HANDOUT 3

DEDICATED PEOPLE

INNOVATIVE PORTFOLIOS

PERSONALIZED PLANS

RISK PROTECTION

Engenia™ Herbicide

Dr. Dan Westberg
Regional Tech Service Mgr

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Grow Smart™ with BASF

Engenia™ Herbicide

The most advanced dicamba formulation from BASF

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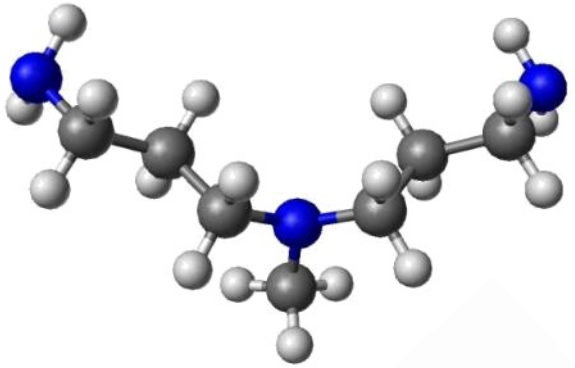
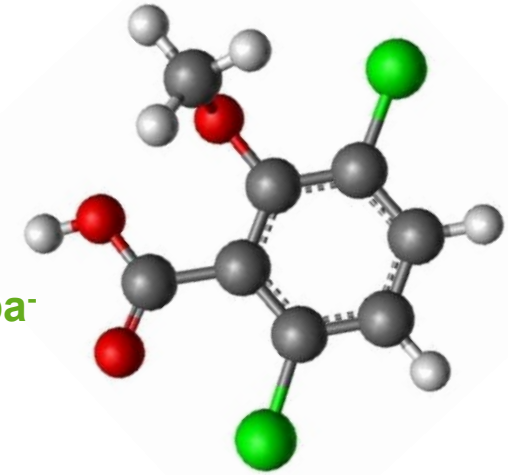
- Chemistry: Dicamba BAPMA
  - BAPMA: N,N-Bis[aminopropyl] methylamine
- Improved secondary loss characteristics
- Strong broadleaf weed control
- Good compatibility and handling characteristics



BAPMA^{+}



Dicamba^{-}

Engenia™ Herbicide

Current utility of dicamba based products

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- Dicamba has been utilized for 50 years to manage more than 190 broadleaf weeds
- Fifth most widely used herbicide in the US in 2013
- Used on more than 35 million acres in 2013
  - 15 million acres of corn
  - 5 million acres of wheat
  - 10 million acres of range/pasture
  - 6.5 million acres of turf




BASF and Dicamba

A history of innovation

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Continuous Dicamba Formulation Leadership

1958
Discovery of dicamba

1964
Banvel® Herbicide (dicamba dimethylamine (DMA)): Corn, Sorghum, Sm Grains & Pasture

1986
Marksman® Herbicide (potassium dicamba + atrazine)

1992
Clarity® Herbicide (dicamba diglycolamine (DGA))

1998
Distinct® Herbicide (sodium dicamba + diflufenzopyr (DFFP))

2007
Status® Herbicide (sodium dicamba + DFFP + safener)

2017
Engenia™ Herbicide
Registration Expected

2018+
Next generation Engenia™ Premixes

1958 — ***Anticipated Competitive DT Brands*** — **2017+**

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The most advanced dicamba formulation from BASF

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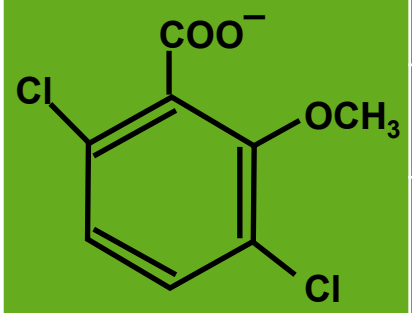
Dicamba (Anion)	Cation Chemical Formula	Cation Name	Mol. Wt.	Product
 Dicamba Structure	H^+	Acid	1	Parent
	$CH_3\text{-}NH_2\text{-}CH_3$ +	DMA	45	Banvel® herbicide
	$+NH_3\text{-}CH_2\text{-}CH_2\text{-}O\text{-}CH_2\text{-}CH_2\text{-}OH$	DGA	105	Clarity® herbicide
	$NH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}NH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}NH_2$ (with CH_3 branch) +	BAPMA	145	Engenia herbicide

