EVALUATION OF HERBICIDE AND ADJUVANT PHYSICAL COMPATIBILITY

ANNUAL REPORT FOR FY 2010

ODOT SPR ITEM NUMBER 2157

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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 program uses a dynamic, adaptive approach, providing fiscal and environmentally responsible management of Oklahoma rights-of-way. ODOT utilizes an integrated roadside vegetation management (IRVM) strategy. IRVM incorporates mechanical, cultural, biological methods, and herbicides to effectively manage roadside vegetation along the state highway system.

Herbicides are a vital component of ODOT's IRVM strategy and will likely stay that way for the foreseeable future. The U.S. Environmental Protection Agency (US EPA) regulates pesticide registration in the U.S. and along with the Oklahoma Department of Agriculture, Food, and Forestry (ODAFF), directly and indirectly controls the availability of herbicides for vegetation managers in Oklahoma. Currently the US EPA and ODAFF do not regulate pesticide adjuvants sold separately from or as a part of the pesticide formulated products. Adjuvants are products that improve the performance characteristics of a pesticide and/or its application. An example of an adjuvant used often by ODOT would be the product Detain II[1]. Detain II (1) is a deposition aid and drift retardant (Appendix A). ODOT uses Detain II to improve herbicide spray characteristics. It achieves this by decreasing the number of small spray particles of 100 microns or less in diameter and thus reduces the likelihood of "off-target particle drift."

The lack of close regulation of adjuvants as well as the lack of published data on the physical compatibility of herbicide's and adjuvants allows for possible unknown physical tank mix incompatibilities to exist. Compatibility testing of herbicide/adjuvant tank mix partners helps the ODOT guard against unidentified and potentially costly issues of physical incompatibility between new or reformulated herbicides and adjuvants.

Adverse consequences of physical incompatibility can include settling, layer formation, globule formation or formation of precipitants. If these issues occur, they can damage or clog sprayer components. Incompatible mixes may even affect an herbicide's performance in terms of weed control. In the event of a tank mix of incompatible herbicides and adjuvants, the applicator would then have to deal with disposal of the material in a legal manner. Applying the incompatible mixture to the roadside may not be an option if sprayer components are clogged or if the incompatible mixture cannot be accurately applied. This may result in ODOT being forced to dispose of the tank mix as a hazardous waste material. Obviously the latter option is very undesirable.

[1]Detain II is manufactured by TENKOZ INC., 100 North Point Center East, Alpharetta, GA 30202

The Oklahoma State University Roadside Vegetation Management (OSU-RVM) Program is under contract by ODOT to annually test the physical compatibilities of all new herbicide's and adjuvants intending to be added to the *ODOT Approved Herbicide and Adjuvant List* (AHAL). The intent of this effort is to place only those new products on the AHAL that have proven tank mix compatibility. This ultimately will prevent ODOT herbicide applicators from being in the position of dealing with a tank of incompatible herbicide waste in the future. As long as ODOT continues to only use those herbicides and adjuvants that are on the current AHAL and provided suitable tank agitation is present, we are confident there should be no tank mix physical incompatibility issues.

2.0 PROBLEM STATEMENT

In 2010 there were no new generic herbicides in need of physical compatibility testing for ODOT. However, there were several new herbicides that required testing. For the past three years our OSU RVM Program has been assisting in the label and use recommendation development of three new herbicides from DuPont[1]. These herbicides will soon receive their Section 3 EPA label. This will allow for their use on roadside right-of-way.

These three new products from DuPont are Pastora® (2), Streamline® (3) and Perspective® (3) herbicides. These products have shown the ability to control many problem weeds that are commonly found on Oklahoma roadsides (4). Pastora® will primarily be used to control johnsongrass, sandbur, and broadleaf weeds when applied in May/June. Pastora® includes the new active ingredient nicosulfuron combined with an old standby active ingredient metsulfuron. Metsulfuron is found in the product Escort XP® (5). Because of the new nicosulfuron component, Pastora® needed to be tested for any incompatibilities with Detain II before being placed on the ODOT AHAL.

