ODOT is using technology and if other improvements are desired by ODOT's pesticide applicators.

19. Do you use a precision monitoring device? *(for example: digital speedometer, GPS guidance system, etc.)*

- ◯ Yes
- ◯ No

20. Do you plan on increasing the use of a weed wiper as part of your IVM program as a result of herbicide shortages ?

- ◯ We did not plan on wiping, regardless of the herbicide shortages
- ◯ Yes
- ◯ No

21. Would a speed monitoring device benefit your herbicide application program?

- ◯ Yes
- ◯ No
- ◯ Maybe

22. How would a precision monitoring device help your herbicide program?

23. What might be a disadvantage(s) of a precision monitoring device to your herbicide program?

Early Spring/Late Winter Herbicide Program Section 1

Time to pull those spray records. Please provide the following answers for your spray programs. Some units use two different tanks resulting in different acres per load. There will be two sections available to fill in the pertinent information for that situation or another situation where you may have used two herbicides this program. Don't worry if you don't require a second section. You'll be

24. Were you able to apply a late winter/early spring herbicide application along the right-of-way?

- ◯ Yes
- ◯ No

25. Was herbicide applied after sunset (dusk) and before sunrise (dawn)?

- ◯ Yes
- ◯ No

26. Did Late Winter/Early Spring broadcast treatments take longer than 24 hours to complete?

- ◯ Yes
- ◯ No

27. How many center lane miles were treated with a late winter/early spring broadcast application?

Please enter only a number. This could also be described as linear miles that were treated with herbicide. We are specifically not asking for lane miles, which considers the number of lanes. Although the number of lanes is important for some of ODOT's maintenance needs (like asphalt), the number of lanes present minimally impacts the herbicide program.

The value must be a number

28. What size is the herbicide tank for this treatment?

If you use two different sized tanks, please complete the remainder of this section for 1 tank. There will be another section immediately after this for your second tank.

The value must be a number

29. Which products were used for the broadcast early spring/late winter herbicide treatment?

If you used Milestone herbicide don't worry, we're asking about that in a moment.

- ◯ Landmaster BW (Albaugh, LLC)
- ◯ Imitator + 2,4-D (Drexel Chemical Co.)
- ◯ Roundup Pro Concentrate (glyphosate) (Bayer/Monsanto)
- ◯ Other

30. What rate of Landmaster BW (per acre) did you use?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

31. What rate of Imitator + 2,4D (per acre) did you use?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

32. What rate of Roundup Pro Concentrate (per acre) did you use?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

33. Since you answered Other, what herbicide and at what rate did you use it?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

34. Was Milestone herbicide used with your late winter/early spring herbicide program?

- ◯ Yes
- ◯ No

35. What rate of Milestone was used?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

36. Which drift control agent was used?

- ◯ Reign LC (Loveland Products)
- ◯ Corral Poly (WinField United)
- ◯ Control (GarrCo Products)
- ◯ Elite Supreme Ultra (Red River Specialties)
- ◯ Other

37. Since you answered Other, what drift control agent did you use?

38. How much drift control agent was put into each tank load?

39. What rate of AMS was used per tank load?

Please answer with the amount used per tank load. We realize this is different than how we usually ask this question.

40. What was the target carrier rate (in gallons per acre) used?

Please enter a number only

The value must be a number

41. What is the target speed in miles per hour (MPH) while applying your broadcast treatment?

42. How many acres were sprayed per load?

The value must be a number

43. How many tank loads of this herbicide mix were made?

The value must be a number

44. How many total acres were treated?

The value must be a number

45. Date of **first** herbicide application for your early spring/late winter herbicide treatment?

Please input date (M/d/yyyy)

46. Date of **final** herbicide treatment for your late winter/early spring treatment.

Please input date (M/d/yyyy)

47. What level of control did you achieve with your late spring/early winter herbicide treatment?

- ◯ Good (80%-100% control)
- ◯ Fair (50%-79% control)
- ◯ Poor (less than 50% control)

Early Spring/Late Winter Herbicide Program Section 2

Time to pull those spray records. Please provide the following answers for your spray programs. Some units use two different tanks. There will be two sections available to fill in the pertinent information for that situation. Don't worry if you don't require a second section. You'll be asked a

48. Do you require a second section to complete your broadcast late winter/early spring herbicide treatment?

- ◯ Yes
- ◯ No

49. Which product was used for the broadcast early spring/late winter herbicide treatment?

If you use Milestone we're asking about that in a moment.

- ◯ Landmaster BW (Albaugh, LLC)
- ◯ Imitator + 2,4-D (Drexel Chemical Co.)
- ◯ Roundup Pro Concentrate (glyphosate) (Bayer/ Monsanto)
- ◯ Other

50. What rate of Landmaster BW (per acre) did you use?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

51. What rate of Imitator + 2,4-D (per acre) did you use?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

52. What rate of Roundup Pro Concentrate (per acre) did you use?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

53. Since you answered 'Other', what herbicide and at what rate (per acre) did you use it?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

54. Was Milestone herbicide used with your late winter/early spring herbicide program?

- ◯ Yes
- ◯ No

55. What rate of Milestone was used?

Please enter this as a rate per acre, not amount put in the tank. If you need help calculating please contact andrea.payne@okstate.edu or gerkend@okstate.edu