BAPMA has strong ionic bonding characteristics and acts as an "anchor" keeping Engenia herbicide in place

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The most advanced dicamba formulation from BASF

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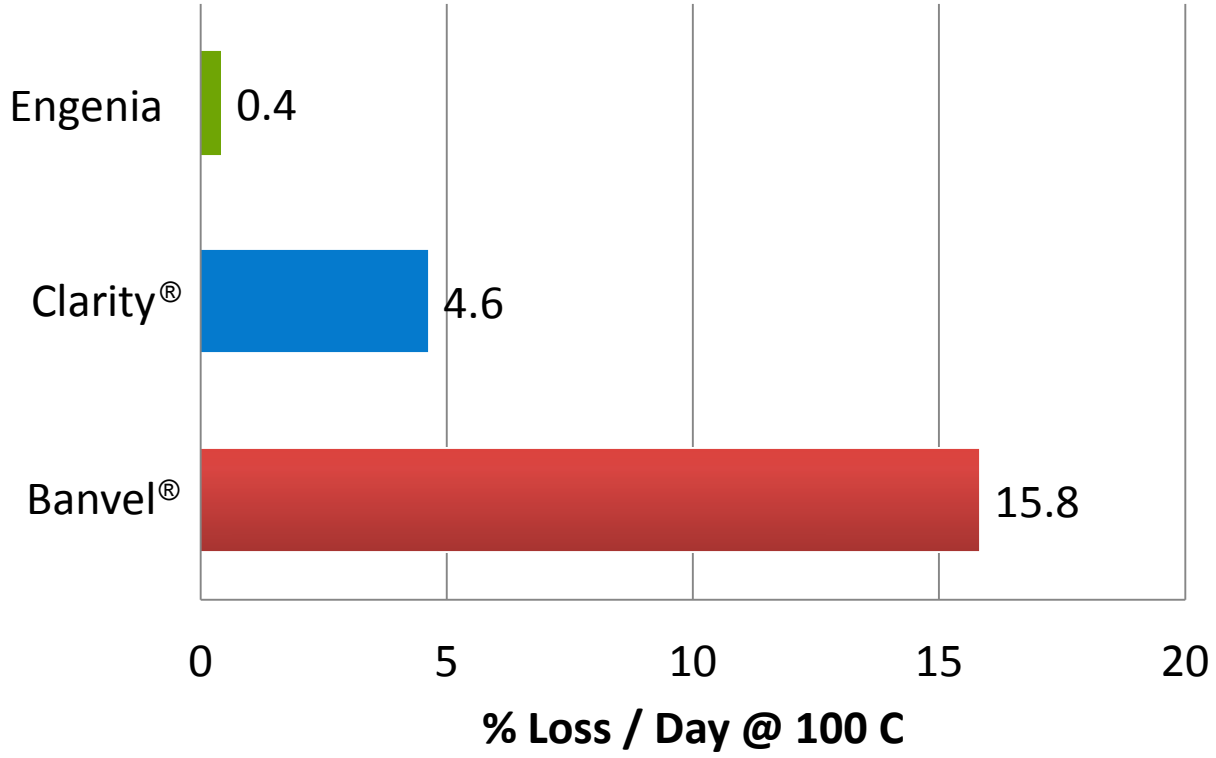

Test Conditions:

Temp.: 100 ºC

Time: 20 hours

Air flow: 2 l/min

Relative humidity : 0%

Thermogravometric analysis provides quick information, differentiation

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The most advanced dicamba formulation from BASF

