Official Dicamba-related Injury Investigations as Reported by State Departments of Agriculture (*as of July 19, 2017)
Estimates of Dicamba-injured Soybean Acreage in the U.S. as Reported by State Extension Weed Scientists (*as of July 19, 2017)

*Total: ~2.5 million

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Influence of Application Factors on Dicamba Volatility

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Dicamba Volatility by Target Surface

Field Low Tunnel Experiments (3 site-years)

Behrens and Lueschen
Soybean Injury Scale

- Injury (index scale)
- Bare soil
- Vegetation

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DAT

3  7  14  21  28
Carrier Volume

Vapor Chamber Experiment

*Banvel formulation applied to soybean leaf targets.*
Droplet Size

Vapor Chamber Experiment

*Banvel formulation applied to soybean leaf targets.*
Herbicide Formulation

Vapor Chamber Experiment

*Banvel formulation applied to soybean leaf targets.*
Dicamba Volatility from Soybean Foliage

Vapor Chamber Experiment
(Pooled over sensitive/tolerant varieties)

*Banvel formulation applied to soybean leaf targets.
**PRELIMINARY 2017 DATA**

**Dicamba Volatility by Herbicide**

**Field Low Tunnel Experiment**

*Methods:* Sprayed 3 flats with bare soil for each treatment and placed in the center of 2 soybean rows. Injury rating is for soybean plants immediately adjacent to the flats.

![Bar chart showing soybean injury (%) at 21 DAT for different herbicides.](chart)

- **Banvel + Roundup PM**
- **Clarity + Roundup PM**
- **Engenia + Roundup PM**
- **Xtendimax + Roundup PM**
- **Xtendimax + Roundup PM + AMS**
Tunnel Volatility Study (Soybean)

13 days after treatment

- Plants under dome injured (%)
- Injury under dome (%)

Herbicide treatment:
- Engenia
- Xtendimax
- S-moc/Xtendimax
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<th>050</th>
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</table>
Soybean placed in treated field 30 minutes after Engenia application
Physical Drift, Vapor Drift, and Overall Drift Comparison
Comparison of two dicamba formulations for risk of off-target movement to soybean

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2University of Arkansas Research and Extension Service, Lonoke, AR

Introduction

With the advent of dicamba-resistant crops, there will be greater possibility for off-target movement of dicamba due to increased use. Soybean response to Clarity (DGA dicamba) and Banvel (DMA dicamba) has been documented to be similar (Egan and Mortensen 2012). It has yet to be determined if soybean response to Engenia (DAPMA dicamba) will be similar.

Previous research has documented Clarity (glycinebuctol dicamba) to have reduced secondary (volatile) loss of 50% when compared to liberal (glycinebuctol dicamba) (Egan and Mortensen 2012).

Other research has documented a 20% decrease in deposition by all samples when Clarity was applied over Banvel (Muehle et al. 2016).

Engenia (N-Benoxycinnamoyl) methylenediacetamide dicamba is claimed to have decreased secondary loss in regards to Clarity; however, no peer-reviewed research is available concerning this formulation.

Hypotheses

Soybean response to Clarity and Engenia will be similar.

Engenia will display reduced secondary injury to soybean in regards to Clarity.

Objective

To separate the combined effects of primary and secondary drift to soybean.

Materials and Methods

Trials were established in 2015 and 2016 at the Northeast Research and Extension Center in Keiser, AR.

In two side-by-side 5 ft. fields, Engenia and Clarity were simultaneously applied to a 1.444 Mha area at 349 g a.e. ha⁻¹ using Dowmerr Microtwin (Dowmerr Manufacturing, Newport, AR, Figure 1).

The Microtwin were equipped with identical 7.0 m spay booms and were calibrated to deliver 94 L ha⁻¹ from TTI 11003 nozzles (Teledyne Technologies, Springfield, OR) while traveling at 15.6 km h⁻¹.

Plots were established in each cardinal direction.

- Every 5 m for the first 24 m
- Every 6 m up to 26 m
- Every 12 m up to 27 m

Every 12 m until the edge of the field was reached.

Three sets of 4.0 plants were marked at each distance and 19 L buckets were used to seed plants from primary (physical) and secondary drift.

The first set was only exposed to secondary drift (bucket was placed over these plants during application).

