EVALUATION OF HERBICIDE TANK MIX COMPATIBILITY

ANNUAL REPORT FOR FY 2009

ODOT SPR ITEM NUMBER 2157

Submitted to:

Ginger McGovern, P.E.
Planning and Research Division Engineer
Oklahoma Department of Transportation
200 N.E. 21st Street
Oklahoma City, Oklahoma 73105

Submitted by:

Craig Evans, M.S.
Douglas Montgomery, M.S.
Dennis Martin, Ph.D., Principal Investigator
Oklahoma State University
Department of Horticulture & Landscape Architecture
358 Agricultural Hall
Stillwater, OK 74078

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METRIC CONVERSION PAGE

SI (METRIC) CONVERSION FACTORS

Approximate Conversions to SI Units					*Approximate Conversions from SI Units*				
Symbol	When you know	Multiply by	To Find	Symbol	Symbol	When you know	Multiply by	To Find	Symbol
		LENGTH					LENGTH		
in	**inches**	**25.40**	**millimeters**	**Mm**	**mm**	**millimeters**	**0.0394**	**inches**	**in**
ft	**feet**	**0.3048**	**meters**	**M**	**m**	**meters**	**3.281**	**feet**	**ft**
yd	**yards**	**0.9144**	**meters**	**M**	**m**	**meters**	**1.094**	**yards**	**yds**
mi	**miles**	**1.609**	**kilometers**	**Km**	**km**	**kilometers**	**0.6214**	**miles**	**mi**
		AREA					AREA		
in^2	**square inches**	**645.2**	**square millimeters**	**mm^2**	**mm^2**	**square millimeters**	**0.00155**	**square inches**	**in^2**
ft^2	**square feet**	**0.0929**	**square meters**	**m^2**	**m^2**	**square meters**	**10.764**	**square feet**	**ft^2**
yd^2	**square yards**	**0.8361**	**square meters**	**m^2**	**m^2**	**square meters**	**1.196**	**square yards**	**yd^2**
ac	**acres**	**0.4047**	**hectacres**	**Ha**	**ha**	**hectacres**	**2.471**	**acres**	**ac**
mi^2	**square miles**	**2.590**	**square kilometers**	**km^2**	**km^2**	**square kilometers**	**0.3861**	**square miles**	**mi^2**
		VOLUME					VOLUME		
fl oz	**fluid ounces**	**29.57**	**milliliters**	**Ml**	**mL**	**milliliters**	**0.0338**	**fluid ounces**	**fl oz**
gal	**gallon**	**3.785**	**liters**	**L**	**L**	**liters**	**0.2642**	**gallon**	**gal**
ft^3	**cubic feet**	**0.0283**	**cubic meters**	**m^3**	**m^3**	**cubic meters**	**35.315**	**cubic feet**	**ft^3**
yd^3	**cubic yards**	**0.7645**	**cubic meters**	**m^3**	**m^3**	**cubic meters**	**1.308**	**cubic yards**	**yd^3**
		MASS					MASS		
oz	**ounces**	**28.35**	**grams**	**G**	**g**	**grams**	**0.0353**	**ounces**	**oz**
lb	**pounds**	**0.4536**	**kilograms**	**Kg**	**kg**	**kilograms**	**2.205**	**pounds**	**lb**
T	**short tons (2000 lb)**	**0.907**	**megagrams**	**Mg**	**Mg**	**megagrams**	**1.1023**	**short tons (2000 lb)**	**T**
		TEMPERATURE (exact)					TEMPERATURE (exact)		
°F	**degrees Fahrenheit**	**(°F-32)/1.8**	**degrees Celsius**	**°C**	**°C**	**degrees Fahrenheit**	**9/5(°C)+32**	**degrees Celsius**	**°F**
		FORCE and PRESSURE or STRESS					FORCE and PRESSURE or STRESS		
lbf	**poundforce**	**4.448**	**Newtons**	**N**	**N**	**Newtons**	**0.2248**	**poundforce**	**lbf**
lbf/in^2	**poundforce per square inch**	**6.895**	**kilopascals**	**kPa**	**kPa**	**kilopascals**	**0.1450**	**poundforce per square inch**	**lbf/in^2**

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1.0 INTRODUCTION

The Oklahoma Department of Transportation (ODOT) Roadside Vegetation Management (RVM) program uses a dynamic, adaptive approach providing fiscal and environmentally responsible management of Oklahoma rights-of-way. An integrated roadside vegetation management (IRVM) strategy is used to contribute to safe travel corridors. IRVM incorporates mechanical, cultural, biological and herbicidal management of vegetation in the right of way.

