DELIVERY OF CALIBRATION WORKSHOPS COVERING HERBICIDE APPLICATION EQUIPMENT

Final Report ~ FHWA-OK-14-03
ODOT SP&R ITEM NUMBER 2156

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16. ABSTRACT

Proper herbicide sprayer set-up and calibration are critical to the success of the Oklahoma Department of Transportation (ODOT) herbicide program. Sprayer system set-up and calibration training is provided in annual continuing education herbicide workshops offered by the Oklahoma State University (OSU) Roadside Vegetation Management Program. Although pesticide applicator continuing education (CEU) workshops are offered yearly, equipment calibration is not discussed in CEU workshops in the depth of detail that can be undertaken with on-site. Four ODOT herbicide applicator sprayer calibration workshops were conducted for ODOT in 2013. Sixty-five newly certified ODOT applicators received in-depth training on sprayer equipment calibration. The final decision regarding the capabilities of ODOT employees assigned to specific spray duties should continue to be made by supervisors familiar with each employee. The OSU-RVM professional staff also encourages supervisors and spray crews to thoroughly review spray system setup, annual spray application goals, specific target weed complexes, herbicides to be utilized and sensitive crop or sensitive area locations immediately prior to the beginning of each spray season. Participants in our joint project training effort are encouraged to attend annual pesticide applicator CEU workshops presented by the OSU-RVM Program.

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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
A	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)				
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC
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	A
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)				
^oC	Celsius	1.8C+32	Fahrenheit	^oF
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.

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1.0 INTRODUCTION

Proper herbicide sprayer set-up and calibration are critical to the success of the ODOT herbicide program. Sprayer system set-up and calibration training is provided in annual continuing education herbicide workshops offered by the Oklahoma State University Roadside Vegetation Management Program to ODOT employees. Although continuing education (CEU) workshops are offered as a part of Joint Project 2156, equipment calibration is not discussed in CEU workshops in the depth of detail that can be undertaken with on-site training with individual ODOT herbicide spray crews. During 2004 through 2009 we provided 10 hands-on equipment calibration and training workshops per year around the state with three workshops, each year, in 2010 and 2011 (1) and four workshops in 2012 (2). However, new ODOT employees are hired each year and newly certified employees are assigned to ODOT spray crews. These individuals did not participate in prior equipment calibration workshops and they need "hands-on" orientation in system calibration and problem diagnosis.

2.0 OBJECTIVE

To conduct four calibration workshops in 2013 for newly Certified Pesticide Applicators assigned to ODOT herbicide spray crews.

3.0 BACKGROUND AND SIGNIFICANCE OF TRAINING

ODOT field staff are responsible for a number of activities from laying asphalt to managing roadsides for weeds. Due to the broad range of work responsibilities of ODOT field staff, they may not have a mastery of each type of activity. This training need has been addressed in over 74 hands-on equipment calibration workshops (prior to this year) to approximately 44 spray crews over the last 10 years. Most herbicide application crews are now well trained and their equipment is generally in good working order. However, new hires or newly certified ODOT herbicide applicators have not yet had this hands-on calibration or equipment troubleshooting training. OSU RVM personnel work with weed control issues and use application equipment on a daily basis.

While overviews of weed control programs can be taught in a classroom setting, spray equipment calibration can be more effectively taught to the new individual ODOT applicators during a hands-on demonstration. During past consultation visits to some maintenance facilities, our RVM staff have witnessed some pieces of equipment in need of small but important adjustments to make equipment more effective in the herbicide application process. Problems have been resolved but new hires and newly certified applicators did not have the benefit of this training and trouble-shooting experience.

We conducted three one-half day sprayer calibration workshop sessions in 2010 and 2011 (1) and four in 2012 (2). Each workshop taught newly certified applicators the

proper methods of sprayer calibration and how to “troubleshoot” the application equipment. Employees who were unable to attend were rescheduled to attend the following year to obtain the training (1, 2). These workshops prepared the ODOT herbicide applicators for more specific training and assignments to be provided by experienced ODOT herbicide applicators that can serve as “mentors” to the new trainees.