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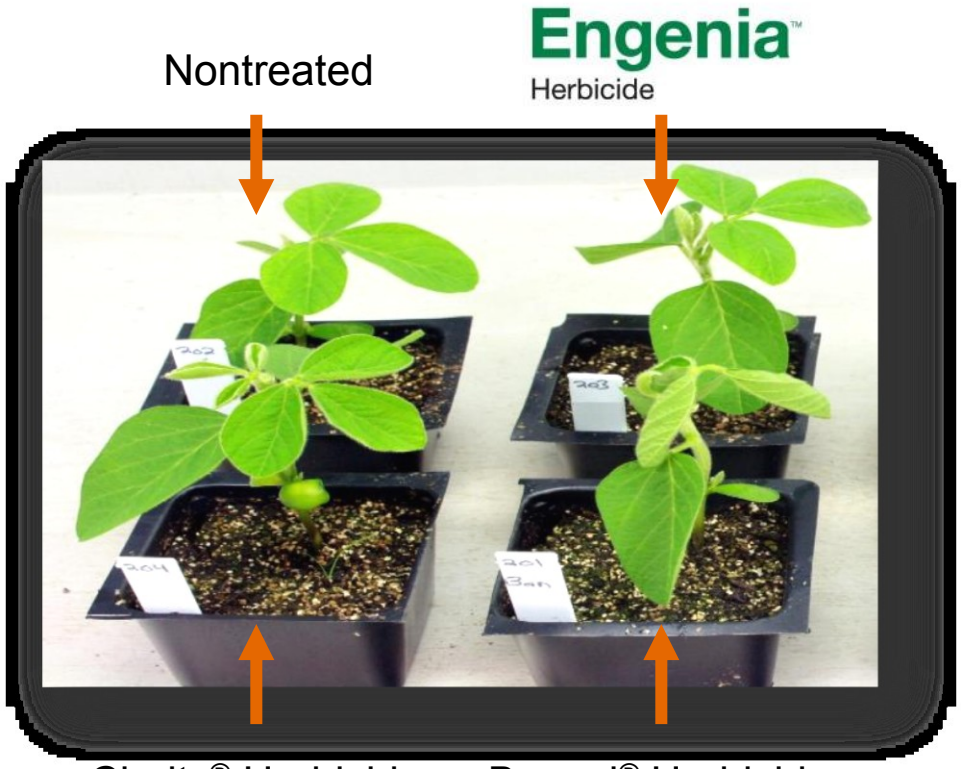

Humidome Exposure Results
Risk of Secondary Off Target Loss
Banvel >> Clarity > Engenia = Nontreated

Formulation stability provides application peace of mind

Engenia™ Herbicide Stewardship

Best management practices

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Weed Management Stewardship

- Engenia Herbicide Use
  - Full Labeled Rate
  - ≤ 4" Weeds
- Herbicide Programs
  - Multiple SOA
  - Use Residual(s)
  - Agronomic and Cultural Practices

On-Target Application Stewardship

- Formulation Selection
- Nozzle
- Boom Height
- Wind Speed
- Application Volume
- Sprayer Cleanout

Engenia™ Herbicide

Weed management stewarship

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A PRE fb POST Engenia herbicide system provides:

Maximize Yield Potential

- Prevents early season weed competition
- PRE followed by POST programs consistently out yield POST only programs

Time Management

- A PRE application will allow more time to apply the POST

Risk Management

- More time allows better selection of a good spray day
- Reduces the chance of weed control disasters
- Reduces the risk of developing resistant weeds

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Better weed control with a system