56. Which drift control Agent was used?

- ◯ Reign LC (Loveland Products)
- ◯ Corral Poly (WinField United)
- ◯ Reign (Loveland Products)
- ◯ Control (GarrCo Products)
- ◯ Other

57. Since you answered Other, what drift control agent did you use?

58. How much drift control agent was put into each tank load?

59. What size was your herbicide tank for this treatment?

The value must be a number

60. What was the target carrier rate (in gallons per acre) used?

Please enter a number only

The value must be a number

61. How many acres were sprayed per load?

The value must be a number

62. How many tank loads of this herbicide mix were applied?

The value must be a number

63. How many total acres were treated?

The value must be a number

64. What was the date of your **first** herbicide application for your early spring/late winter herbicide treatment?

Please input date (M/d/yyyy)

65. What was the date of the **final** herbicide treatment for your late winter/early spring treatment.

Please input date (M/d/yyyy)

66. What level of control did you achieve with your late spring/early winter herbicide treatment?

- ◯ Good (80%-100% control)
- ◯ Fair (50%-79% control)
- ◯ Poor (less than 50% control)

Cable Barrier Treatments

For this section please only consider herbicide applications made to cable barriers. The next section will ask about guardrails specifically.

67. Were cable barriers treated between September 1 and April 30.

- ◯ Yes
- ◯ No

68. How many miles of cable barrier were treated with herbicide?

The value must be a number

69. What herbicides, adjuvants, and at what rate per acre were herbicides used during your cable barrier treatment? *Do not include drift control, that's the next question.*

For example: Roundup Pro Concentrate (16 fl oz/A) + Esplanade 200 SC (7 fl oz/A)

70. On what date was your first herbicide application for your cable barrier treatment?

Please input date (M/d/yyyy)

71. On what date was your final herbicide application for your cable barrier treatment?

Please input date (M/d/yyyy)

72. What level of control did you achieve with your cable barrier treatment?

- ◯ Good (80%-100%) control
- ◯ Fair (50%-79%) control
- ◯ Poor (less than 50%) control

73. Was a string trimmer/Weedeater used to reduce vegetation height in the cable barrier or cable barrier footprint (aggregate/millings/asphalt/concrete immediately around the cable barrier) between September 1 and April 30?

- ◯ Yes
- ◯ No
- ◯ Do not remember

Cable Barrier Treatment Section 2

For this section please only consider herbicide applications made to cable barriers.

74. Do you require a second section to complete your cable barrier treatments?

- ◯ Yes
- ◯ No

75. How many miles of cable barrier were treated with herbicide?

The value must be a number

76. What herbicides, adjuvants, and at what rate per acre were herbicides used during your cable barrier treatment? *Do not include drift control, that's the next question.*

For example: Roundup Pro Concentrate (16 fl oz/A) + Esplanade 200 SC (7 fl oz/A)

77. On what date was your first herbicide application for your cable barrier treatment?

Please input date (M/d/yyyy)

78. On what date was your final herbicide application for your cable barrier treatment?

Please input date (M/d/yyyy)

79. What level of control did you achieve with your cable barrier treatment?

- ◯ Good (80%-100%) control
- ◯ Fair (50%-79%) control
- ◯ Poor (less than 50%) control

Guardrail Treatments

Please only consider herbicide applications made to guard rails between September 1, 2022 and

80. Were guardrails treated between September 1 and April 30.

- ◯ Yes
- ◯ No

81. How many miles of guardrail were treated with herbicide?

The value must be a number

82. What herbicides, adjuvants, and at what rate per acre were herbicides used during your guardrail treatment? *Do not include drift control, that's the next question.*

For example: Roundup Pro Concentrate (16 fl oz/A) + Esplanade 200 SC (7 fl oz/A)

83. On what date was your **first** herbicide application for guardrail treatment?

Please input date (M/d/yyyy)

84. On what date was your **final** herbicide application for the guardrail treatment?

Please input date (M/d/yyyy)

85. What level of control did you achieve with your guardrail treatment?

- ◯ Good (80%-100%) control
- ◯ Fair (50%-79%) control
- ◯ Poor (less than 50%) control

86. Was a string trimmer/Weedeater used to reduce vegetation height in the guardrail or guardrail footprint (aggregate/millings/asphalt/concrete immediately around the cable barrier) between September 1 and April 30?

- ◯ Yes
- ◯ No
- ◯ Don't remember

Guardrail Treatments Section 2

Please only consider herbicide applications made to guard rails between September 1, 2022 and

87. Do you require a second section to complete the guardrail treatments?

- ◯ Yes
- ◯ No

88. How many miles of guardrail were treated with herbicide?

The value must be a number

89. What herbicides, adjuvants, and at what rate per acre were herbicides used during your guardrail treatment? *Do not include drift control, that's the next question.*

For example: Roundup Pro Concentrate (16 fl oz/A) + Esplanade 200 SC (7 fl oz/A)

90. On what date was your **first** herbicide application for guardrail treatment?

Please input date (M/d/yyyy)

91. On what date was your **final** herbicide application for the guardrail treatment?

Please input date (M/d/yyyy)

92. What level of control did you achieve with your guardrail treatment?

- ◯ Good (80%-100%) control
- ◯ Fair (50%-79%) control
- ◯ Poor (less than 50%) control

93. Was a string trimmer/Weedeater used to reduce vegetation height in the guardrail or guardrail footprint (aggregate/millings/asphalt/concrete immediately around the cable barrier) between September 1 and April 30?

