



Herbicide and Adjuvant Tank Mix Compatibility Testing in Oklahoma Roadside Vegetation Management Programs

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Introduction

Herbicides and spray adjuvants are vital tools in the Oklahoma Dept of Transportation's (ODOT) Integrated Roadside Vegetation Management program. Adjuvants are products that improve the performance characteristics of a pesticide and/or its application. Detain II (Tenkoz 1997) is a deposition aid and drift retardant (adjuvant) successfully used by ODOT for many years for compliance with an in-house Drift Control Policy (ODOT 2011) aimed at reducing risk of herbicide particle drift. Compatibility testing of herbicide/adjuvant tank mix partners (Montgomery et al. 2005 & 2009) helps the ODOT guard against previously 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 or affect herbicide performance. The Oklahoma State University Roadside Vegetation Management (OSU-RVM) Program was under contract by ODOT to annually test the physical compatibilities of new herbicides and adjuvants intending to be added to the ODOT Approved Herbicide and Adjuvant List [AHAL] (Montgomery et al. 2011). The AHAL of products is used to formulate the state bid contract in Oklahoma. The intent of this effort is to place only those new products on the AHAL that have proven tank mix compatibility. Detain II had a short shelf life (separation of the polymers and emulsifiers) of approximately 6 months based on the experiences of the ODOT and OSU RVM personnel. Discontinuation of Detain II manufacture was recently announced so a search for alternatives started in 2010. The purpose of this research was to test two locally available candidate drift control additives for replacement of Detain II on the Approved List by testing their tank mix compatibility with the main herbicide treatment combinations used by ODOT.

Objectives

To test the physical tank-mix compatibility of 15 selected herbicide treatment combinations with i) Control™ and ii) Corral® Poly drift control additives using an industry standard jar test.

Methods

Compatibility testing was conducted in 2011 at the Turfgrass Research Center at Oklahoma State University, Stillwater, OK (Figure 1).

Two replications, RCB. Rated for presence or absence of formation of layering, precipitates, flakes, sludges, flocculation of particles as well as color and clarity.

Fifteen herbicide treatments utilized by ODOT (Table 1) evaluated for physical tank mix compatibility with the Control™ brand (GarrCo Products 2011) and Corral® Poly brand (Winfield Solutions 2011) spray adjuvants (Figure 2 and Table 2) utilizing an industry standard jar test (Montgomery et al. 2009).

Tank mix carrier rate of 30 gallons per acre (GPA). 1-liter soda bottles were filled with 500 ml of deionized water (pH of 6.6). Lab air temperatures were 23.9 – 26.7 C with water temperatures 27.2 – 28.9 C.

Specific Procedures for Conducting Jar Text Compatibility Testing

1. All herbicides mixed in 1 L bottle before addition of adjuvants. Product mixing followed the order: a. Ammonium sulfate (AMS), b. dry herbicides, c. liquid solubles, d. liquid emulsifiables, e. adjuvants.
2. Bottle slowly inverted 4 times (no shaking) after each product was added to allow complete dispersal. For dry herbicides inversion was allowed several more times over 1-3 minutes until all prills were dispersed.
3. Add step 1.e. adjuvants one at a time followed by slowly inverting the mixture 10 times. Evaluate mixture immediately then move on to the next adjuvant, repeating the process. Once the first mixture was evaluated, time was noted. Next let bottles set undisturbed for 30 minutes.
4. After 30 minutes each bottle evaluated for the second time. Acceptable to pick up the bottles, but carefully so as not to disturb the mixture. Bottles backlight making mixture incompatibilities more visible. When the last mixture was evaluated, proceed to step 5, the third and final evaluation.
5. Final evaluation occurred after slowly inverting the bottles 10 times.



Figure 1. Herbicide and adjuvant compatibility testing set-up at the OSU Turfgrass Research Center in Stillwater.



Figure 2. Control™ brand and Corral® Poly brand drift control additives.



Figure 3. Bottle on left contains the incompatible mixture of the herbicide Prodiamine 65 WDG (active ingredient prodiamine) and Corral® Poly brand adjuvant. Middle bottle contains only Prodiamine 65 WDG herbicide in water. Bottle on the far right contains compatible mixture of Control™ brand adjuvant and the herbicide Prodiamine 65 WDG.