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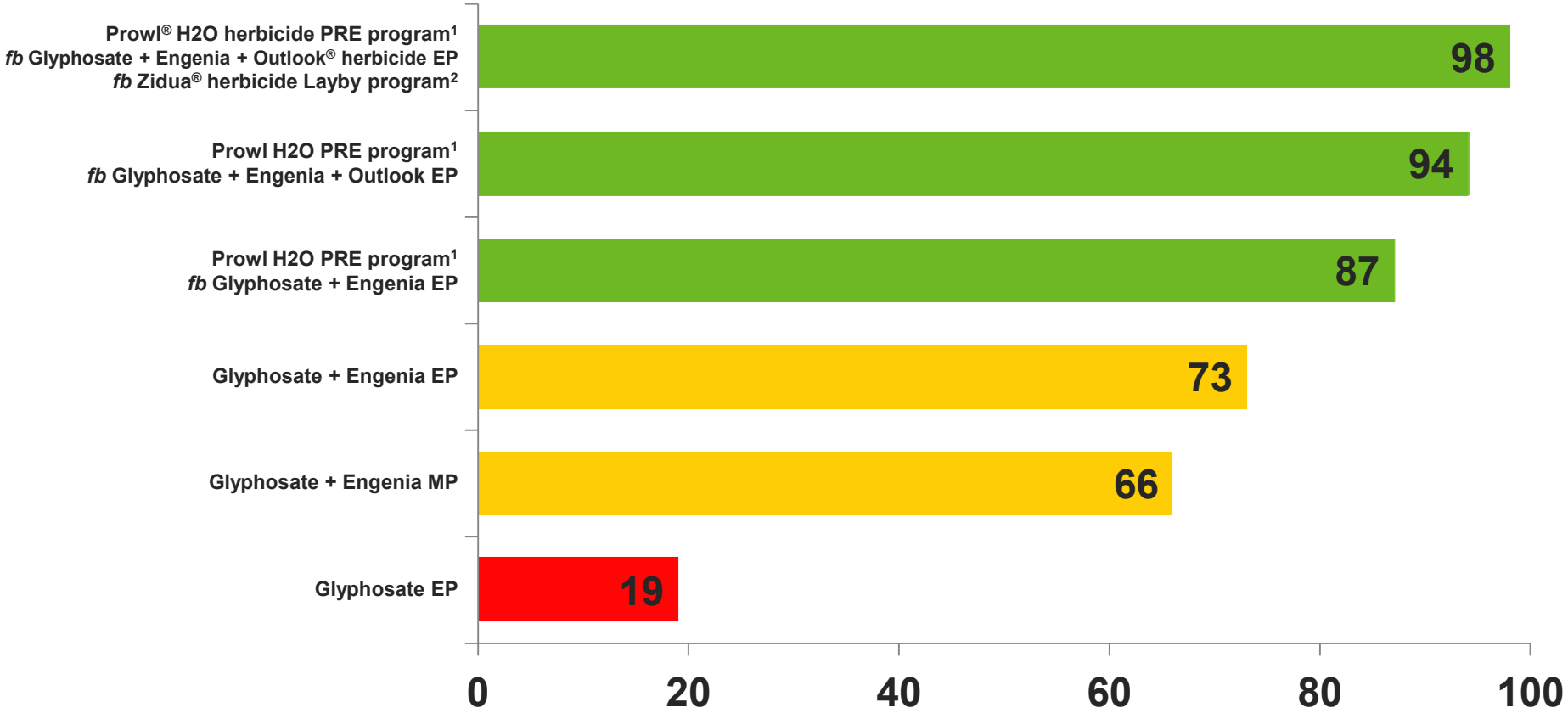
% Palmer Amaranth Control in Cotton – 4 to 8 weeks after Mid-POST



2015 Glyphosate resistant Palmer amaranth locations – AL (2), GA (2), MS (1), NC (2), TN (3), TX (2)
PRE = preemergence, EP = early post (2-3 leaf cotton), MP = mid post (4-5 leaf cotton), layby = post directed.
[1]Prowl® H2O herbicide +/- Cotoran® or Reflex®. [2]Liberty® + Zidua® herbicide or glyphosate + diuron + Zidua herbicide. Engenia herbicide applied at 12.8 fl oz/A; Outlook herbicide applied at 12-16 fl oz/A. All other herbicides applied at 1X use rates.

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Effective weed control solutions in cotton

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BASF Research Farm – 13 days after MPost – Princeton, NC

Primary weed : GR Palmer amaranth

EPost: Glyphosate (22 fl oz/A) + DGA Dicamba (16 fl oz/A) + Warrant® (48 fl oz/A)
MPost: Glyphosate (22 fl oz/A) + DGA Dicamba (16 fl oz/A) + Warrant (48 fl oz/A)

PRE: Prowl® H2O herbicide (32 fl oz/A) + Reflex® (12 fl oz/A)
EPOST: Engenia herbicide (12.8 fl oz/A) + Outlook® herbicide (12 fl oz/A) + glyphosate (22 fl oz/A)

PRE fb Post consistently outperforms total Post

Engenia™ Herbicide Stewardship

Best management practices

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Weed Management Stewardship

- Engenia Herbicide Use
  - Full Labeled Rate
  - ≤ 4" Weeds
- Herbicide Programs
  - Multiple SOA
  - Use Residual(s)
  - Agronomic and Cultural Practices

On-Target Application Stewardship

- Formulation Selection
- Nozzle
- Boom Height
- Wind Speed
- Application Volume
- Sprayer Cleanout

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Application stewardship

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Proposed label requirements to maximize on-target application