- ◯ Yes
- ◯ No
- ◯ Don't remember

Wiper Applications

Some units may treat tall vegetation during the fall months prior to final freeze using a wiper.

94. Did you use a wiper between September 1 and April 30?

- ◯ Yes
- ◯ No

95. What herbicide(s) was used in the wiper tank?

96. What width is your wiper?

The value must be a number

97. What concentration (as a percent) of herbicide was used?

Do not include the %. Please enter only a number.

The value must be a number

98. How many acres were treated using a wiper?

99. Between September 1 and April 30, when was your earliest wiper application?

Please input date (M/d/yyyy)

100. Between September 1 and April 30, when was your last wiper application?

Please input date (M/d/yyyy)

101. What level of control did you achieve with the wiper treatment?

- ◯ Good (80%-100% control)
- ◯ Fair (50%-79% control)
- ◯ Poor (less than 50% control)

Brush Control Herbicide Program

102. Did your unit perform brush control or tree removal either using or not using herbicides between September 1 and April 30?

- ◯ Yes
- ◯ No

103. What was the method of brush control?

Please mark all that apply

- ☐ Cut Stump
- ☐ Hack and Squirt
- ☐ Basal Bark
- ☐ Foliar
- ☐ Other

104. If you answered "Other", what method did you use?

If you did not answer other, please write NA

105. Were pesticides used during your brush control or tree removal?

- ◯ Yes
- ◯ No

106. Did you complete a spray record for each pesticide application made to brush/trees?

- ◯ Yes
- ◯ No

107. Since you answered no, why were pesticide records not completed?

108. What equipment was used when applying pesticide to brush and/or trees?

Answer all that apply

- ☐ Handgun (100 psi)
- ☐ Handpump sprayer
- ☐ 12V sprayer
- ☐ Paint brush
- ☐ Other

109. What herbicides, adjuvants, and at what rate per acre were herbicides used during your brush/tree control? *Do not include drift control, that's the next question.*

For example: Landmaster BW (2pts/A) + AMS (5.1 lbs/A). If it is easier to report the use rate as a % product (50% Garlon 3A) please report that way instead.

110. What rate of drift control was used for your brush/tree control?

If your application method did not require a drift control please respond NA

111. What carrier rate (in gallons per acre) was used?

Please enter a number only.

The value must be a number

112. How many acres were sprayed per load for your brush/tree control?

Please type a number only. No need to report A or acres, these will eventually be deleted for our analysis.

113. How many loads of herbicide mix were made for your brush/tree control?

The value must be a number

114. How many total acres were treated for your brush/tree control?

The value must be a number

115. What level of control did you achieve with your brush/tree treatment?

- ◯ Good (80%-100% control)
- ◯ Fair (50%-79% control)
- ◯ Poor (less than 50% control)

Weather Monitoring

116. Was the Oklahoma Mesonet Drift Risk Advisor used prior to making herbicide applications at least once between Sept 1 and April 30?

- ◯ Yes
- ◯ No

117. Was the results of the Drift Risk Advisor included with the spray record?

- ◯ Yes
- ◯ No

118. Was the Drift Risk Advisor checked after 24 hours to receive updated information for your spray treatment?

- ◯ Yes
- ◯ No

119. What was the source of weather information most frequently used between September 1 and April 30 when deciding if weather conditions were appropriate for a pesticide application?

This is the the most frequently used source of weather information used. Please select only one option.

- ◯ Weather Underground
- ◯ Oklahoma Mesonet
- ◯ AccuWeather
- ◯ The Weather Channel (this includes their phone app, website, or iPhone weather app which uses information from Weather.com)
- ◯ Other
- ◯ Local News Organization

120. Since you selected 'Other', what source of weather information did you use most frequently.

121. Did the information gathering from your weather monitoring modify the herbicide application timing?

- ◯ Yes
- ◯ No
- ◯ Maybe

Mowing Practices between September 1 and April 30.

122. Did you begin a cleanup mow (fence-to-fence) between Sept 1 of last year and April 30?
If you began your cleanup mow prior to September 1 of last year that should have been counted on last year's herbicide survey.

- ◯ Yes
- ◯ No

123. Approximately what day did the cleanup mow begin?
Please be as exact as possible but being off a few days or even a week won't affect our interpretation. We do understand not every unit captures this information exactly.

Please input date (M/d/yyyy)

124. Was the cleanup mow for your unit completed?

- ◯ Yes
- ◯ No

125. What prevented you from completing your cleanup mowing event?
Please be as specific as possible

126. Did you perform any mowing of ***only*** the safety zone between September 1 and April 30?

The Safety zone is the 30 foot area immediately adjacent to the roadside. If your right-of-way is so narrow that a single or double pass reaches the fence and the intent or purpose of the mowing event is a safety mow, please consider these as a safety mowing event and NOT a fence-to-fence mowing event.

- ◯ Yes
- ◯ No

127. How many times was the safety zone mowed between September 1 and April 30?

A mowing event is considered a planned mowing that occurs within the first 15-30 feet that is intended to be a safety mow. In some location a double pass may also be a fence-to-fence mow. If the intention of the mowing event is to be a safety mow please consider those a safety mow.

