

Exhibit 24

MONSANTO



**Off-Target Movement Due to Potential Volatility of M1691 Herbicide Poses
No Risk to Threatened and Endangered Species**

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Introduction

As EPA requested, Monsanto is providing this summary explaining why EPA's proposed downwind buffer for M1691 Herbicide protects against any effect to survival, growth, or reproduction of non-target organisms (NTOs), including threatened or endangered species (TES), outside the dicamba-treated area. Specifically, EPA has a broad body of data and information establishing that there will be no effect to NTOs or TES due to volatility, regardless of wind direction. This body of data and information, detailed below, includes: independent peer-reviewed field studies, Monsanto field and growth chamber studies, and EPA modeling and assessments. In light of this body of data and information, a buffer on all four sides of a dicamba-treated field is not necessary for M1691 Herbicide when applied according to the directions for use on the current draft label.

1. Diglycolamine (DGA) Salt Formulations of Dicamba are Significantly Less Volatile than Dimethylamine (DMA) Salt Formulations

Volatilization can occur when pesticide surface residues change from solid or liquid to a gas. Volatility is a function of the chemical properties of the pesticide. DGA salt formulations of dicamba, which include M1691 Herbicide, have reduced volatility relative to DMA salt formulations of dicamba. In fact, Egan and Mortensen (2012) estimated that vapor movement for a DGA dicamba formulation outside of the treated plot was reduced by 94% relative to a DMA dicamba formulation. Furthermore, Monsanto has submitted an ASTM publication "A Method to Determine the Relative Volatility of Auxin Herbicide Formulations" which further supports these results demonstrating 55 times lower volatility for the DGA salt than the DMA salt (MRID 49570505).

2. Volatility is a Minor Component of Potential Off-Target Movement of M1691 Herbicide as Compared to Particle Drift

There are two main routes of potential off-target movement in air: particle drift and vapor movement. With respect to M1691 Herbicide, EPA has concluded that volatility is a minor component of potential off-target movement in air as compared to particle drift.¹ EPA's conclusion was based on multiple lines of evidence, including a field volatility study (Theoretical Profile Shape (TPS) Study, MRID 49022501) and field bioassay studies submitted by Monsanto, and EPA screening-level assessment tools (AERSCREEN and AERMOD) which take into account higher temperatures, high humidity, and larger plot areas. Accordingly, the directions for use on the proposed draft label for M1691 Herbicide on dicamba-tolerant crops protects against

¹ EPA Addendum to the Environmental Fate and Ecological Risk Assessment for the Section 3 New Use on Dicamba-Tolerant Soybean, May 20, 2014

off-target impacts and properly takes into account the minor role of volatility in potential off-target movement.

3. M1691 Herbicide Volatilization Occurs Primarily Within the First 24 Hours of Application, and the Potential for Further Volatilization Declines Over Time

For DGA dicamba formulations like M1691 Herbicide, the majority of volatilization occurs within 24 hours of application. Mueller et al. (2013) investigated the volatilization of DGA dicamba in 12 separate field trials over two years under a range of environmental conditions (**Table 1**). As presented in Table 6 of Mueller et al. (reproduced here as **Table 2**), during the course of a 48-hour monitoring period, 68-80% of the dicamba that volatilized did so during the first 24 hours (**Table 2**). In addition, Egan and Mortensen (2012) concluded from three studies performed over two years covering a broad range of temperatures (63 °F - 83°F; 17 °C – 28 °C) that the amount of dicamba volatilized was comparable for 8-hour and 24-hour exposure periods.² Taken together these studies demonstrate that the majority of volatilization occurs in the first 24 hours after application.

Other factors reduce volatility in the time period following application. These factors, including soil adsorption, soil degradation, plant uptake and plant metabolism, decrease the amount of dicamba available to volatilize. Thus, while the majority of dicamba volatilizes within the first 24 hours (Mueller et al., 2013; Egan and Mortensen, 2012), the amount of dicamba remaining to volatilize continues to decline over time.