Herbicides (weed killing compounds) are a type of pesticide (pest killing product) that are a vital component of an IRVM strategy not only currently, but for the foreseeable future. As part of the pesticide registration and reregistration process, the U.S. Environmental Protection Agency (EPA) regulates pesticide registration in the U.S. This active roll ultimately controls the availability of herbicides to vegetation managers amongst other factors that affect herbicide product availability.

Currently, the EPA does not actively regulate inert ingredients in pesticides or adjuvants that are tank mixed with pesticides. Adjuvants are products that are either premixed or tank mixed with a pesticide in an attempt to improve the performance characteristics of the pesticide. An example is the product Detain II® which is both a spreader/sticker and a drift control additive. ODOT uses Detain II® to improve herbicide uptake by weeds upon which the herbicide tank mix is sprayed in addition to the Detain II® increasing mean spray particle size diameter, which helps reduce the risk of wind drift of the spray particles.

The lack of close regulation of inert ingredients and adjuvants as well as the lack of published data on the compatibility of every herbicide formulation and every adjuvant allows for possible physical tank mix incompatibilities of the components to exist.

Compatibility testing of herbicide/adjuvant tank mix partners helps the ODOT guard against unidentified and potentially costly issues of incompatibility between new or reformulated herbicides and/or adjuvants mixed with required drift retardant.

Adverse consequences of incompatibility can include settling, layer formation, globule formation or formation of precipitants. When these issues occur, they can prevent the appropriate application of herbicide/adjuvant/drift retardant mixtures to highway rights-of-way. Use of incompatible mixtures can also cause reduced weed control due to inaccurate application rates of herbicides to the target area.

The Oklahoma State University Roadside Vegetation Management (OSU-RVM) Program is under contract by ODOT to annually investigate herbicide products useful to ODOT IRVM and whose use without prior testing might possibly result in physical tank mix incompatibility. Tank mix incompatibility in a worst case scenario can possibly result

in the generation of unusable tank mixes, hazardous waste or an otherwise inefficient use of maintenance funds.

2.0 PROBLEM STATEMENTS

With recent US EPA restrictions (1) regarding the cancellation and phase out of Monosodium Acid Methanearsonate (MSMA) for roadside vegetation management use, ODOT's contracted supplier of MSMA 6 Plus® could not obtain product from the manufacturer, Drexel Chemical Company [DCC] (DCC, P.O. Box 13327, Memphis TN, 38113). Investigations were conducted to locate other registrants of MSMA herbicide that could meet ODOT's continuing need for MSMA herbicide product. Those investigations yielded knowledge of the existence of registrations for the products Target® 6 Plus (Luxembourg_Pamol, Inc., 5100 poplar Avenue, Suite 2700, Memphis, Tennessee 38137) and Weed-Hoe® 108 (Albaugh, Inc., 1525 NE 36th Street, Ankeny, Iowa 50021). However, the MSMA sources had not been tested for weed control effectiveness by ODOT or the OSU RVM Program, nor had tank mix compatibility with ODOT approved drift control additives been conducted. Also, the MSMA products were not listed on the ODOT Approved Herbicide & Adjuvant List (AHAL) (2)

In 2009 the OSU RVM team learned that the herbicide product Campaign®, formerly manufactured and marketed by Monsanto, would not be manufactured in the future. An investigation of label registrants of glyphosate + 2,4-D premix herbicides yielded information that confirmed that Albaugh corporation marketed a product called Landmaster® BW that was identical to Campaign® in terms of herbicide active ingredients and active ingredient forms, according to the Landmaster® BW herbicide product label. However, Landmaster® BW herbicide has not been tested by ODOT or the OSU RVM Program for weed control effectiveness nor tank mix capability with ODOT approved drift control additives. Also, Landmaster® BW herbicide was not listed on the ODOT Approved Herbicide & Adjuvant List (AHAL) (2).