- Nozzle .....Extremely coarse to ultra coarse droplets (TTI)
- Boom Height .....< 24 inches to spray target
- Application Volume .....10 GPA minimum
- Wind Speed/Setback to Sensitive Areas .....TBD
- Additives/Adjuvants .....Tank mixtures and adjuvants approved by EPA
  - NO ammonium salt (e.g., AMS, UAN)
  - NO acidifying water conditioners
- Sprayer Cleanout .....Use a detergent based commercial cleaner
  - Triple rinse
- No Aerial Applications

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Nozzle selection key for on-target applications

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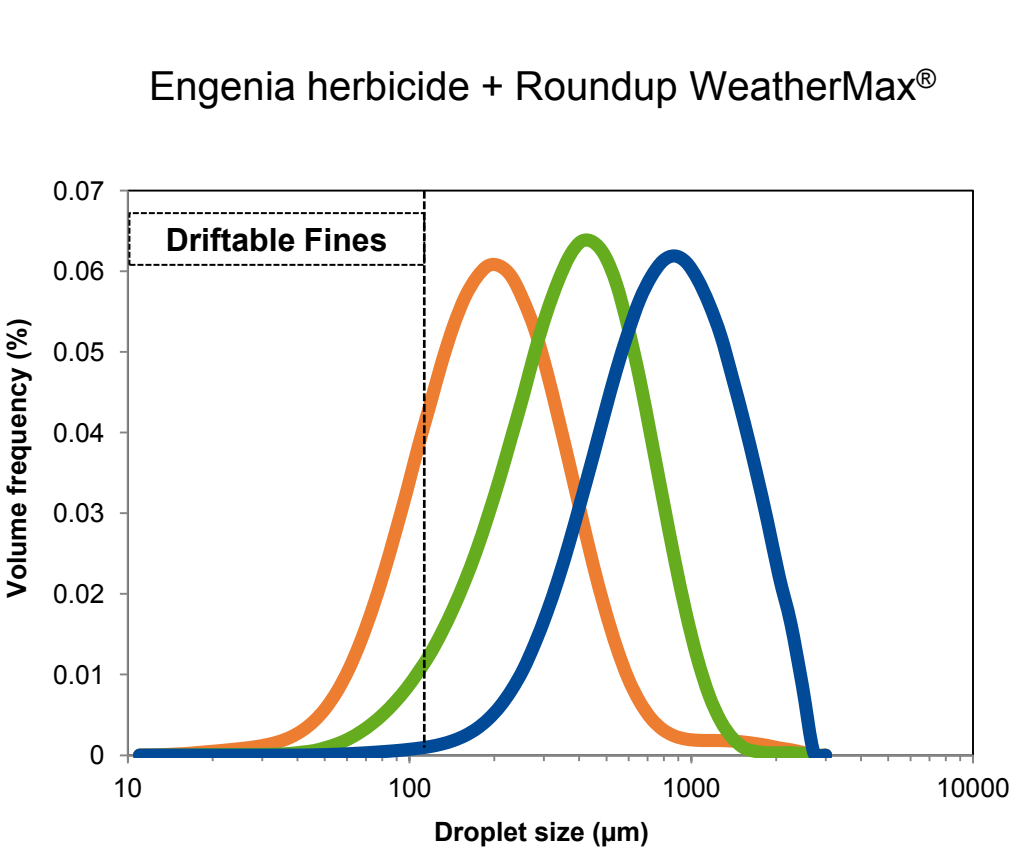

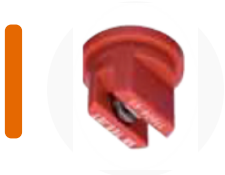

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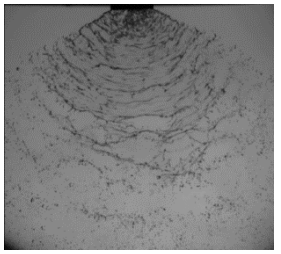
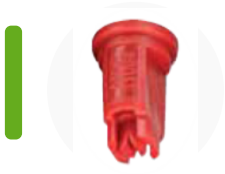
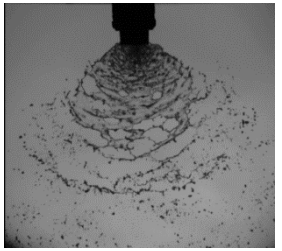
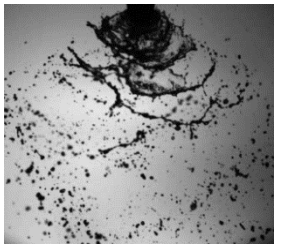