- ◯ 1 Mowing Event
- ◯ 2 Mowing Events
- ◯ 3 Mowing Events

128. On what day did you start one of your mowing events?

Please provide your best estimation is an exact date is not known. Being off a few days either direction will not greatly affect our interpretation. If an estimation is not possible, please leave blank.

Please input date (M/d/yyyy)

129. On what day did you start one of your mowing events?

Please provide your best estimation is an exact date is not known. Being off a few days either direction will not greatly affect our interpretation. If an estimation is not possible, please leave blank.

Please input date (M/d/yyyy)

130. On what date did you finish your mowing events?

Please provide your best estimation is an exact date is not known. Being off a few days either direction will not greatly affect our interpretation. If an estimation is not possible, please leave blank.

Please input date (M/d/yyyy)

Wildflower Plots

This section will focus on the wildflower plots previously established by ODOT.

131. Do you have official wildflower plots (Color Oklahoma Wildflower Plantings) in your country or unit

- ◯ Yes
- ◯ No
- ◯ I don't know

132. Approximately, how many signed wildflower plots are located in your unit?

An approximate answer is appropriate, if unknown please write 'Unknown'.

133. Is an official Color Oklahoma Wildflower plot marked so that accidental untimely mowing of the wildflower plot does not occur

- ◯ Yes
- ◯ No
- ◯ Most are Marked
- ◯ Most are not marked
- ◯ I Don't Know

134. Have you been presented with clear written directions on when not to mow or when to mow the wildflower plots so as to allow them to set seed for the next year?

- ◯ Yes
- ◯ No
- ◯ I Don't Know

135. Would you like to have a short educational segment at the annual herbicide applicator CEU workshop concerning proper mowing timing of wildflower plots to achieve the best outcome for maximizing success of the official wildflower plots?

- ◯ Yes
- ◯ No
- ◯ I Don't Know

Quality of the Right-of-Way

136. Please rate the follow statements.

	Absolutely False	Mostly False	Neither true nor false	Mostly True	Absolutely True	N/A
My safety zone looked good this year.	○	○	○	○	○	○
Our Late Winter/Early Spring Program could use improvement.	○	○	○	○	○	○
Our Late Winter/Early Spring Program helped us manage the safety zone.	○	○	○	○	○	○
I could delay our first safety mow because of our herbicide program.	○	○	○	○	○	○
I could eliminate at least 1 mowing event this year because of our herbicide program.	○	○	○	○	○	○
	Absolutely False	Mostly False	Neither true nor false	Mostly True	Absolutely True	N/A

Our cable barrier herbicide program could use improvement	◯	◯	◯	◯	◯	◯
Our brush control program could use improvement	◯	◯	◯	◯	◯	◯
I am satisfied with the IVM program we used so far this year	◯	◯	◯	◯	◯	◯

137. Rate the quality of desirable species in **only** the safety zone (the first 30 feet immediately adjacent to the road). *1 = bareground/dirt, 5 = minimal acceptable, 10 = perfect stand of only desirable species* *

This is a rating of how good your spray zone appears, not how well you were able to complete your spray program. Please take into consideration all aspects of your IVM program (mowing, mechanical control, chemical control, etc.)

1	2	3	4	5	6	7	8	9	10

138. How effective was your Integrated Vegetation Management program (mowing, mechanical, and chemical treatments) at preventing or suppressing weed populations to an acceptable level in the spray zone between September 1 and April 30. *

- ◯ Very effective
- ◯ Somewhat effective
- ◯ Neither effective nor ineffective
- ◯ Somewhat ineffective
- ◯ Very ineffective

139. Is there anything else you would like the RVM team to know about your IVM program that will help us develop more effective programs? *

Satisfaction Survey

This is an optional section that will take less than 5 minutes to complete.

140. How satisifed are you with taking this survey as an electronic form instead of hard copy?

- ◯ Very satisfied
- ◯ Somewhat satisfied
- ◯ Neither satisfied nor dissatisfied
- ◯ Dissatisfied
- ◯ Very dissatisfied

141. Which method do you prefer to use when completing the annual IVM survey?

- ◯ Internet based like this year
- ◯ Printed copy
- ◯ Electronic form that is completed using Adobe such as what was available last year

APPENDIX B

PART 2: 2021/2022 ANNUAL ODOT HERBICIDE PROGRAM SURVEY

Part 2 | 2022 Annual Herbicide Survey for the ODOT IVM Program (May 1 to August 31)

The Oklahoma State University Roadside Vegetation Management Team would like to collect information concerning each District's herbicide programs and practices through a web-based survey. This seemed to go over extremely well for Part 1 of the survey with an average completion time of 45 minutes. Through verbal communication, a large portion of ODOT was not able to make herbicide applications this year due to herbicide shortages. We want to make sure that we're capturing the unique information about spray areas affected by this situation. This survey may be one of the most useful IVM surveys we've been able to conduct in several years due to the lack of herbicide applications caused by shortages and significant cost increases.

You will find this years survey more streamlined especially for those who did not make pesticide applications. Units can complete the form quickly while still providing useful information regarding mowing practices, right-of-way quality, weather monitoring, and use of other equipment practices that do not require herbicide applications. For this electronic version, questions have been written in such a way as to lead you through the survey. Questions may appear odd but have been designed to flow through the survey faster by presenting only relevant questions to capture your Integrated Vegetation Management (IVM) program. This will begin with the fourth question of the survey.