Anticipating continued instability in the availability of MSMA herbicides for johnsongrass control by certain ODOT Divisions during the registration phase out of MSMA and understanding that ODOT needs a replacement herbicide for Campaign® for winter annual weed control, a research study on tank mix compatibility was formulated for conduct under ODOT/OSU Joint Project 2157.

3.0 PURPOSE OF RESEARCH

The purpose of this research study was to test the tank mix compatibility of previously non-evaluated herbicide products with Detain II® drift control additive. If found to not have adverse tank mix compatibility, and assuming that the herbicides are efficacious in weed control, these products could be added to the ODOT AHAL for use by the Oklahoma Department of Central Services for requesting product price bid. These products could then be available for use by ODOT for use in weed control on ODOT managed rights of way.

4.0 STUDY OBJECTIVES

Using an industry standard jar test, the specific objectives of this research were to test the tank mix compatibility of

i) Target® 6 Plus (MSMA) with Detain II® drift control additive,

ii) Weed-Hoe® 108 (MSMA) with Detain II® drift control additive, and

iii) Landmaster® BW with Detain II® adjuvant drift control additive

5.0 MATERIALS AND METHODS

In August of 2009, two generic MSMA containing six pounds MSMA per gallon (Appendix A and B) and one glyposate/2,4-D blend (Appendix C) were investigated for tank mix compatibility. Compatibility testing focused upon the interaction of each of the three products, Target® 6 Plus (MSMA), Weed-Hoe® 108 (MSMA) and Landmaster® BW (glyposate/2,4-D blend), with ODOT's standard, single bid drift control product, Detain II®. Detain II® is a polyacrylamide copolymer that is required in each broadcast application of herbicide utilized by ODOT.

An industry standard broadcast herbicide spray carrier rate of 30 gallons per acre (GPA) was simulated in the experiment with Landmaster® BW. The minimum labeled carrier rate of 40 GPA of water/herbicide tank mixes were simulated in the experiments that utilized Target® 6 Plus brand herbicide (active ingredient MSMA) and Weed-Hoe® 108 brand herbicide (active ingredient MSMA).

Clear, clean, unused 1-liter soda bottles were filled with 500 ml of deionized water. This water sourced had a pH of 6.5 with minimal amounts of cations and anions (see Appendix D). The lack of calcium and magnesium resulted in classification of this carrier

as “soft”. The appropriate herbicide amounts were added to each bottle to represent recommended broadcast herbicide treatment rates for ODOT weed control applications in compliance with the product labels and as suggested in the OSU Publication E-958: Suggested Maintenance Practices for Roadside Weed and Brush Problems (3). Landmaster® BW (isopropyl amine salt of glyphosate and same form of 2,4-D) was mixed at a rate equivalent to 2 pints of product per acre with sprayable grade ammonium sulfate (AMS) at an amount equal to 17 pounds of AMS per 100 gallons of carrier. Both Target® 6 Plus (MSMA) and Weed-Hoe® 108 (MSMA) were mixed into the simulated tank mix in an amount that when applied at 40 GPA would require 3 lbs of active ingredient MSMA per acre.

Laboratory experimental conditions were maintained under relatively controlled environmental conditions where air temperatures averaged 71.7 ^{o}F (range 71.0 to 72.5^{o}F) and deionized water temperatures averaged 71.9^{o} F (range from 71.8 to 72.0 ^{o}F). Water temperature readings were taken hourly throughout the course of the experiments using a REOTEMP brand bimetal thermometer (Accuracy ± 1% full scale) while air temperature was monitored hourly with an EXTECH® digital thermometer (Model 445702 accuracy ± 1.8 ^{o}F).