AIXR 11004



TTI 11004



Extremely coarse to ultra coarse nozzles required to mitigate spray drift

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Nozzle selection key for on-target applications

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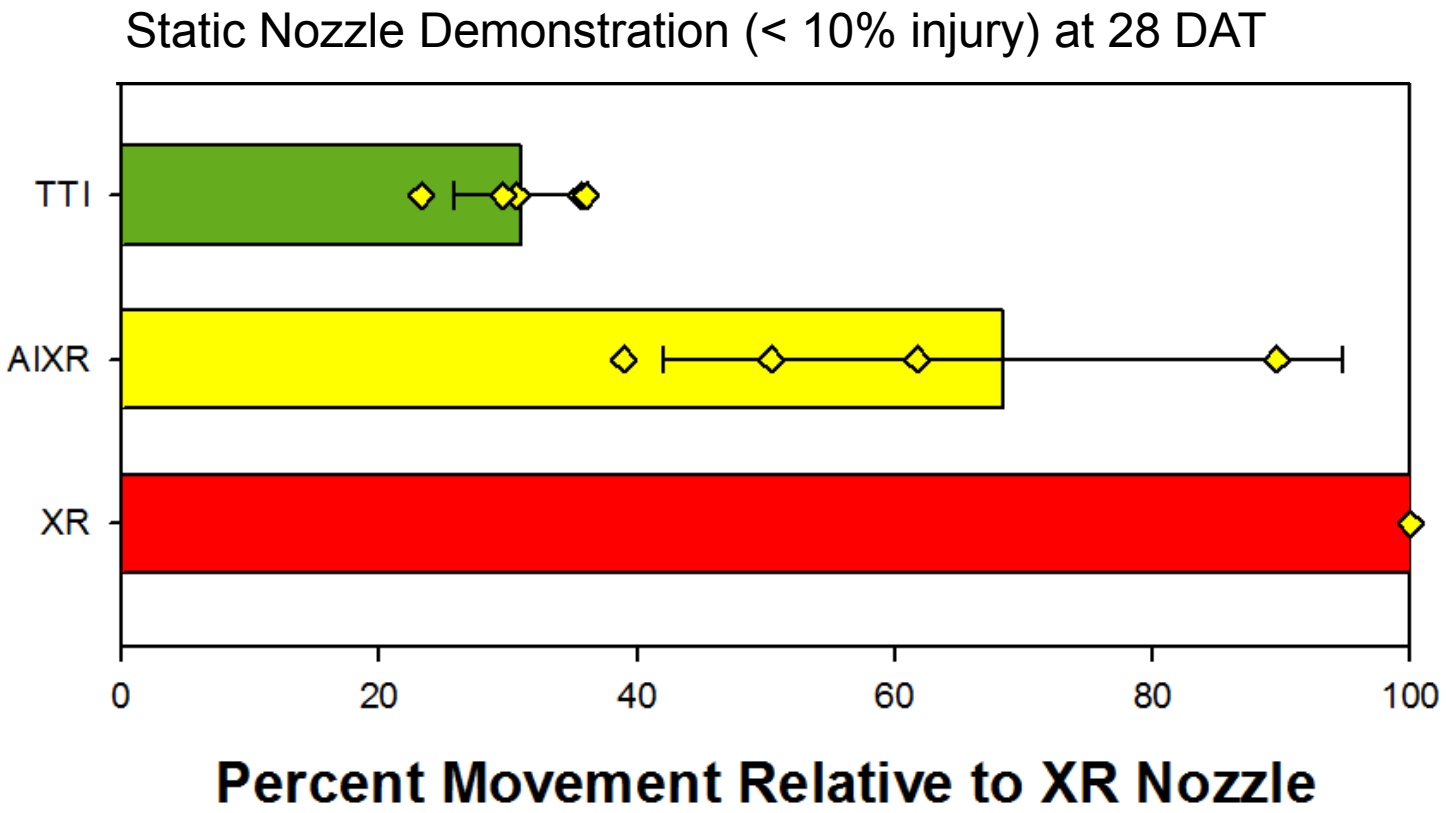

TTI nozzles provide the most consistent on-target application

2013 BASF field studies (n = 5).
Engenia Herbicide + Roundup PowerMax® (0.5 + 1 lb ae/A).
Wind speed ranged from 3 to 9 MPH. Calibrated for 10 GPA using 04 orifices.