Please do your best to answer every question. If you have additional comments or questions please contact Dr. Andrea Payne Connally or Mr. David Gerken.

Dr. Andrea Payne Connally
Office: 405-744-4085
Mobile: 918-914-3532 *text messages are fine
andrea.payne@okstate.edu

Mr. David Gerken
405-744-4091
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This survey has been designed to take between 30 mins and 2 hours depending on how extensive your IVM program was between September 1 of last year and April 30th of this year.

This survey also includes several 'Pages'. There is also a tracker located at the bottom to help identify where you are during the completion of the survey.

When answering the questions please only consider the period between May1, 2022 and August 31, 2022 unless otherwise stated.

Basic Information

This section identifies what district and unit you are in and the location. These questions will also help us in the analysis of the information which you provide later.

1. What district are you in? *

Select your answer

2. Name of Unit. *

Please enter your unit as the County name (Payne County) or Interstate unit (Guthrie I-35).

3. Are you an Interstate Unit? *

Interstate Units operate their IVM programs slightly different. Due to these differences, it is important to make this distinction and classify your unit correctly.

- ◯ Yes
- ◯ No
- ◯ Both

4. Did you apply any herbicide between May 1 and August 31, 2022 *

- ◯ Yes
- ◯ No

5. Were you able to begin your summer broadcast (Johnsongrass) herbicide program?

- ◯ Yes
- ◯ No

6. Why were you not able to apply your summer broadcast (Johnsongrass) herbicide program?

Please select all that apply

- ☐ Herbicide we wanted to use was not available
- ☐ Weather related issues
- ☐ Other responsibilities were a priority
- ☐ Spray equipment was not functioning correctly
- ☐ Herbicide was too expensive
- ☐ A lack of personnel
- ☐ Other

7. **If you answered other**, please provide details.

8. Were you able to begin ***BOTH*** your Late Winter/Early Spring application AND summer (Johnsongrass) broadcast program?

- ◯ Yes
- ◯ Only the summer Johnsongrass broadcast program
- ◯ Only the Late Winter/ Early Spring Program
- ◯ We did not begin either broadcast programs this year

9. Was timing of mowing events in the *safety zone* (first 30 feet) from May 1 to August 31, 2022 impacted by the absence of herbicide applications?

NOTE: Do not consider mowing events intended to be fence-to-fence.

- ◯ Our first mowing event occured earlier than normal
- ◯ No affect
- ◯ Our first mowing event occurred later than normal
- ◯ Our safety zone was not mowed this year.

10. What impact did a lack of broadcast herbicide treatment have on the weed population in the safety zone (first 30 feet)?

- ◯ We had more weeds in the safety zone than we usually do
- ◯ Our safety zone looked about the same as it usually does
- ◯ We had less weeds in the safety zone than we usually do

11. How was the quality of your desirable ground cover (such as bermudagrass or buffalograss) impacted in the safety zone (first 30 feet) as a result of not spraying herbicide?

- ◯ Our desirable ground cover looked better
- ◯ Our desirable ground cover looked about the same
- ◯ There was an increase in weed population in our desirable ground cover.

12. Did you apply any herbicides (broadcast cable barrier, guardrails, brush control, and/or spot treatments) between May 1 and August 31, 2022?

- ◯ Yes
- ◯ No

13. Even though you did not make an herbicide application, did you monitor weather conditions in an attempt to find a period of time where weather conditions met label requirements?

- ◯ Yes
- ◯ No

Recordkeeping

The following question are meant to assess recordkeeping practices by ODOT to ensure they are compliant with ODOT policy and Oklahoma law.

14. Was a herbicide record completed for each application?

    This would include spot treatments, signage, guard rails, cable barrier, cut stump, basal bark, etc.)

    - ◯ Yes
    - ◯ No

15. Why was a record not completed for a pesticide application?

16. For broadcast applications, was an application record completed for each tank load?

    - ◯ Yes
    - ◯ No
    - ◯ N/A

17. Oklahoma Department of Food and Forestry (ODAFF) requires pesticide applicators to keep records of pesticide applications for two years. If ODAFF were to request spray records, do you feel confident you can find all pesticide application records over the last 2 years?

- ◯ Yes
- ◯ No
- ◯ Not Sure

18. Who fills out spray application records?

- ◯ Superintendent (regardless if they sprayed of didn't spray only the superintendent fills out that record)
- ◯ The person(s) who made that application (this could be either the superintendent, TEO, etc,)
- ◯ Secretary
- ◯ District leadership personnel
- ◯ Other

19. Who is responsible for maintaining spray records?

- ◯ Superintendent
- ◯ The person(s) who made that application
- ◯ Secretary
- ◯ District Leadership personnel
- ◯ Other

Equipment Use

20. Did you increase the use of a weed wiper as part of your IVM program during this year?

- ◯ Yes
- ◯ The wiper was used on the same number of acres as last year
- ◯ We wiped less area than in most past years
- ◯ We did not use a wiper at all this year

21. If your unit was given a wiper for use for a growing season, how much would you rely on it to manage tall weeds outside the spray zone?

Please answer all that apply

- ☐ We would use a wiper whenever possible
- ☐ We would use a wiper in specific areas regardless of weed pressure in other areas
- ☐ Terrain would limit the areas we could use a wiper
- ☐ We don't want to use a wiper

22. Did you calibrate your sprayer after the completion of your late winter/early spring broadcast program but before the beginning of your johnsongrass broadcast program?