Streamline® and Perspective® herbicides will be used to provide control of a wide spectrum of annual, biennial, and perennial broadleaf weeds. In addition, they provide control of summer annual grassy weeds. Streamline® and Perspective® contain the new active ingredient aminocyclopyrachlor which is combined with the active ingredient metsulfuron to make Streamline®, or combined with the active ingredient chlorsulfuron to make Perspective®. Because of the new active ingredients in these products it was necessary to test them for any incompatibilities before their being placed on the ODOT AHAL. Lastly, ODOT vegetation managers requested an herbicide to provide improved

[1] E. I. du Pont de Nemours and Company, Crop Protection, 1007 Market Street, Wilmington, Delaware 19898.

pre-emergent weed control in the cable barrier foot print. In an effort to provide a good residual pre-emergent weed control with reduced risk of off-target movement we have suggested the use of prodiamine herbicide. Prodiamine 65 WDG, containing the active ingredient prodiamine, needed to be evaluated for physical compatibility with Detain II drift control additive.

3.0 PURPOSE OF RESEARCH

The purpose of this research was to test the physical compatibility of Pastora®, Streamline®, Perspective® and Prodiamine 65 WDG herbicides when mixed with Detain II drift control additive. Provided no physical incompatibility was found, these products would be recommended for inclusion on the ODOT AHAL. This would allow bids to be accepted and contract awards made on these products allowing for future purchase and effective use by ODOT.

4.0 STUDY OBJECTIVES

Using an industry standard jar test, the specific objectives of this research were to test the physical compatibility of selected treatments of:

i) Pastora® (nicosulfuron + metsulfuron) herbicide with Detain II drift control additive,

ii) Streamline® (aminocyclopyrachlor + metsulfuron) herbicide with Detain II drift control additive

iii) Perspective® (aminocyclopyrachlor + chlorsulfuron) herbicide with Detain II drift control additive, and

iv) Prodiamine 65 WDG (prodiamine) herbicide with Detain II adjuvant drift control additive

5.0 MATERIALS AND METHODS

This research was conducted on 22 September 2010 from 1:00 to 3:00 p.m. at the Turfgrass Research Center located at the Oklahoma Botanical Garden, Oklahoma State University, Stillwater, OK. Selected treatments of Pastora®, Streamline®, Perspective®, and Prodiamine 65 WDG herbicides were investigated for physical compatibility with Detain II® (Table 1). Detain II is a polyacrylamide copolymer drift control additive that

when used properly can help reduce the potential for off-target particle drift. Detain II has been the product awarded the State of Oklahoma contract drift control contracted for many years. Under ODOT Policy No. D-504-1 [effective 8-01-95] (6), a drift control product must be used in each broadcast or powered handgun herbicide application made by ODOT personnel.

A tank mix carrier rate of 20 gallons per acre (GPA) was used in this test for all treatments. The 20 GPA carrier rate represents the lowest labeled and recommended carrier rate for ODOT broadcast applications and was selected so as to facilitate tank mix physical incompatibilities if the products were prone to tank mixing physical incompatibility. An industry standard jar test method was used for tank mix compatibility testing (7). Clear, clean, unused 1-liter soda bottles were filled with 500 ml of deionized water. The deionized water had a pH of 6.2 with minimal amounts of cations and anions present (Appendix B). The lack of calcium and magnesium resulted in classification of this carrier as “soft” (8) The appropriate herbicide amounts were added to each bottle to represent higher OSU recommended broadcast herbicide treatment rates for these specific herbicides and manufacturer recommended rates for Detain II®. Specific herbicide treatments and treatment rates are listed in Table 1. Herbicide rates used in these tests represent what would be the highest recommended use rate for ODOT. The intent of using a high rate of these herbicides is to facilitate any possible physical incompatibilities that may occur. Detain II was used at the manufacturers recommended high end rate of 16 fluid ounces per 100 gallons of water.