Furthermore, dicamba-tolerant soybean and cotton crops express an enzyme that rapidly metabolizes dicamba to non-herbicidal metabolites. Indeed, less than 20% of the initial dicamba residue was recovered as parent dicamba from soybean forage a day after application (MRID 48644205). Therefore, the properties of dicamba-tolerant soybean and cotton are such that the amount of dicamba available to volatilize is minimal the day after treatment (and thereafter).

4. Any Volatilized Dicamba that Could be Available Following Application of M1691 Herbicide Will Not Affect TES Outside Treated Areas – Even if the Wind Changes Direction

Egan and Mortensen (2012) detected no concentrations of dicamba resulting from volatilization outside of the treated area except in the downwind direction (**Figure 1**). In other words, they found that dicamba vapor movement only occurs in a downwind direction. Significantly, the

² Significantly – and as discussed in further detail in Section 4 – any M1691 Herbicide that could be available for volatilization within 24 hours of application (or thereafter) will not cause any effects outside of the treated areas, even if the wind changes directions.

predicted downwind concentrations resulting from volatilization immediately adjacent to the edge of the treated area were below the NOAEC for non-target plants for the DGA salt of dicamba. Consequently, any downwind vapor movement that may occur will not affect TES. Notably, this is a worst-case exposure scenario since all of the volatilized dicamba moving off the treated area traveled in a single direction. Therefore, if the wind changes direction after treatment has occurred, dicamba concentrations outside of the treated area would under no circumstances exceed levels of concern because dicamba air concentrations are further diluted. Accordingly, the proposed label including only a downwind buffer is protective of potential off-target movement, including volatility.

5. Modeling Tools Evaluating Extreme Environmental Conditions Further Support No Impact on TES Outside Treated Areas

EPA screening-level air dispersion models (i.e. AERSCREEN and AERMOD) are used to obtain exposure estimates to calculate risk to TES, including non-target plants. EPA utilized this approach to evaluate M1691 Herbicide¹ and considered the flux value from the Monsanto TPS field volatility study (MRID 49022501) as the lower bound estimate of flux.³ However, Monsanto strongly believes the TPS flux value is in fact representative of flux values expected during the periods of dicamba use on dicamba-tolerant crops for the following reasons: a) mean air temperature correlates with the amount of dicamba volatilized (Mueller et al. 2013) and b) the mean air temperature for the TPS volatility study was 25.1°C (77.2°F), which is in the upper range of reported mean air temperatures during the dicamba use period in soybean and cotton growing states (52 – 83°F; 11 – 28°C)⁴ (**Figure 2**). The AERSCREEN and AERMOD models evaluate a wide range of environmental inputs (temperature, relative humidity, etc.), simulating the most extreme environmental conditions and commercially relevant field sizes. With the representative flux value from the TPS study as the input for these models, EPA concluded there would be no exposure of concern from volatility outside the treated area.⁵

In summary, the existing weight of evidence addressing dicamba volatility, including the peer-reviewed publications, Monsanto-submitted studies, and EPA assessments discussed above, supports EPA's conclusion that a downwind buffer is protective of NTOs and will support an EPA determination there is no effect to TES outside the treated area. Therefore, no additional buffer restrictions are warranted.

³ The flux values determined using the TPS methodology are statistically equivalent to values calculated using other commonly used approaches i.e. aerodynamic method, integrated horizontal flux method (Majewski et. al., 1990).

⁴ Mean air temperatures from 1985-2015.

⁵ Furthermore, the Egan and Mortensen study conducted under similar temperature conditions (63 °F - 83°F; 17 °C – 28 °C) also confirmed that for the DGA salt, concentrations outside the treated area are below the no effect concentration for non-target plants.

Figure 1. Predicted concentrations within and outside a treated area following a DMA dicamba application.