Tank mix treatments were evaluated at three separate stages (see Appendix E) to determine if any incompatibility complexes were initiated. Once all herbicide/adjuvant components were placed in the plastic bottle, the bottle was inverted slowly 10 times to mix the components. Assessment was made immediately upon mixing. After 30 minutes the bottle was checked for any incompatibility complexes before being inverted slowly for 10 times. Upon this mixing effort, a final evaluation was performed for incompatibility. Four questions were asked at each stage of the evaluation (see Appendix F) to assess the major visual incompatibilities that are commonly found. The visual physical incompatibilities for which the herbicide/adjuvant tank mix was assessed included: formation of precipitates, layering, change in flocculation and excessive foaming. Bottles were backlit with strong light sources to make incompatibilities more evident, if present. The experiment was designed as a Randomized Complete Block with 3 replications (blocks) of herbicide/adjuvant tank mix treatments. Digital images were recorded for all herbicide/adjuvant tank mix combinations during the third replication of treatments (3rd block) within the experiment.

6.0 RESULTS

No significant incompatibilities were observed in any of the replicated combinations of Target® 6 Plus (MSMA) or Weed-Hoe® 108 (MSMA) with Detain II® drift control additive. No significant incompatibilities were observed in any of the replicated

combinations of Landmaster® BW (glyposate/2,4-D blend) with Detain II® drift control additive.

7.0 DISCUSSION

Our testing can be considered to represent a conservative approach. We are confident that this testing method, referred to as “an industry standard jar test” would detect incompatible tank mix combinations that would be problematic to the ODOT RVM Managers. We do not feel that Target® 6 Plus (MSMA), or Weed-Hoe® 108 (MSMA) or Landmaster® BW (glyposate/2,4-D blend) when used alone in combination with Detain II® would cause any problems to ODOT personnel as long as labeled directions are followed and characteristics of water carrier sources are not extreme.

8.0 CONCLUSIONS

1. Use of either Target® 6 Plus (MSMA) or Weed-Hoe® 108 (MSMA) at labeled rates in a tank mix with labeled use rates of Detain II® would not be expected to create any tank mix combination that would be unusable, nor be expected to create any hazardous waste requiring special disposal measures for ODOT pesticide applicators as long as labeled directions are followed and characteristics of water carrier sources are not extreme.

2. Use of Landmaster® BW (glyposate/2,4-D blend) at labeled rates in a tank mix with labeled use rates of Detain II® would not be expected to create any tank mix combination that would be unusable, nor be expected to create any hazardous waste requiring special disposal measures for ODOT pesticide applicators as long as labeled directions are followed and characteristics of water carrier sources are not extreme.

9.0 LIMITATIONS ON CONCLUSIONS

Our compatibility testing is only for physical incompatibility that can be detected via a visual test. ODOT herbicide applicators are required to read all herbicide labeled information concerning water carrier issues and to be familiar with the water source they are using. ODOT applicators can reference the OSU RVM Programs report “2005 Evaluation of ODOT Water Quality Characteristics for Suitability in Herbicide Spray Applications” or the ODOT Roadside Vegetation Management Guidelines, 3rd Ed. 2008,

to determine specific characteristics of water sources tested. Additionally, we would encourage periodic testing of water sources especially if water sources change from previous sources.

10.0 RECOMMENDATIONS

The OSU-RVM Program has formally recommended that Target® 6 Plus (MSMA), Weed-Hoe® 108 (MSMA) and Landmaster® BW (glyposate/2,4-D blend) be included in the next ODOT Approved Herbicide & Adjuvant List (AHAL). Additionally, we recommend that the end user read the section of this report on “LIMITATIONS ON CONCLUSIONS” as well as read and follow all product label directions.

11.0 IMPLIMENTATION OF RECOMMENDATIONS

The 2.5 gallon container sizes of the products Target® 6 Plus (MSMA), Weed-Hoe® 108 (MSMA) and Landmaster® BW (glyposate/2,4-D premix) were included on the August 2009 ODOT Approved Herbicide & Adjuvant List (AHAL).