4.0 IMPLEMENTATION OF TRAINING

4.1 Training Dates, Locations and Attendance

Four sprayer equipment calibration workshops were held in 2013 for newly certified ODOT herbicide applicators. The workshops were conducted by Mr. Doug Montgomery, OSU-RVM Extension Associate and Mr. Clayton Hurst. Extension Assistant. The training dates, training locations and Divisions from which personnel were trained were: April 9 at Division 1 Headquarters (Muskogee) for Division 1, 2 and 8; April 16 at Division 6 Major County Yard (Fairview) for Division 4 and 6; April 23 at Division 3 Headquarters (Ada) for Division 3; and April 30 at Division 7 Grady County Yard (Chickasha) for Division 5 and 7. A total of 65 ODOT personnel were trained in the 4 workshops. The number of trainees attending each session were 15 on April 9, 7 on April 16, 20 on April 23 and 23 on April 30. The specific trainee numbers, in parentheses, from each Division were: Div 1 (9), Div 2 (1), Div 3 (20), Div 4 (0), Div 5 (10), Div 6 (7), Div 7 (13), and Div 8 (5).

4.2 Educational Content of the Sprayer Calibration Workshops

The agenda for the training sessions is shown in Table 1. Each trainee received educational support materials at the beginning of each workshop. Support materials included 1) a laminated version of the Oklahoma Cooperative Extension Service publication L-322: *Boomless Roadside Herbicide Sprayer Assessment Guide* (2); 2) a paper copy of the handout *Directions on Using the Calibration/Speed Adjustment Charts;* and 3) a paper copy of the *ODOT Sprayer Calibration & Tank Mix Calculation Worksheet.* Copies of these handouts are available upon request from our program.

Each workshop was an open forum lab and the attendees were encouraged to ask questions and interact with OSU-RVM professional staff. ODOT participants in the workshops were first trained on the sprayer components and functions listed in the publication L-322 (3) that was provided. The components on which the attendees were trained consisted of the sprayer tank and lid, spray tank shut-off valve, in-line screen, drift control injector, water pump, hoses/plumbing, agitation system, pressure gauges, pressure regulators, spray nozzles, control arms, nozzle shut-off valves, in-cab switches, handgun and hoses, and Calc-an-Acre™ controllers. Discussions included the need for components and the consequences to applicators, the roadside, the herbicide

weed control program and the environment that might result if the components failed. Applicators were taught how to diagnose and confirm component proper operation and component failure. Basic preventative maintenance was also discussed regarding each component.

Table 1. Herbicide applicator sprayer calibration workshop training agenda utilized in 2013.

Time	Topics[2]
9:00 – 9:45 am (45min)	Equipment and Component Training/Explanation Review of system troubleshooting guide. Support Material: Handout – L-322 Boomless Roadside Herbicide Sprayer Assessment Guide
9:45 – 10:00 am (15min)	Break
10:00 – 10:45 am (45min)	Broadcast Sprayer setup. Demonstrate proper calibration variable collection – GPM, GPA, SW & MPH Support Material: Handout – Directions on Using the Calibration/Speed Adjustment Charts
10:45 – 11:45 am (60min)	Broadcast Sprayer Calibration. Demonstrate – ODOT Sprayer Calibration & Use of Tank Mix Calculation Worksheet
11:45 am – 12:45 pm	Lunch
12:45 – 1:15 pm (30min)	Pump-up sprayer setup and calculation. Backpack setup and use. Demonstrate – ODOT Sprayer Calibration and Tank Mix Calculation Worksheet
1:15 – 1:45 pm (30min)	Handgun sprayer setup and calibration. Craig Evans and Doug Montgomery provide group demonstration on setup and use of handgun sprayer supplied by ODOT.

[1]Trainings were conducted on April 9 at Division 1 Headquarters (Muskogee) for Division 1, 2 and 8, April 16 at Division 6, Major County Yard (Fairview) for Division 4 and 6, April 23 at Division 3 Headquarters (Ada) for Division 3 and April 30 at Division 7, Grady County Yard (Chickasha).

[2]Participants were kept in one group for the first two workshops. For the final two workshops participants were assigned to one of two groups. Group 1 was assigned to Truck number one with Trainer Doug Montgomery. Group 2 was assigned to Truck

number two with Trainer Clayton Hurst. Groups one and two ran concurrently until the 1:15 pm session.