Results and Discussion

Control™ brand spray adjuvant was compatible with all herbicide treatments/combinations at the specific concentrations listed in Table 1.

Corral® Poly brand adjuvant had moderate to severe physical incompatibility (Figure 3) with Prodiamine 65 WDG but was otherwise compatible with all other herbicide treatments tested.

The physical incompatibility in the Prodiamine 65 WDG and Corral® Poly adjuvant tank mix took the form of moderate to severe flocculation followed by settling with inability to re-suspend.

The incompatibility that occurred in this test between Prodiamine 65 WDG and Corral® Poly at the 2.0 oz/100 gallon carrier rate appeared permanent and irreversibly. This incompatibility might pose a risk of clogging sprayer components and affect spray distribution and thus weed control efficacy.

The jar compatibility test was useful in locating physical tank mix incompatibility of the specific herbicide/adjuvant treatment combinations screened in this trial.

Individual water quality characteristics can influence herbicide/adjuvant tank mix compatibility on-site. Consequently, the reader is encouraged to perform on-site jar test compatibility testing for combinations for which the applicator does not have previous experience in constructing. Alterations in herbicide/adjuvant concentrations could potentially change compatibility findings justifying additional testing.

Results of this research have been used in educating ODOT pesticide applicators concerning specific herbicide/adjuvant tank mix compatibility issues.

Table 1. Herbicide and adjuvant treatments evaluated for physical compatibility during 2011 testing.†

Treatment Number & Product Names	Form Conc ¹	Form Unit	Form Type	Rate	Rate Unit	Carrier Rate
1 Landmaster BW Ammonium Sulfate	3.1 99	lb ai/gal %	SG L	32 17	fl oz/a lb/100 gal	30
2 Roundup Pro Concentrate	5	lb ai/gal	L	32	fl oz/a	30
3 Ranger Pro	4	lb ai/gal	L	32	fl oz/a	30
4 Roundup Pro Concentrate Oust Extra	5 71.25	lb ai/gal %	L WG	13 1.5	fl oz/a oz/a	30
5 Roundup Pro Concentrate Outrider	5 75	lb ai/gal %	L WG	13 1	fl oz/a oz/a	30
6 Vanquish Non-ionic surfactant	4 90	lb ai/gal %	L L	32 0.25	fl oz/a % v/v	30
7 Transline Non-ionic surfactant	3 90	lb ai/gal %	EC L	8 0.25	fl oz/a % v/v	30
8 Arsenal Non-ionic surfactant	2 90	lb ae/gal %	L L	64 0.25	fl oz/a % v/v	30
9 Prodiamine 65 WDG	65	%	WDG	2.3	lb/a	30
10 Perspective Non-ionic surfactant	55.3 90	% %	DF L	4.75 0.25	oz/a % v/v	30
11 Streamline Non-ionic surfactant	52.1 90	% %	DF L	4.75 0.25	oz/a % v/v	30
12 Garlon 4 Ultra Tordon K Non-ionic surfactant	4 2 90	lb ai/gal lb ai/gal %	EC SC L	96 32 0.25	fl oz/a fl oz/a % v/v	30
13 Krenite S Crop oil concentrate	4 90	lb ai/gal %	SC L	128 1	fl oz/a % v/v	30
14 Milestone VM Non-ionic surfactant	2 90	lb ai/gal %	SC L	4 0.25	fl oz/a % v/v	30
15 Roundup Pro Concentrate Plateau	5 2	lb ai/gal lb ai/gal	L SC	10 4	fl oz/a fl oz/a	30

†Form = Formulation, Conc = Concentration, lb ai = pounds of active ingredient, lb ae = pounds of acid equivalent, gal=gallons, fl oz = fluid ounces, v=volume of product to volume of water ratio, a = acres, L=liquid, SG=soluble granule, WG=wettable granule, EC=emulsifiable concentrate, WDG=water dispersible granule, DF=dry flowable, and SC=soluble concentrate.

Table 2. Selected drift control products, rates and carrier rates evaluated for physical compatibility with selected herbicides.†

Treatment Number & Product Names	Active Ingredient Concentration by Weight (%)	Formulation Type	Product Use Rate	Spray Carrier Rate
1 Control™	37	L	1 fl oz/100 gal	30
2 Corral® Poly	30	L	2 fl oz/100 gal	30

† L=liquid, fl oz = fluid ounces, gal = gallon.

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