12.0 REFERENCES

1. US EPA. 2009. Rulemaking Underway Related to Disclosure of All Pesticide Ingredients. US Environmental Protection Agency website. Available on-line at: http://www.epa.gov/opprd001/inerts/index.htm (Verified 22 December 2009).

2. Montgomery, D.P., C.C. Evans and D.L. Martin. 2008. A Suggested Revised ODOT Approved Herbicide & Adjuvant List (AHAL) for 2008. 2008 Annual Report for Project 2156: Task 5. Oklahoma Dept. of Transportation. 13 pages. Available on-line at: http://www.okladot.state.ok.us/hqdiv/p-r-div/spr-rip/library/2156-2157/2008ahal.pdf (verified 23 December 2009).

3. Montgomery, D.P., C.C. Evans and D.L. Martin. 2008. Suggested Maintenance Practices for Roadside Weed and Brush Problems. Publication E-958. Oklahoma State University. 12 pages. Available on-line at: http://www.okrangelandswest.okstate.edu/files/invasive%20species%20pdfs/E-958.pdf (verified 23 December 2009).

APPENDIX A

TARGET® 6 PLUS (MSMA) LABEL COVER

TARGET® 6 Plus

MSMA Plus Surfactant For Postemergence Weed Control in Cotton, Ornamental Turf Grass, Non-Bearing Almond, Walnut, Grapefruit, Lemon, Lime, Orange and Tangerine Orchards, Plantings of Non-Bearing Apples, Cherries, Peaches, Pears, Plums, Prunes and Drainage Ditch Banks, Right-of-ways, and Storage Yards

ACTIVE INGREDIENT:
Monosodium Acid Methanearsonate (MSMA)*.....48.30%
OTHER INGREDIENTS: 51.70%
TOTAL: 100.00%
Total arsenic (as elemental), all in water soluble form.....22.30%
*Product contains 6.0 lbs MSMA per gallon

Keep Out of Reach of Children

CAUTION

FIRST AID

IF SWALLOWED: Call a Poison Control Center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a Poison Control Center or doctor. Do not give anything by mouth to an unconscious person.

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a Poison Control Center or doctor for treatment advice.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a Poison Control Center or doctor for treatment advice.

IF INHALED: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a Poison Control Center or doctor for further treatment advice.

HOT LINE NUMBER

Have the product container or label with you when calling a Poison Control Center or doctor, or going for treatment.You may also contact **1-800-424-9300** for emergency medical information

SEE LABEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

FOR CHEMICAL SPILL, LEAK, FIRE OR EXPOSURE, CALL TOLL FREE: **1-800-424-9300**

AGRICULTURAL CHEMICAL DO NOT SHIP OR STORE WITH FOODS, FEEDS, DRUGS OR CLOTHING

EPA Reg. No. 42519-3
EPA Est. No. 42519-ISR-1

Specimen Label

Manufactured for:
LUXEMBOURG-PAMOL, INC.
5100 Poplar Avenue, Suite 2700
Memphis, Tennessee 38137, U.S.A.

SPC_3/080102_1/7

MADE IN ISRAEL

Available on-line at: http://www.luxpam-usa.com/assets/TargetPlus_LABEL.pdf
(Verified December 14, 2009)

APPENDIX B

WEED-HOE® 108 (MSMA) LABEL COVER

SPECIMEN LABEL

Agri Star®
By Albaugh Inc.

WEED-HOE® 108

ARSONATE LIQUID FOR POSTEMERGENCE WEED CONTROL IN COTTON, NON-BEARING ALMOND AND WALNUT ORCHARDS, PLANTINGS OF NON-BEARING APPLES, APRICOTS, CHERRIES, PEACHES, PEARS, PLUMS AND PRUNES, BEARING AND NON-BEARING CITRUS ORCHARDS SUCH AS GRAPEFRUIT, ORANGE, TANGERINE, LEMON AND LIME, GOLF-COURSES, TURFGRASS, GRASS SEED CROPS, FORESTRY, AND OTHER NON-CROP AREAS SUCH AS DRAINAGE DITCH BANKS, RIGHTS-OF-WAY (INCLUDING HIGHWAY, RAILROAD, PIPELINE, AND UTILITY), FENCE ROWS, GOLF COURSE SAND TRAPS AND STORAGE YARDS.