Engenia™ Herbicide Research Results

Impact of nozzle selection on drift distance

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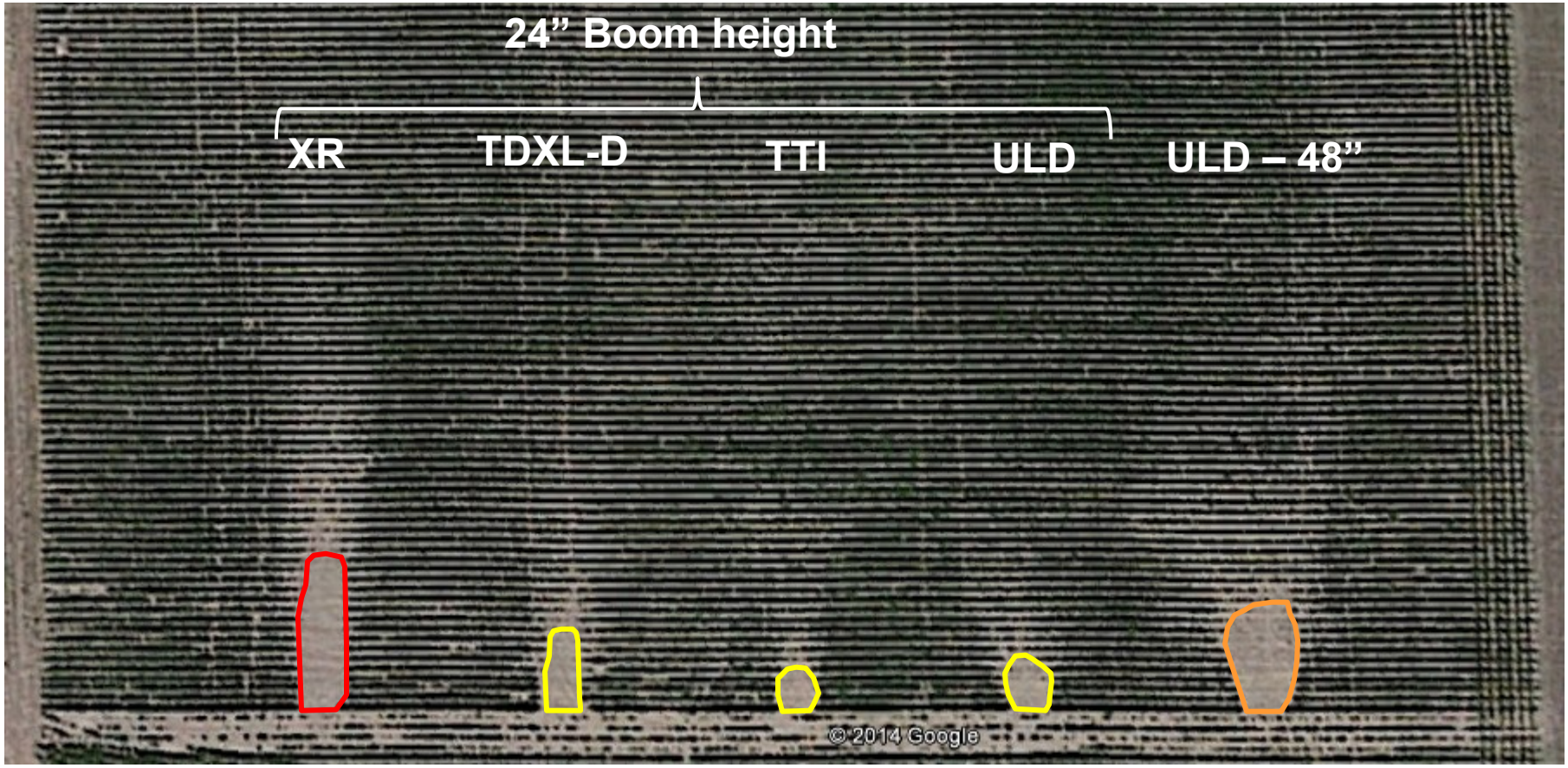

Location: KS - 8/12/2014 image date
Engenia Herbicide + Roundup PowerMax® (1:2) sprayed for 10 seconds.
Wind speed averaged 12 MPH. Calibrated for 10 GPA using 04 orifices.
Trial site was sponsored by BASF.