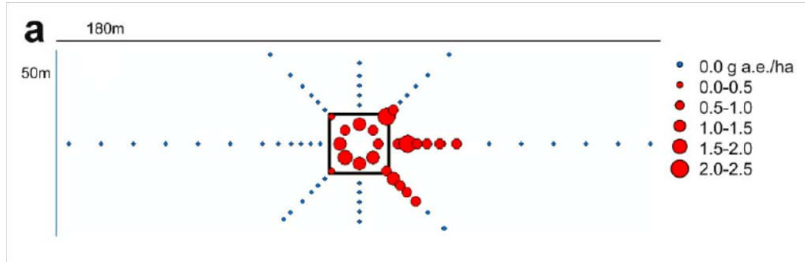
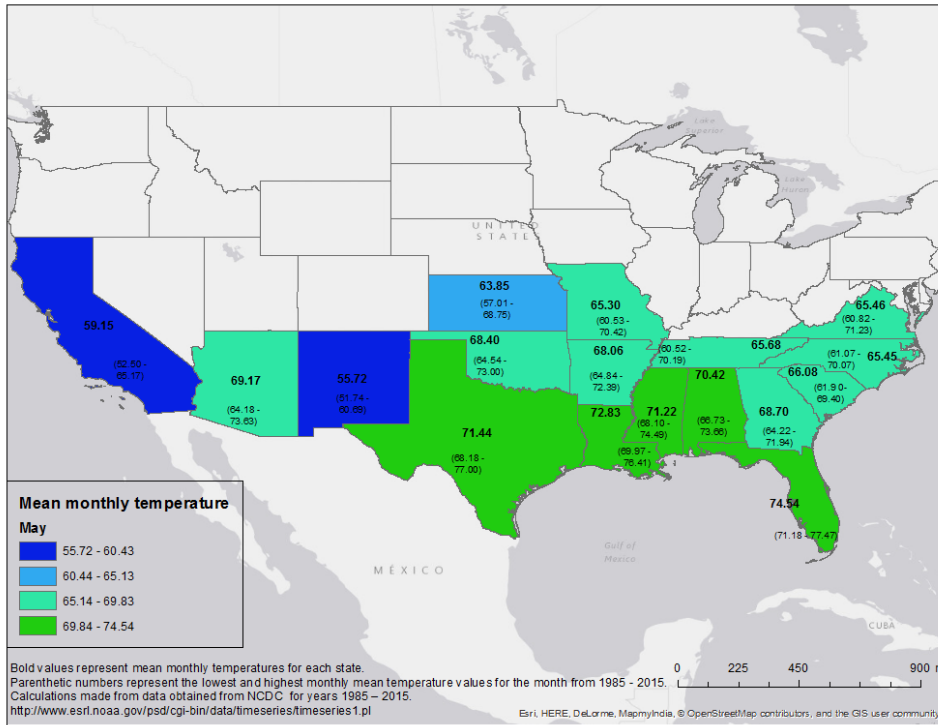


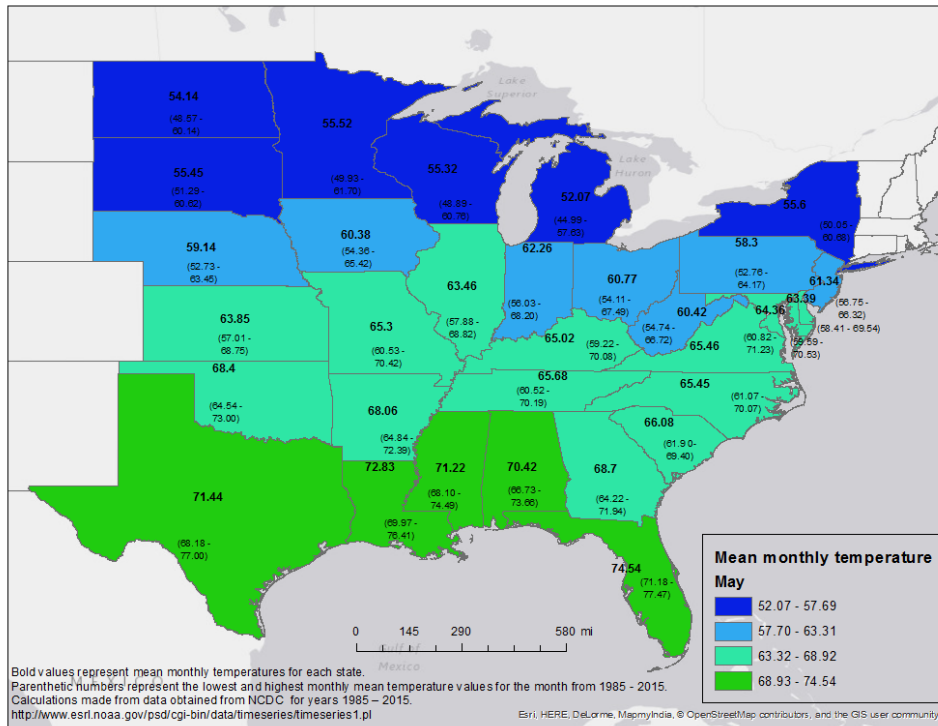
Fig. 1.a. from Egan and Mortensen (2012). The red dots indicate estimated dicamba exposure (in g a.e./ha) based on an evaluation of visual effects. The black square symbolizes the dicamba-treated area. Note: concentrations of DMA dicamba are only detectable outside the treated area in the downwind direction. Table 3 of the Egan and Mortensen paper shows that concentrations of DGA dicamba immediately outside the treated area (0.11 g a.e./ha) are below the NOAEC for non-target plants.