ACTIVE INGREDIENT:
Monosodium Acid Methanearsonate 47.8%
INERT INGREDIENTS: 52.2%
TOTAL 100.0%

Total arsenic, all in water soluble form, expressed as elemental 22.1%. This product contains 6 lbs. MSMA per gallon.

EPA Reg. No. 42750-29 EPA Est. No. 42750-MO-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID	
IF SWALLOWED:	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
IF IN EYES:	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
IF ON SKIN OR CLOTHING:	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-424-9300 for emergency medical treatment information.

See inside booklet for additional PRECAUTIONARY STATEMENTS.

Manufactured for:
ALBAUGH, INC.
1525 NE 36th Street
Ankeny, Iowa 50021

FOR CHEMICAL SPILL, LEAK, FIRE, OR EXPOSURE, CALL CHEMTREC (800) 424-9300

AD112807

Available on-line at: http://www.cdms.net/LDat/ld4AC000.pdf. (Verified December 14, 2009).

APPENDIX C

LANDMASTER® BW (GLYPOSATE/2,4-D BLEND) LABEL COVER

SPECIMEN LABEL

Landmaster® BW

AVOID CONTACT WITH FOLIAGE OF CROP OR OTHER DESIRABLE VEGETATION SINCE SEVERE INJURY OR DESTRUCTION MAY RESULT.

Read the "CONDITIONS OF SALE AND WARRANTY" before buying or using. If terms are not acceptable, return at once unopened.

ACTIVE INGREDIENTS*:	
Glyphosate (N-(phosphonomethyl))glycine, in the form of its isopropylamine salt	12.9%
2,4-D, 2,4-dichlorophenoxyacetic acid, in the form of its isopropylamine salt	20.6%
OTHER INGREDIENTS	66.5%
TOTAL	100.0%

*Contains 144 grams per litre or 1.2 lbs per U.S. gallon of the active ingredient, glyphosate, in the form of its isopropylamine salt and 227 grams per liter or 1.9 lbs per U.S. gallon of the active ingredient, 2,4-D, in the form of its isopropylamine salt.

Equivalent to 108 grams per litre or 0.9 lb per U.S. gallon of the acid, glyphosate, and 182 grams per litre or 1.5 lbs per U.S. gallon of the acid 2,4-D.

EPA Reg. No. 42750-62 EPA Est. No. 42750-MO-1

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID	
If swallowed:	• Call a poison control center or doctor immediately for treatment advice. • Have person sip a glass of water if able to swallow. • Do not induce vomiting unless told to do so by a poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If on skin or clothing:	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
If in eyes:	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-424-9300 for emergency medical treatment information.

See inside booklet for additional PRECAUTIONARY STATEMENTS.

Manufactured by:

ALBAUGH, INC.

1525 NE 36th Street
Ankeny, Iowa 50021

FOR CHEMICAL SPILL, LEAK, FIRE, OR EXPOSURE, CALL CHEMTREC (800) 424-9300

AD091009

Agri Star® By Albaugh, Inc.
Premier Supplier of off-patent Crop Protection Products

Label available on-line at: http://www.cdms.net/LDat/ld59E007.pdf. (Verified December 14, 2009).