If you did not make your late winter/early spring broadcast program, did you calibrate immediately prior to your first johnsongrass program

- ◯ Yes
- ◯ No, we did not calibrate prior to spraying
- ◯ No, we didn't spray therefore we didn't calibrate

23. What was your measured spray width?

If you did not measure your spray width please write 0

The value must be a number

Johnsongrass Broadcast Program (Section 1)

24. Were you able to begin your broadcast Johnsongrass program?

- ◯ Yes
- ◯ No

25. Were you able to complete your broadcast application for Johnsongrass?

- ◯ Yes
- ◯ No

26. What prevented you from completing your johnsongrass broadcast program?

27. Approximately what percent of your intended johnsongrass program was able to be treated?

Select your answer

28. How many center lane miles were treated with a broadcast johnsongrass program?

The value must be a number

29. What size is the herbicide tank for this treatment?

The value must be a number

30. What herbicide(s) and what rates were they applied?

For Example: Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (1.5 oz/A)

31. Which drift control agent was used?

- ◯ Reign LC (Loveland Products)
- ◯ Corral Poly (Winfield United)
- ◯ Control (GarrCo Products)
- ◯ Elite Supreme Ultra (Red River Specialties)
- ◯ Other

32. How much drift control was used per **tank load?**

The value must be a number

33. What was your target carrier rate (Gallons per acre)?

The value must be a number

34. What was your target speed in miles per hour (MPH) while applying your broadcast treatment?

The value must be a number

35. How many acres were sprayed per load?

The value must be a number

36. How many total loads were sprayed with this treatment?

The value must be a number

37. How many total acres were treated?

The value must be a number

38. Date of first herbicide application for the johnsongrass broadcast treatment?

Please input date (M/d/yyyy)

39. Date of last herbicide application for the johnsongrass broadcast treatment?

Please input date (M/d/yyyy)

40. What level of control did you achieve with your johnsongrass broadcast treatment?

- ◯ Good (80%-100%)
- ◯ Fair (50% - 79%)
- ◯ Poor (less than 50% control)

41. Since you answered Fair or Poor, what weeds were not controlled?

Johnsongrass Broadcast Program (Section 2)

42. Were additional herbicide treatments or tank configurations made to complete your johnsongrass broadcast program that would require a second section to record your complete broadcast johnsongrass program?

- ◯ Yes
- ◯ No

43. What size is the herbicide tank for this treatment?

The value must be a number

44. What herbicide(s) and what rate were they applied?

For Example: Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (1.5 oz/A)

45. Which drift control agent was used?

- ◯ Reign LC (Loveland Products)
- ◯ Corral Poly (Winfield United)
- ◯ Control (GarrCo Products)
- ◯ Elite Supreme Ultra (Red River Specialties)
- ◯ Other

46. How much drift control was used per **tank load?**

The value must be a number

47. What was your target carrier rate (Gallons per acre) for this treatment?

The value must be a number

48. What was your target speed in miles per hour (MPH) while applying your broadcast treatment?

The value must be a number

49. How many acres were sprayed per load for this treatment?

The value must be a number

50. How many total loads were sprayed with this treatment?

The value must be a number

51. How many total acres were treated with this treatment?

The value must be a number

52. Date of first herbicide application for the johnsongrass broadcast treatment?

Please input date (M/d/yyyy)

53. Date of last herbicide application for the johnsongrass broadcast treatment?

Please input date (M/d/yyyy)

54. What level of control did you achieve with this johnsongrass broadcast treatment?

- ◯ Good (80%-100%)
- ◯ Fair (50% - 79%)
- ◯ Poor (less than 50% control)

55. Since you answered Fair or Poor, what weeds were not controlled in the sprayer area.

Guardrail Broadcast Program (Section 1)

56. Were you able to begin your guardrail program?

- ◯ Yes
- ◯ No

57. Were you able to complete your guardrail program?

- ◯ Yes
- ◯ No

58. What prevented you from completing your guardrail program?

59. Approximately what percent of your intended guardrail program was able to be treated?

Select your answer

60. Was a string trimmer or weedeater used around guardrails between May 1 and August 31?

- ◯ Yes
- ◯ No

61. What herbicide(s) and rates were applied?

For Example: Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (1.5 oz/A)

62. How many miles of guardrail were treated with this program?

The value must be a number

63. What size is the herbicide tank for this treatment?

The value must be a number

64. Which drift control agent was used?

Select your answer

65. How much drift control was used per **tank load?**

66. What was your target carrier rate (Gallons per acre)?

The value must be a number

67. What was your spray width for this treatment?

If you used a handgun or spot treatment instead of a broadcast application please put 'handgun' or 'spot treatment'

68. What was your target speed in miles per hour (MPH) while applying your broadcast treatment?

The value must be a number

69. How many acres were sprayed per load?

The value must be a number

70. How many total loads were sprayed with this treatment?

The value must be a number

71. How many total acres were treated with this treatment?

The value must be a number

72. Date of first herbicide application to the guardrail for this treatment?

Please input date (M/d/yyyy)

73. Date of last herbicide application to the guardrail for this treatment?

Please input date (M/d/yyyy)

74. What level of control did you achieve with your guardrail treatment?

- ◯ Good (80%-100%)
- ◯ Fair (50% - 79%)
- ◯ Poor (less than 50% control)