Laboratory experimental conditions were maintained under relatively controlled environmental conditions where the mean air temperatures were 73.0 ^{o}F $\pm$ 0 ^{o}F and deionized water temperatures were 79.0 ^{o}F. $\pm$ 0 ^{o}F. Air and water temperatures were measured with a calibrated mercury in glass thermometer and read to the nearest 0.1 ^{o}F.

Treatments were evaluated at three separate stages (see Appendix C) to determine if any physical incompatibilities were produced and sustained. Once all herbicide/adjuvant components were mixed properly initial evaluations were made immediately after the initial mixing, followed by evaluations at 30 minutes after initial mixing but prior to remixing. Final evaluations were taken immediately after remixing. Four questions were asked at each stage of the evaluation (see Appendix E) to assess any visual physical incompatibilities. The visual physical incompatibilities assessed were: formation of precipitates, layering, flocculation and foaming. Bottles were backlit with a light source to make incompatibilities more evident, if present. The experiment was designed as a Randomized Complete Block with 2 replications of treatments. Digital images were recorded for all herbicide/adjuvant treatments but are not included in this report.

TABLE 1. SELECTED HERBICIDE TREATMENTS, HERBICIDE RATES, AND CARRIER RATES EVALUATED FOR PHYSICAL COMPATIBILITY WITH DETAIN II DRIFT CONTROL ADDITIVE.

Herbicide Treatment	Herbicide Rate (product/acre)	Manufacturer	Carrier Rate (GPA) [6]
Pastora® + Roundup Pro Concentrate®	1.5 oz. + 13 fl.oz.	Dupont[1] Monsanto[2]	20
Streamline® + non-ionic surfactant	4.76 oz. + 0.25% V/V	Dupont Estes[3]	20
Streamline® + Landmaster® BW + ammonium sulfate	4.76 oz. + 32 fl. oz. + 17 lb. /100 gallons of water	Dupont Albaugh[4] Estes3	20
Perspective® + non-ionic surfactant	4.76 oz. + 0.25% V/V	Dupont Estes	20
Perspective® + Landmaster® BW + ammonium sulfate	4.76 oz. + 32 fl. oz. + 17 lb. /100 gal. of water	Dupont Albaugh Estes	20
Prodiamine 65 WDG	2.3 lb.	Makhteshim Agan of North America[5]	20

[1] E. I. du Pont de Nemours and Company, Crop Protection, 1007 Market Street, Wilmington, Delaware 19898.

[2] Monsanto Company, 800 N. Lindbergh Blvd, C3NA, St. Louis , MO 63167-0001.

[3] Estes, Inc. PO Box 8287. Wichita Falls, TX 76307. Detain II is manufactured for Estes, Inc

[4] Albaugh Inc. PO Box 2994. Cordova , TN 38088.

[5] Makhteshim Agan Of N. America, Inc. 1133 Polo Drive, Ste 103. Collierville , TN 38017.

[6] GPA = gallons per acre.

6.0 RESULTS

No incompatibilities were observed in any of the replicated combinations of Pastora® + glyphosate, Streamline® + non-ionic surfactant, Streamline® + Landmaster BW® + ammonium sulfate, Perspective® + non-ionic surfactant, or Perspective® + Landmaster BW® + ammonium sulfate treatments when combined with Detain II drift control additive at 16oz/100 gallon of water. However, when Prodiamine 65 WDG was combined with the Detain II drift control additive moderate to severe physical incompatibilities occurred. The physical incompatibilities were in the form of moderate to severe flocculation (to cause to mass in a group) followed by settling and eventually the formulation of a heavy sludge. Prodiamine 65 WDG is a dry herbicide formulation that when added to water will disperse and form a homogeneous suspension provided that normal tank agitation is provided. However, if agitation is marginal or not existent, settling is likely. Once settled, re-suspension may be difficult but can usually be achieved with adequate agitation over several minutes. The incompatibility that occurred in this test between Prodiamine 65 WDG and Detain II at the 16oz/100 gallon carrier rate appeared to permanently and irreversibly changed the ability of Prodiamine 65 WDG to disperse and to remain dispersed properly in water. The severity of the incompatibility would likely cause clogging of sprayer components (i.e. 50 mesh screens, electric shut-off valves, electric pressure control valves, small spray tips, etc.) and would likely affect the proper distribution of this herbicide during the application.