Figure 2. Mean monthly temperature by state.

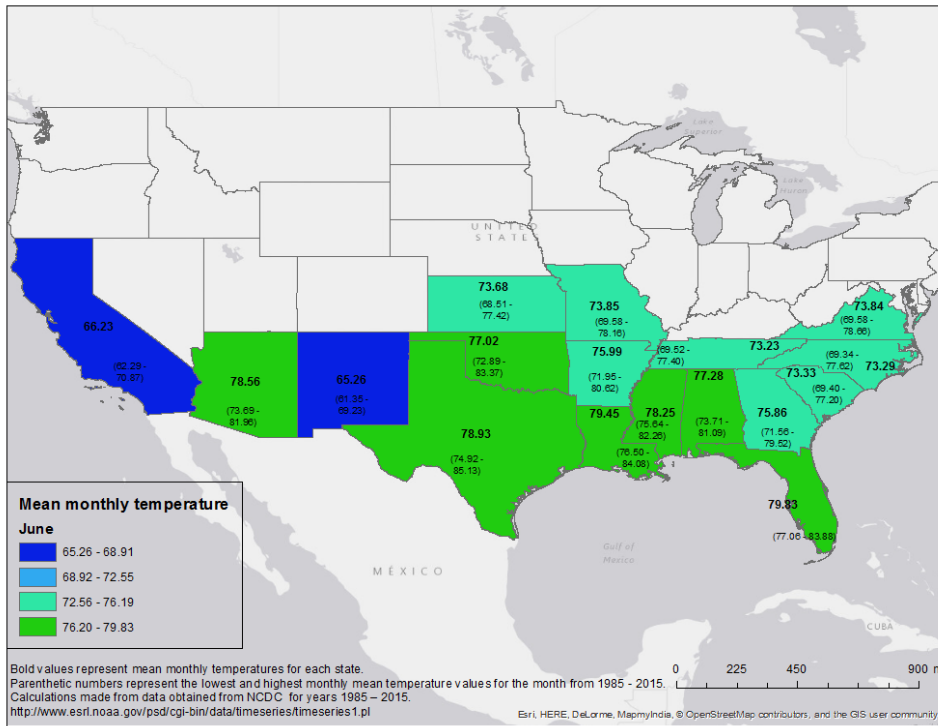
Cotton growing states - May



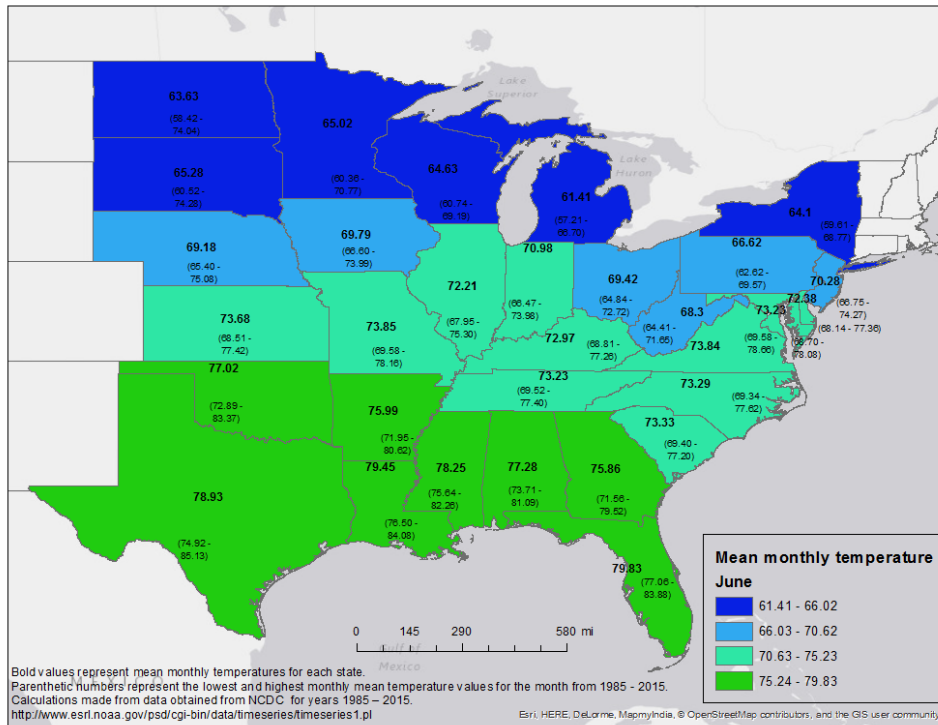
Soybean growing states – May



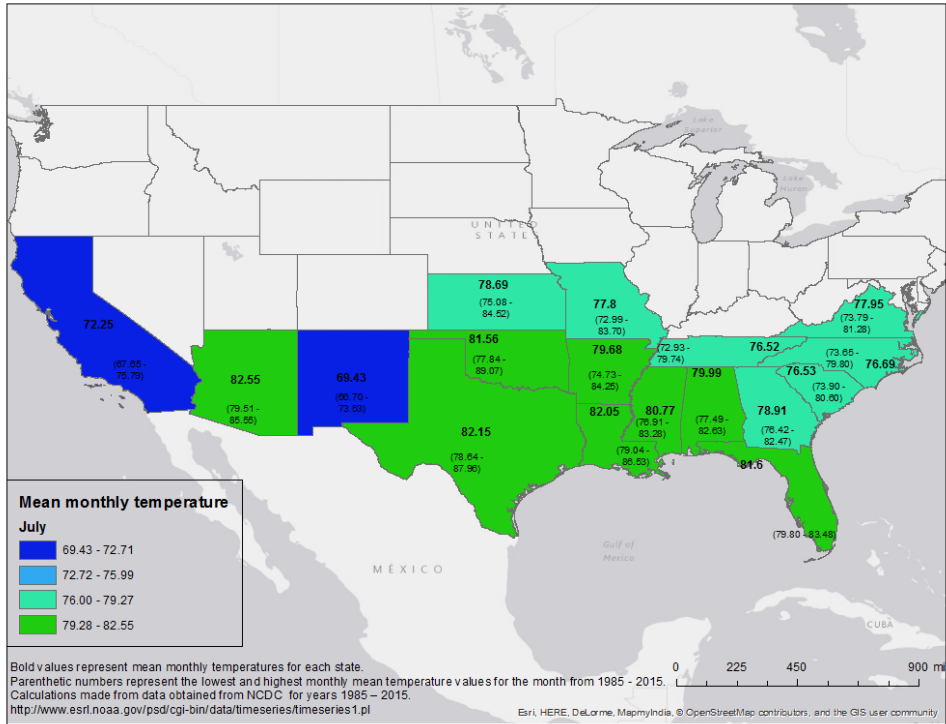
Cotton growing states - June



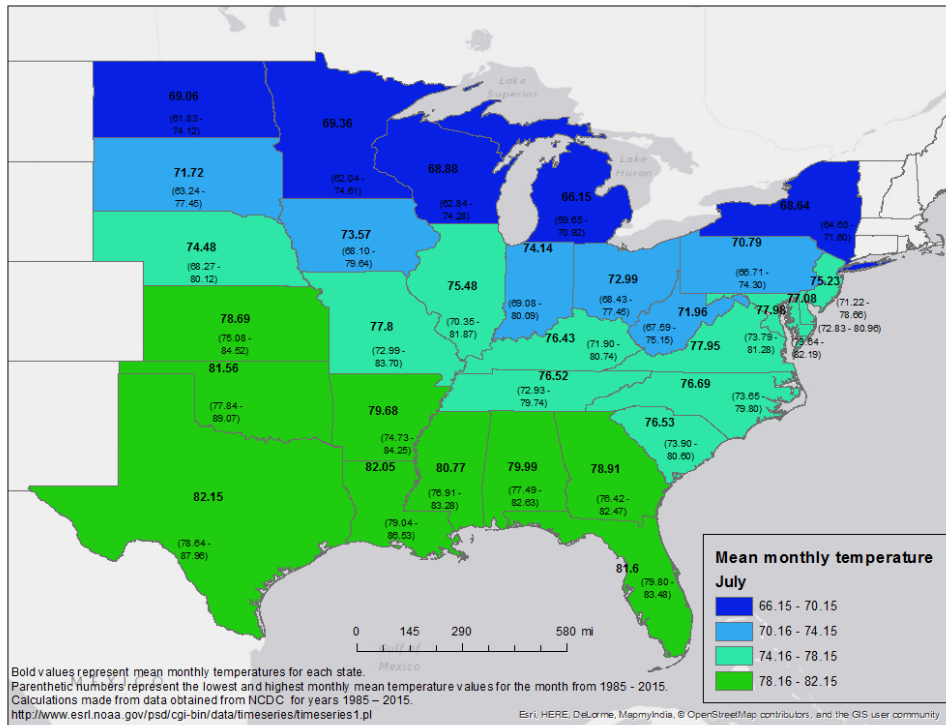
Soybean growing states - June



Cotton growing states - July



Soybean growing states – July



Methodology for Figure 2. mean monthly temperature maps.

Cotton and soybean growing states were identified via the USDA NASS Quick Stats (<http://quickstats.nass.usda.gov/>) data as those states having acreages of cotton or soybeans planted in 2015. Thirty-four states were identified as having either cotton or soybeans planted in 2015.