75. Since you answered Fair or Poor, what weeds were not controlled in the sprayer area.

Guardrail Broadcast Program (Section 2)

76. Do you require a second section to complete your guardrail program?

- ◯ Yes
- ◯ No

77. What herbicide(s) and rates were they applied?

For Example: Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (1.5 oz/A)

78. How many miles of guardrail were treated with this program?

The value must be a number

79. What size is the herbicide tank for this treatment?

The value must be a number

80. Which drift control agent was used?

Select your answer

81. How much drift control was used per **tank load?**

82. What was your target carrier rate (Gallons per acre)?

The value must be a number

83. What was your spray width for this treatment?

If you used a handgun or spot treatment instead of a broadcast application please put 'handgun' or 'spot treatment'

84. What was your target speed in miles per hour (MPH) while applying your broadcast treatment?

The value must be a number

85. How many acres were sprayed per load?

The value must be a number

86. How many total loads were sprayed with this treatment?

The value must be a number

87. How many total acres were treated?

The value must be a number

88. Date of first herbicide application for the guardrail treatment?

Please input date (M/d/yyyy)

89. Date of last herbicide application for the guardrail treatment?

Please input date (M/d/yyyy)

90. What level of control did you achieve with your guardrail treatment?

- ◯ Good (80%-100%)
- ◯ Fair (50% - 79%)
- ◯ Poor (less than 50% control)

91. Since you answered Fair or Poor, what weeds were not controlled in the sprayer area.

Cable Barrier Program (Section 1)

92. Were you able to begin your Cable Barrier program?

- ◯ We have no cable barrier to treat
- ◯ Yes
- ◯ No

93. Were you able to complete your cable barrier management program?

- ◯ Yes
- ◯ No

94. What prevented you from completing your cable barrier management program?

95. Approximately what percent of your intended cable barrier was able to be treated?

Select your answer

96. Did you use a string trimmer or weedeater around cable barriers between May 1 and August 31?

- ◯ Yes
- ◯ No

97. What herbicide(s) and rates were applied?

For Example: Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (1.5 oz/A)

98. How many miles of cable barrier were treated with this program?

The value must be a number

99. What size is the herbicide tank for this treatment?

The value must be a number

100. Which drift control agent was used?

Select your answer

101. How much drift control was used per **tank load?**

102. What was your target carrier rate (Gallons per acre)?

The value must be a number

103. What was your spray width for this treatment?

If you used a handgun or spot treatment instead of a broadcast application please put 'handgun' or 'spot treatment'

104. What was your target speed in miles per hour (MPH) while applying your broadcast treatment?

if using handgun or spot treatment please write 0 (I hope vehicles came to a full stop)

The value must be a number

105. How many acres were sprayed per load?

The value must be a number

106. How many total loads were sprayed with this treatment?

The value must be a number

107. How many total acres were treated with this treatment?

The value must be a number

108. Date of first herbicide application for the cable barrier treatment?

Please input date (M/d/yyyy)

109. Date of last herbicide application for the cable barrier treatment?

Please input date (M/d/yyyy)

110. What level of control did you achieve with your cable barrier treatment?

- ◯ Good (80%-100%)
- ◯ Fair (50% - 79%)
- ◯ Poor (less than 50% control)

111. Since you answered Fair or Poor, what weeds were not controlled in the sprayer area.

Cable Barrier Program (Section 2)

This section is for those who need a second section due to different tank mixes, tank sizes, application method etc. in the treatment of their cable barrier.

112. Do you require a second section to complete your cable barrier herbicide program?

- ◯ Yes
- ◯ No

113. Were you able to complete this cable barrier treatment?

- ◯ Yes
- ◯ No

114. What prevented you from completing your cable barrier program?

115. Approximately what percent of your intended cable barrier was able to be treated with this program?

Select your answer

116. What herbicide(s) and rates were applied?

For Example: Roundup Pro Concentrate (16 fl oz/A) + Oust Extra (1.5 oz/A)

117. How many miles of cable barrier were treated with this program?

The value must be a number

118. What size is the herbicide tank for this treatment?

The value must be a number

119. Which drift control agent was used?

Select your answer

120. How much drift control was used per **tank load?**

121. What was your target carrier rate (Gallons per acre)?

The value must be a number

122. What was your spray width for this treatment?

If you used a handgun or spot treatment instead of a broadcast application please put 'handgun' or 'spot treatment'

123. What was your target speed in miles per hour (MPH) while applying your broadcast treatment?

if using handgun or spot treatment please write 0 (I hope vehicles came to a full stop)

The value must be a number

124. How many acres were sprayed per load?

The value must be a number

125. How many total loads were sprayed with this treatment?

The value must be a number

126. How many total acres were treated with this treatment?

The value must be a number

127. Date of first herbicide application for this cable barrier treatment?

Please input date (M/d/yyyy)

128. Date of last herbicide application for this cable barrier treatment?

Please input date (M/d/yyyy)

129. What level of control did you achieve with your cable barrier treatment?

- ◯ Good (80%-100%)
- ◯ Fair (50% - 79%)
- ◯ Poor (less than 50% control)

130. Since you answered Fair or Poor, what weeds were not controlled in the sprayer area.

Wiper Program

131. Was a weed wiper with herbicide used to treat tall vegetation either inside or outside the safety zone (first 30 feet)?