7.0 DISCUSSION

Our testing can be considered to represent a conservative approach. We are confident that this testing method would detect incompatible tank mix combinations that would be problematic to the ODOT RVM Managers. We do not feel that Pastora® + glyphosate, Streamline® + non-ionic surfactant, Streamline® + Landmaster BW® + ammonium sulfate, Perspective® + non-ionic surfactant, or Perspective® + Landmaster BW® + ammonium sulfate treatments when used in combination with Detain II at the highest manufactures recommended rate would cause any problems to ODOT personnel as long as labeled directions are followed and characteristics of water carrier sources are not extreme. However, we feel that Prodiamine 65 WDG should not be used in combination with the Detain II drift control additive at the highest manufactures recommended rate as these products are physically incompatible and could cause numerous problems for ODOT personnel.

8.0 CONCLUSIONS

1. Use of Pastora® + glyphosate, Streamline® + non-ionic surfactant, Streamline® + Landmaster BW® + ammonium sulfate, Perspective® + non-ionic surfactant, or Perspective® + Landmaster BW® + ammonium sulfate treatments 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 Prodiamine 65 WDG with labeled use rates of Detain II at 16oz/100 gallon of water will create an incompatible unusable spray solution, the solution could clog and create damage to spray equipment, the solution could cause erratic weed control results if applied, and the solution could create a hazardous waste requiring special disposal measures for ODOT pesticide applicators if equipment became clogged or applications could not be made as per label directions.

9.0 LIMITATIONS ON CONCLUSIONS

Our compatibility testing is only for physical incompatibility that can be detected via a visual industry standard jar test (7). ODOT herbicide applicators are required to read all herbicide label 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* (9) 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

Considering the positive compatibility results, the OSU-RVM Program will formally recommend that Pastora® herbicide be included in the next *ODOT Approved Herbicide & Adjuvant List (AHAL)* that is produced. Additionally, due to a finding of no tank mix incompatibility for Streamline® and Perspective® herbicides when mixed with Detain II, the OSU-RVM Program will formally recommended that these products be included in the next *ODOT Approved Herbicide & Adjuvant List (AHAL)* provided that they receive registration in Oklahoma. Because of the resulting incompatibilities between Prodiamine

65 WDG and Detain II at the 16oz per 100 gallon of water carrier rate we cannot recommend that ODOT use prodiamine herbicide with Detain II. We also recommend the end user read the section of this report on “LIMITATIONS ON CONCLUSIONS” as well as read and follow all product label directions.

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APPENDIX A

DETAIN II DRIFT CONTROL ADDITIVE LABEL

Estes

DETAIN II ®

DEPOSITION AID / DRIFT RETARDANT

PRINCIPLE FUNCTIONING AGENTS:

Polyacrylamide Copolymer	30%
Inert Ingredients	70%
TOTAL	100%

The principle functioning agents are exempt from tolerance requirements under Title 40, Code of Federal Regulations 180.1001 (d).

CAUTION

KEEP OUT OF REACH OF CHILDREN

May cause irritation to skin and eyes. If in contact, flush immediately with plenty of water. See a doctor if irritation persists. Follow appropriate precautions on label of pesticide used.

SHAKE WELL BEFORE USING

GENERAL INFORMATION

DETAIN II is an effective, easy to use adjuvant for deposition improvement and drift retardation in spraying operations.

SPRAY PRESSURE	NOZZLE ORIENTATION	DETAIN II DOSAGE
Aerial Applied:		
below 45 psi	Straight Back	14-20 oz. / 100 gal.
	45° Angle Back	16-24 oz. / 100 gal.
Ground Applied:		
20-40 psi	Flat Fan	4-8 oz. / 100 gal.
20-50 psi	Off-Center	12-16 oz. / 100 gal.
50-150 psi	Brush Gun	32-64 oz. / 100 gal.
20-40 psi	Direct Spray	16-32 oz. / 100 gal.