State-averaged mean monthly temperatures for 1985 – 2015 were obtained via download by state from the NOAA Timeseries Extraction Page (<http://www.esrl.noaa.gov/psd/cgi-bin/data/timeseries/timeseries1.pl>) on February 3, 2016. Thirty-year mean monthly temperatures were calculated for May, June, and July for each state from the 30 year dataset as the average of the state-averaged mean monthly temperature variable for the 1985 – 2015 period. Mean monthly temperatures are depicted as the large bolded font value in each state. Minimum and maximum mean monthly temperatures were determined as the lowest and highest values of the state- averaged monthly mean values of the 30 year period for each state. Minimum and maximum mean monthly temperatures are depicted parenthetically for each state in the figures.

Table 1. Summary of Environmental Conditions for the 2009 and 2010 Field Volatility Trials At Time of Application from Mueller et al. 2013.

2009 Trials

Trial	Date of sampling	Start time	End time	Sampling period	Time after treatment	Temp. °F	Rel. Humidity %
DGA	6/1/2009	7:10	14:05	0–6	6		
DGA	6/1/2009	14:35	19:12	6–12	12		
DGA	6/1–2/2009	19:36	8:19	12–24	24	64.7	99.3
DGA	6/2/2009	9:10	7:20	24–48	48		
DGA	6/3/2009	7:53	17:25	48–58	58		
DGA	6/19/2009	6:31	12:19	0–6	6		
DGA	6/19/2009	12:20	18:25	6–12	12		
DGA	6/19–20/2009	18:26	6:36	12–24	24	65.0	100
DGA	6/20–21/2009	6:38	9:23	24–51	48		
DGA	6/21/2012	9:24	11:42	51–53	53		
DGA	6/21–22/2009	16:29	6:40	53–67	67		
DGA	6/29/2009	6:58	13:06	0–6	6		
DGA	6/29/2009	13:07	19:19	6–12	12		
DGA	6/29–30/2009	19:21	6:50	12–24	24	62.6	100
DGA	6/30–7/1/2009	6:51	6:55	24–48	48		
DGA	7/1–2/2009	6:56	6:46	48–72	72		