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Why will ammonium sulfate be restricted?

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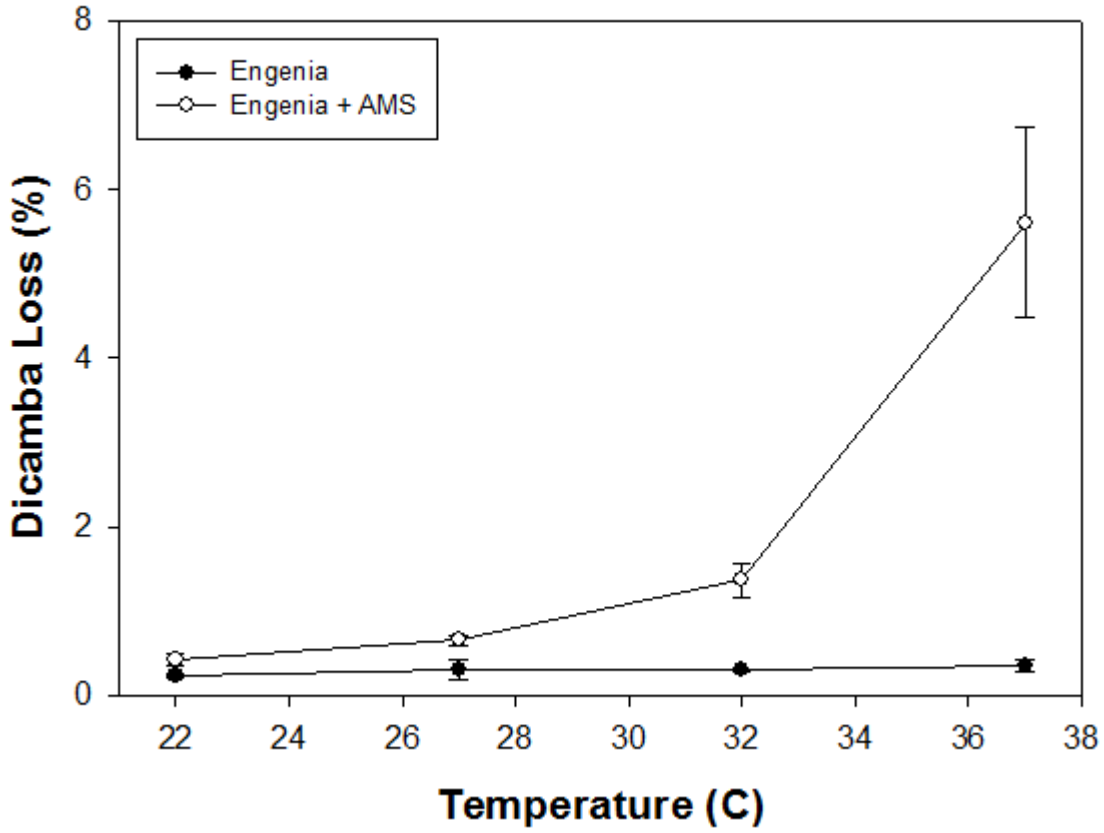

Test Conditions:

Time: 1 day (24 hr)

Air flow: 0.5 l/min
using 2.5 l tank

Relative Humidity: 5%

Substrate: glass

BASF lab study
Application rates:
Engenia – 12.8 fl oz/A
AMS – 0.5% w/v

NH_4^+ cation alters salt balance and shifts to more volatile form of dicamba

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Training on Stewardship and Educational Information on Use of Forthcoming Engenia Herbicide

The experimental product, Engenia herbicide, described in this presentation is not registered or available for sale.

Information contained in this presentation is intended for educational purposes and is not intended to promote the sale of a product.

Any sale of this product after registration is obtained shall be solely on the basis of the EPA approved product label, and any claims regarding product safety and efficacy shall be addressed solely by the label.