- ◯ Yes
- ◯ No

132. What size tank does the wiper have.

The value must be a number

133. What glyphosate herbicide did you use in the tank?

Select your answer

134. Did you use another herbicide in the tank besides Roundup Pro Concentrate or other glyphosate containing product?

- ◯ Yes
- ◯ No

135. What other product was added to the tank besides glyphosate and water and how much was added?

Example: MSMA (2.5 gallons)

Weather Monitoring

136. Did you monitor weather conditions to determine is herbicide applications could safely be applied?

- ◯ Yes
- ◯ No

137. Did you use the Drift Risk Advisor on the Oklahoma Mesonet to determine an appropriate window to spray?

- ◯ Yes
- ◯ No

138. Based on what the Drift Risk Advisor results, did you make changes to your schedule or cancel a planned herbicide application?

- ◯ Yes
- ◯ No
- ◯ Maybe

139. What was the biggest weather factor that negatively impacted your spray program?

140. Did you print out the results of the Drift Risk Advisor and include it as part of your spray records?

- ◯ Yes
- ◯ No

Mowing practices between May 1 and August 31

For this next section we need to define some things.

Safety mowing event - a mowing event where the intent is to mow only the first 15-30 (single or double pass) of the right-of-way adjacent to the road. In some areas of the state the ROW is so narrow that this will look like a fence-to-fence. However if the intent is to only perform a single or double pass of your area please consider that as a safety mow.

Fence-to-Fence Mowing Event - a mowing event where the entire right-of-way is mowed from the fence line on one side of the ROW to the other fence line on the other side of the ROW, regardless of if you are in an interstate or county unit. Although a fence-to-fence mowing event does include the

141. Was only the safety zone mowed during May 1 and August 31??

Although Fence-to-Fence mowing does include the safety zone as well as area outside the safety zone, please do not count that mowing event towards a safety zone mowing. We'll ask about fence-to-fence mowing next.

- ◯ Yes
- ◯ No

142. Please provide the approximate date when your first mowing event of the safety zone occurred.

If this occurred prior to May 1 please provide the date that occurred prior to May 1

Please input date (M/d/yyyy)

143. Approximately, how many times was the safety zone mowed between May 1 and August 31?

Select your answer

144. Did you mow the safety zone more or less than normal this year?

- ◯ We mowed more than usual
- ◯ We mowed less than usual
- ◯ We mowed about the same as usual

145. Did you mow fence-to-fence between May 1 and August 31?

A fence-to-fence mowing event includes not only the area 15-30 feet off the pavement but also the vegetation outside of the safety zone all the way to the right-of-way fence. In some locations a double pass may also be a fence-to-fence mow. If the intention of the mowing event is to be a safety mow please consider those a safety mow.

- ◯ Yes
- ◯ No

146. At what height is your mower cutting your right-of-way?

Ideally, please measure this in the grass. You can also measure how high the blades sit off the ground in your yard.

- ◯ 3" or less
- ◯ 4"-6"
- ◯ 7"-8"
- ◯ greater than 8"

Pollinator Habitat

These are a requested set of questions from ODOT so they can get more specific insights into herbicide use practices for habitat improvement. This section is required.

147. Please describe any herbicide treatments that made to undesirable vegetation that was present outside the the clear zone. *

This may include wiper treatments, spot treatments,

148. What targeted herbicide treatments of undesirable vegetation occurred outside the clear zone? *

- [ ] None were applied outside the clear zone
- [ ] Wiper treatments
- [ ] Spot treatments (signage)
- [ ] Spot treatment (musk thistle)
- [ ] Cut Stump
- [ ] Brush Removal
- [ ] Other

149. What practices are being used to minimize the spread of invasive species (such as johnsongrass) into areas of suitable pollinator or wildlife habitat? *

150. In what months do Monarch Butterflies pass through Oklahoma on their way south into Mexico? *

- [ ] January
- [ ] February
- [ ] March
- [ ] April
- [ ] May
- [ ] June
- [ ] July
- [ ] August
- [ ] September
- [ ] October
- [ ] November
- [ ] December

151. What Integrated Vegetation Management (IVM) practices are being used to enhance floral resources prior to monarch migration and their breeding seasons? *

152. Is brush removal being performed specifically to open habitat for monarchs in areas outside the clear zone? *

- ◯ Yes
- ◯ No

153. Are there plans to modify IVM practices (chemical, mechanical, mowing, etc.) over time specifically for monarch habitat improvement? *

- ◯ Yes
- ◯ No

154. Did you hear of the recent change in the Monarch Butterfly's status to an Endangered species by the International Union for Conservation of Nature (IUCN)? *

- ◯ Yes
- ◯ No
- ◯ Maybe

155. Do you feel there are practices you can change to increase flowering plants that provide food for pollinators outside the spray zone? *

- ◯ Yes
- ◯ No

Survey Satisfaction

This section is an optional section however it will help us tremendously in the future.

156. Would you like to continue to conduct these surveys using the internet-based approach used this year?

- ◯ Yes
- ◯ No

157. What topics would you like to see during the 2023 CEU trainings?

Your opportunity to let us know what would help you in your herbicide program.

158. Is there anything you would like to see added to the Publication E-958 Title: Suggested practices for roadside weed and brush control?

159. When is the last time the water used for herbicide applications was tested ?

- ◯ in 2022
- ◯ 1 to 5 years ago
- ◯ We can check water quality?