2010 Trials

Trial	Date of Sampling	Start time	End time	Sampling period	Time after treatment	Temp. °F	Rel. Humidity %
Morning	6/2/2010	6:00	12:00	0-6	6		
Morning	6/2/2010	12:00	18:00	6-12	12	NA	NA
Morning	6/2-3/2010	18:00	6:00	12-24	24		
Morning	6/3-4/2010	6:00	6:00	24-48	48		
Midday	6/2/2010	12:30	18:30	0-6	6		
Midday	6/2-3/2010	18:30	0:30	6-12	12	88.8	52.5
Midday	6/3/2010	0:30	12:30	12-24	24		
Midday	6/3-4/2010	12:30	12:30	24-48	48		
Evening	6/2-3/2010	19:00	1:00	0-6	6		
Evening	6/3/2010	1:00	7:00	6-12	12	85.1	55.7
Evening	6/3/2010	7:00	19:00	12-24	24		
Evening	6/3-4/2010	19:00	19:00	24-48	48		
Morning	6/15/2010	06:10	12:10	0-6	6		
Morning	6/15/2010	12:13	18:11	6-12	12	68.0	98.7
Morning	6/15-16/2010	18:12	06:12	12-24	24		
Morning	6/16/2010	06:13	06:13	24-48	48		
Midday	6/15/2010	12:42	18:42	0-6	6		
Midday	6/16/2010	18:43	00:43	6-12	12	92.4	56.1
Midday	6/16-17/2010	00:44	12:41	12-24	24		
Midday	6/17/2010	12:42	12:42	24-48	48		
Evening	6/15-16/2010	19:10	01:10	0-6	6		
Evening	6/16/2010	01:11	07:12	6-12	12	75.2	77.6
Evening	6/16/2010	07:13	19:12	12-24	24		
Evening	6/16-17/2010	19:13	19:12	24-48	48		

2010 Trials continued

Morning	6/28/2010	06:12	12:12	0-6	6		
Morning	6/28/2010	12:13	18:13	6-12	12		
Morning	6/28-6/29/2010	18:14	06:13	12-24	24	74.9	87.1
Morning	6/29-30/2010	06:14	06:16	24-48	48		
Midday	6/28/2010	12:45	18:45	0-6	6		
Midday	6/28-29/2010	18:46	00:46	6-12	12		
Midday	6/29/2010	00:49	12:49	12-24	24	89.0	51.2
Midday	6/29-30/2010	12:51	12:52	24-48	48		
Evening	6/28-29/2010	19:11	01:12	0-6	6		
Evening	6/29/2010	01:13	07:13	6-12	12		
Evening	6/29/2010	07:14	19:15	12-24	24	94.5	36.8
Evening	6/29-30/2010	19:16	19:16	24-48	48		

Table 2. Cumulative detected dicamba total mean \pm 1 standard error at various times after application. The amount in parentheses is the estimated amount collected within sampling interval. Application timings within a column that do not share the same letter have different average total dicamba collected within that sampling interval.

Application timing	0-6 hours	6-12 hours	12-24 hours	24-48 hours
	total μ g			
Morning	2.8 \pm 1.57 (2.8 B)	9.8 \pm 5.1 (7.0 A)	11.3 \pm 5.65 (1.5 A)	14.1 \pm 4.7 (2.8 A)
Midday	10.4 \pm 2.34 (10.4 A)	12.3 \pm 2.35 (1.9 AB)	14.0 \pm 1.83 (1.7 A)	18.7 \pm 3.22 (4.7 A)
Evening	1.8 \pm 0.25 (1.8 B)	2.0 \pm 0.48 (0.2 B)	5.1 \pm 1.30 (3.1 A)	7.5 \pm 2.55 (2.4 A)

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