APPENDIX D

DEIONIZED WATER ANALYTICAL LABORATORY REPORT

OKLAHOMA COOPERATIVE EXTENSION SERVICE

SOIL, WATER & FORAGE ANALYTICAL LABORATORY

Division of Agricultural Sciences and Natural Resources • Oklahoma State University
Plant and Soil Sciences • 045 Agricultural Hall • Stillwater, OK 74078
Email: soiltesting@okstate.edu
Website: www.soiltesting.okstate.edu

WATER QUALITY REPORT

DOUG MONTGOMERY
ROADSIDE VEGETATION MGMT PROGRAM
358 AG HALL

STILLWATER, OK 74078

Name:

Location:

Lab ID No.: 542257
Customer Code: 216
Sample No.: 1
Received: 8/24/2009

TEST RESULTS

Cations		Anions		Other	
Sodium (ppm)	1	Nitrate-N (ppm)	< 1	pH	6.5
Calcium (ppm)	0	Chloride (ppm)	1	EC (µmhos/cm)	9
Magnesium (ppm)	0	Sulfate (ppm)	0		
Potassium (ppm)	0	Boron (ppm)	< 0.01		
		Bicarbonate (ppm)	8		

Derived Values		Derived Values(cont'd)	
Total Soluble Salts (TSS in ppm)	10	Soduim Percentage	48.8%
Sodium Adsorption Ratio (SAR)	0.3	Hardness (ppm)	2
		Hardness Class	Soft
Residual Carbonates (meq)	0.09	Alkalinity (ppm as CaCO3)	6

INTERPRETATION AND REQUIREMENTS FOR *Irrigation Water*

The total soluble salt and sodium content of this water are low enough that no problem should result from its use.

Signature

Oklahoma State University, U.S. Department of Agriculture, state, and local governments cooperating. Oklahoma Cooperative Extension Service offers its programs to all eligible persons regardless of race, color, national origin, religion, sex, age or disability and is an Equal Opportunity Employer.

APPENDIX E

PROCEDURES FOR CONDUCTING HERBICIDE/ADJUVANT COMPATIBILITY TESTING

Procedures for Conducting Herbicide/Adjuvant Compatibility Testing

1. Mix all herbicides together in the simulated spray tank (bottle) first, before attempting to add any adjuvant. The mixing order of products should follow the guidelines given below.

Mixing order for herbicides:

a. Ammonium sulfate (AMS)

b. dry herbicides

c. liquid solubles

d. liquid emulsifiables

Mixing should occur by slowly inverting bottle 3 or 4 times after each product is added. This should be adequate to mix all liquids but dry herbicides will require repeating the inversion process several more times over a 1-3 minute period or until all dry herbicide prills are visibly dispersed. Inverting bottles should be performed to prevent excessive foaming if at all possible. All herbicides & AMS should be thoroughly mixed before attempting the addition of any adjuvants being tested.

2. Add the appropriate adjuvants to the herbicide mixture one at a time followed by slowly inverting the mixture 10 times. Evaluate the mixture immediately and move on to the next adjuvant, repeating the process. Once the first mixture is evaluated, make a note of the time on the score sheet. Once all evaluations are made with a particular herbicide treatment, allow the bottles to set undisturbed for 30 minutes (or as close as possible).

3. After 30 minutes evaluate each of the bottles for the 2nd time. It is acceptable to pick up the bottles, but this should be done carefully so as not to disturb the mixture. After evaluation, place each bottle down undisturbed. It might be helpful to hold the mixture with a bright light (light bulb, window) behind the bottle to backlight the mixture making possible incompatibilities more visible. When the last mixture is evaluated proceed immediately to the 3rd evaluation.

4. The 3rd and final evaluation occurs by slowly inverting the first bottle 10 times followed by evaluation.

5. Each herbicide treatment will have 3 evaluation sheets, one sheet for each evaluation timing. When evaluations are completed, staple the 3 evaluation sheets together.

APPENDIX F

COMPATIBILITY STUDY DATA COLLECTION FORM

Compatibility Study Data Collection Form

Herbicide Treatment:																Evaluation Step: 1st 2nd 3rd
Evaluator:								Study/Replication Number:								Date:
Adjuvant	Supplier	1. Were precipitates formed?					2. Were separate layers formed?			3. Did herbicide mixture flocculate?			4. Was there a change in foaming?			5. Other?
		No	flakes	colored globules	clear globules	sludge	No	suspend	settled	No	suspend	settled	No change	More	Less	
Detain II	Estes															