The second set was only exposed to primary drift (bucket was placed over these plants 30 min after application and remained for 24 hours).

The seed set was never covered.

An additional rate iteration experiment was established using ten rates ranging from 0.05 to 108 g a.e. ha⁻¹ of each herbicide on the same day as the large drift trials.

Data Collection and Analysis

Visual injury evaluation was conducted at 7, 14, and 21 days after application (DAA) from the drift trials and rate iteration experiments.

Tissue samples were taken at 7 DAA from the Clarity rate iteration and large drift trial to examine tissue concentration of dicamba.

An analysis of variance (ANOVA) was performed using SAS’s (SAS Institute, Cary, NC) statistical software to examine differences in response of soybean to Clarity and Engenia.

Injury ratings in the drift experiment were paired with corresponding injury in the rate iteration experiment to estimate the doses received at distances described.

Results

ANOVA results from the rate iteration experiment documented no difference in soybean sensitivity between Clarity and Engenia either year (Figures 2 and 3) (ii) to reject hypotheses A1. Therefore, data were combined to form a single dose response curve to allow for dose estimation in the Clarity and Engenia large drift experiments (Figures 4 and Table 1).

An unexpected rainfall event of 2.6 cm occurred 8 hours after application on May 23, 2015 which made possible visualization (Beevers and Luttrell 1979).

In 2016, the average wind speed during the 24 hour period was 2% injury via secondary drift from Engenia was decreased by 57 m when compared to Clarity at 21 DAA (fail to reject hypotheses B).

Conclusions

The higher degree of soybean injury observed in 2015 was likely due to a lack of rainfall or irrigation for several days prior to the rate iteration application (Dowmerr et al. 2016) (Figures 2 and 3).

Unexpected rain events disrupted the study in 2015. However, 2016 trials documented the distance to secondary injury to decrease by 47% when Engenia was applied compared to Clarity.

This research suggests that Engenia is less prone to secondary drift than DGA forms of dicamba such as Clarity.

Literature Cited

- Beevers, Simon, and Luttrell, Janet B. Dicamba. Soybean foliage residue of dicamba and 2,4-D and correlation to application rates and yield. Agron J 26:755-760
- Muller, T.C. and Wright, D.R. Reduced NM (2015) Effect of formulation and application time of day on depositing dicamba in the air under field conditions. Weed Sci 61:394-398
- Muehle, John D., Mattison, K. (2016) Comparison of two dicamba formulations for risk of off-target movement to soybean. Clarity herbicide Clarity herbicide
Effect of adding Roundup PowerMax to Engenia on vapor losses under field conditions

Thomas C Mueller
University of Tennessee
July, 2017
Background

- Dicamba injury to soybeans widespread throughout soybean producing regions of Tennessee
- This study requested by Tennessee Soybean Promotion Board (TSPB)
- Specific question:
- What is the effect (if any) on dicamba volatility from adding RoundupPowermax (Rmax) to the tank while applying Engenia
Field Volatility of Dicamba, Knoxville, TN June 2017

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<td>Engenia</td>
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dicamba ng per hour

HAT 0-6
Field Volatility of Dicamba, Knoxville, TN June 2017

Engenia + Rmax

DICAMBA ng per treatment

HAT
Observations

• All samples had detected concentrations of dicamba
• No apparent effect of adding Rmax on dicamba volatility from Engenia
• Greatest dicamba concentrations at 6-12 and 12-24 HAT sampling intervals
• Most dicamba loss to atmosphere per hour was in the first afternoon after spraying (6-12 HAT)
Our Efforts to Understand the Role of Formulations & Temperature Inversions in the Off-site Movement of Dicamba

Methods:

• Banvel, Engenia, and Xtendimax sprayed in geographically separate areas.

• Air samples taken and indicator plants placed at regular intervals after treatment
Evaluation of Soybean “Indicator Plant” Injury Following Application of 3 Dicamba Formulations

% Visual Injury 21 Days after Application

- Banvel
- Engenia
- Xtendimax

Time After Treatment:
- 0-2 hours
- 2-8 hours
- 8-16 hours
- 16-24 hours
- 24-72 hours

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Some Preliminary Air Sampling Results with Engenia and XtendiMax

<table>
<thead>
<tr>
<th>Time in Comparison to Treatment</th>
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