After the introduction to the basic broadcast sprayer system and its components, OSU-RVM staff demonstrated the use of calibration measurement tools to measure pattern widths and graduated collection barrels to properly measure spray system and tip output in gallons per minute (GPM). After variables of carrier rate in gallons per acre (GPA) and pattern spray widths (SW) were collected, the *ODOT Sprayer Calibration & Tank Mix Calculation Worksheet* was utilized in both handout and poster form. The worksheet was used to show how calculations were used to ascertain the necessary truck speed to make an accurate broadcast application. At this point participants were then introduced to the *Directions on Using the Calibration/Speed Adjustment Charts*.

The next portion of the program involved the OSU-RVM staff introducing participants to basic hand pump-up sprayers. Demonstration of the various "spray-to-wet" techniques for weeds such as Musk Thistle and brush species such as Willow were conducted. Attendees were trained upon the need to use Viton® seals to avoid the corrosive effect of commonly used broadleaf and brush herbicides. After demonstration and calculations with hand pressurized spray equipment, trailer mounted gasoline engine sprayers with powered guns (Hypro®) were demonstrated. Spray-to-wet techniques for foliar application and spot treatments were examined and discussed using the hand gun equipment.

Each training session lasted approximately four hours. At the conclusion of each session, OSU-RVM staff encouraged questions regarding any aspect of the training program. While OSU-RVM staff worked in a "hands-on" setting with attendees, continued training of these newly certified herbicide applicators will be necessary. This training should be provided ***at the county unit level by seasoned spray crew leaders whom supervisors trust to properly mentor new spray crew members***.

5.0 SUMMARY AND CONCLUSIONS

Four ODOT herbicide applicator sprayer calibration workshops were conducted for ODOT in 2013. Sixty-five newly certified ODOT pesticide applicators received in-depth and thorough training concerning sprayer equipment calibration and available calibration resources. This compares to 33 and 61 applicators receiving sprayer calibration training in three workshops in 2011 (1) and in four workshops in 2012 (2), respectively.

The final decision regarding the capabilities of ODOT employees assigned to specific spray duties should continue to be made by supervisors that are familiar with each individual's strengths and weaknesses. The OSU-RVM professional staff also encourages supervisors and spray crews to thoroughly review spray system setup, annual spray application goals, specific target weed complexes, herbicides to be utilized and sensitive crop or sensitive area locations ***immediately prior to the beginning of***

each spray season. Participants in our joint project training effort are encouraged to attend annual pesticide applicator continuing education (CEU) workshops presented by the OSU-RVM Program. OSU-RVM staff made each attendee aware that we are available to assist them and their respective counties and divisions in their vegetation management effort.

6.0 ACKNOWLEDGEMENTS

We would like to express our appreciation and gratitude to Division 1 for hosting the workshop at their Division headquarters, supplying the pickup mounted sprayer from Muskogee County and supplying a spray truck from Muskogee County. We would like to express our appreciation and gratitude to Division 6 for hosting the workshop at their Major County Yard, supplying the trailer mounted sprayer and supplying a spray truck from Major County. We would like to express our appreciation to Division 3 for hosting the workshop at their Division Headquarters, and supplying the pickup mounted sprayer and two spray trucks. Finally, we would like to express our appreciation to Division 7 for hosting the workshop at their Grady County Yard and providing a spray truck from Grady County. Also we would like to express our appreciation to Division 5, Kiowa County for supplying a spray truck for that workshop as well.

7.0 LITERATURE CITED

1. Martin, D.L., C.C. Evans, and D.P. Montgomery. 2012. Delivery of Calibration Workshops Covering Herbicide Application Equipment. Federal FY 2011 Annual Report For Task 4 of ODOT/OSU Joint Project 2156. Oklahoma State University. 5 Pages.

2. Martin, D.L., C.C. Evans, and D.P. Montgomery. 2013. Delivery of Calibration Workshops Covering Herbicide Application Equipment. Federal FY 2012 Annual Report For Task 4 of ODOT/OSU Joint Project 2156. Oklahoma State University. 5 Pages.

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