For home and garden sprayers, use approximately 1 tablespoon of **DETAIN II** per 5 gallons of spray solution.

DIRECTIONS FOR USE

IMPORTANT: Keep container closed in storage and do not allow water to come in contact with contents until added to the spray solution. In case of contact with skin or eyes, flush immediately with plenty of water.

Step 1. Select correct dosage from chart.

Step 2. Fill mix tank with water, pesticide and other additives and begin to agitate.

Step 3. SHAKE BOTTLE OF **DETAIN II** WELL BEFORE USING.

Step 4. For best mixing results, either (1) inject **DETAIN II** liquid into the suction side of the feeder or recirculating pump to obtain adequate dispersion of the polymer throughout the pesticide solution, or (2) slowly add **DETAIN II** liquid to the rapidly agitating tank mix in the area of highest turbulence by pouring a thin stream.

Step 5. Continue to agitate tank mix for at least 2 minutes before spraying.

Step 6. Follow all cleanup precautions on label of pesticide used. Follow governmental procedures for disposal of pesticide spray solution.

USE PRECAUTIONS

The degree of drift hazard varies with the type of pesticide, application conditions, and vegetation near the sprayed area. Remember, pesticide drift is no accident. Common sense and sound application technology must be followed when spraying pesticides. **DETAIN II** will retard, but not totally eliminate drift.

STORAGE AND DISPOSAL

Protect from freezing. Freezing may cause separation. Do not contaminate water, food, or feed by storage or disposal. Keep container tightly sealed when not in use. Do not reuse container. Triple rinse (or equivalent) and then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, burning. If burned stay our of smoke.

NOTICE-READ CAREFULLY

Conditions of Sale: Estes, Inc. (and seller) offer(s) this product for sale subject to buyer and all users are deemed to have accepted the following conditions of sale and warranty.

Warranty Limitation: Estes, Inc. warrants that this product conforms to the chemical description on the label subject to the inherent risks referred to below. Estes, Inc. makes no other express warranties. THERE IS NO IMPLIED WARRANTY OF MERCHANTABILITY and there are no warranties which extend beyond the description of label hereof.

Inherent Risks: The directions for use of this product are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks associated with use. Buyer assumes all risks associated with use of application of the product contrary to label instructions or resulting from extraordinary weather conditions.

Limitation of Liability: In no case shall Estes, Inc. be liable for special, indirect or consequential damages resulting from the use or handling of this product and no claim of any kind shall be greater in amount than the purchase price of the product in respect of which such damages are claimed.

Manufactured for: Estes, Inc., Wichita Falls, TX 76301

DETAIN II is a registered trademark of Estes, Inc.

ESTES
INCORPORATED

APPENDIX B

DEIONIZED WATER ANALYTICAL LABORATORY REPORT

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.: 579261
Customer Code: 216
Sample No.: 1
Received: 9/23/2010

TEST RESULTS

Cations		Anions		Other	
Sodium (ppm)	0	Nitrate-N (ppm)	< 1	pH	6.2
Calcium (ppm)	1	Chloride (ppm)	1	EC (µmhos/cm)	10
Magnesium (ppm)	0	Sulfate (ppm)	0		
Potassium (ppm)	0	Bicarbonate (ppm)	6		

Derived Values		Derived Values(cont'd)	
Total Soluble Salts (TSS in ppm)	7		
Sodium Adsorption Ratio (SAR)		Hardness (ppm)	1
		Hardness Class	Soft
Residual Carbonates (meq)	0.05	Alkalinity (ppm as CaCO3)	5

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

APPENDIX C

PROCEDURES FOR CONDUCTING HERBICIDE AND ADJUVANT PHYSICAL COMPATIBILITY TEST

Procedures for Conducting Herbicide and Adjuvant Physical Compatibility Test

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

e. adjuvants

Mixing should occur by slowly inverting bottle 3 or 4 times (no shaking) after each product is added. This should be adequate to mix all liquids but dry herbicides may 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 D

PHYSICAL COMPATIBILITY TEST DATA COLLECTION FORM

Physical Compatibility Test 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																