Best Management Practices for Dicamba use in Illinois

Gary Schmitz
Midwest Tech Service Manager

DEDICATED PEOPLE

INNOVATIVE PORTFOLIOS

PERSONALIZED PLANS

RISK PROTECTION

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Grow Smart™ with BASF

Engenia™ Herbicide
Introduction

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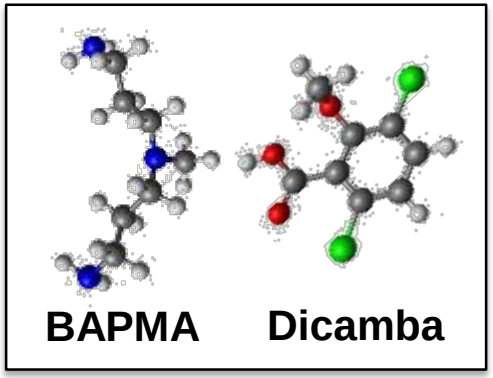
Exciting convergence of technologies creates a new opportunity for soybeans

Genetic Yield Potential

Engenia™
Herbicide



Grow Smart™

Application Technology

Dicamba Expertise
From Invention to Innovation

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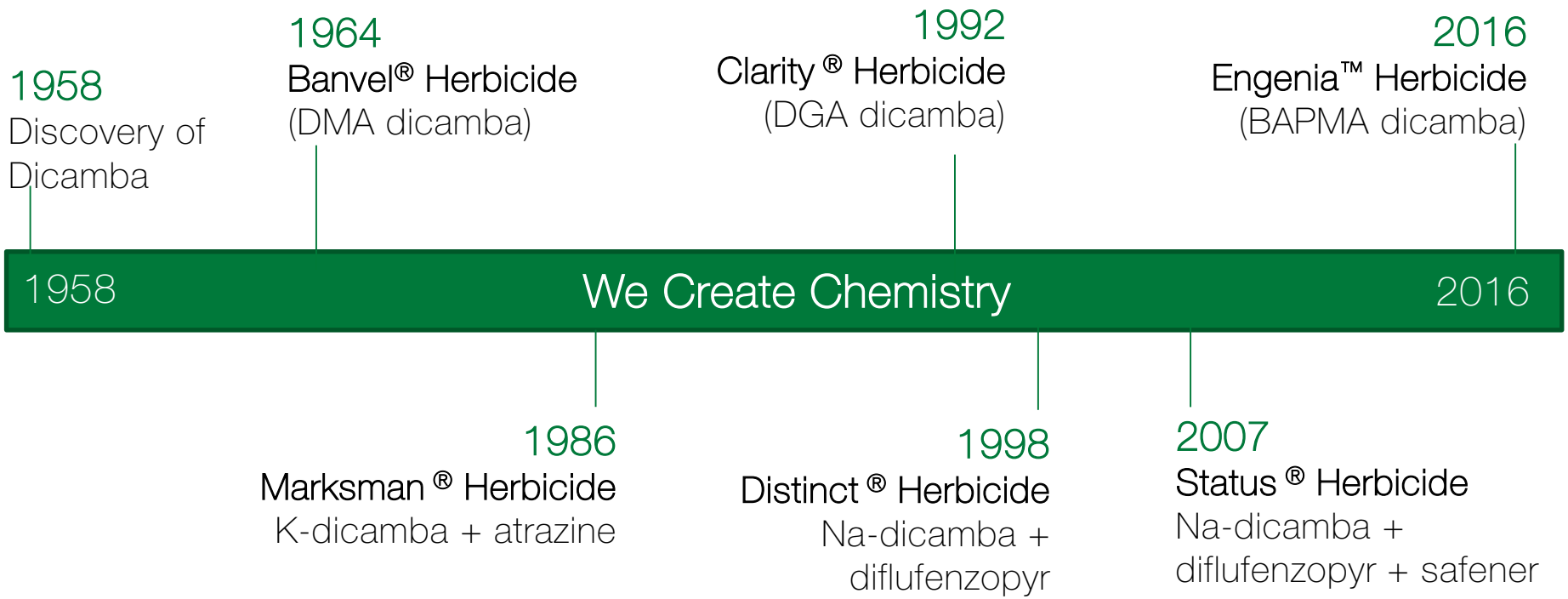
A 50+ Year Culmination of Innovation and Experience!



Engenia™ Herbicide
Flexible and Advanced

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Current market utility of dicamba based products

- Dicamba has been utilized for 50 years to manage more than 200 broadleaf weeds
- Used on more than 35 million agricultural acres in the US in 2015
  - 13.6 million acres of corn
  - 6.3 million acres of wheat
  - 9.1 million acres of fallow/pasture
- Used widely in turf and lawns




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Ensuring An On-Target Application

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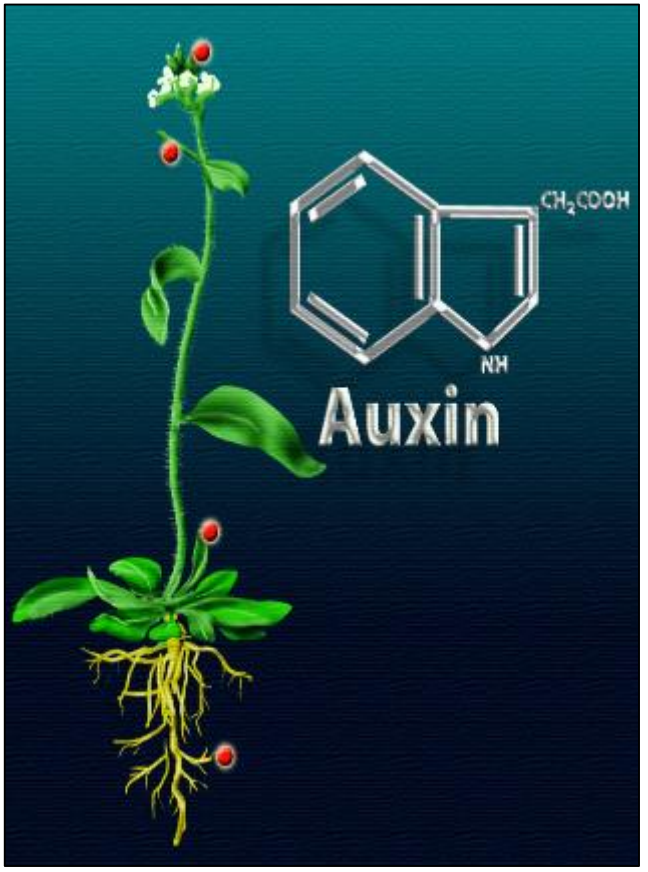
Discussion Outline:

- Understanding Dicamba Mode of Action
- Engenia Herbicide Innovation
- Application and Weed Control Stewardship
- Label and Buffer Zone Management

Education is key to an on-target application

Synthetic Auxins As Herbicides

- Very effective herbicide SOA
- Affect plants similar to natural auxin
- Plant growth effect is “systemic”
- Symptomology will develop at very low rates
  - Plant hormone effect
  - Only effects new growth
  - Visual symptoms are delayed



Dicamba Symptomology

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Dicamba Symptomology

5 DAT

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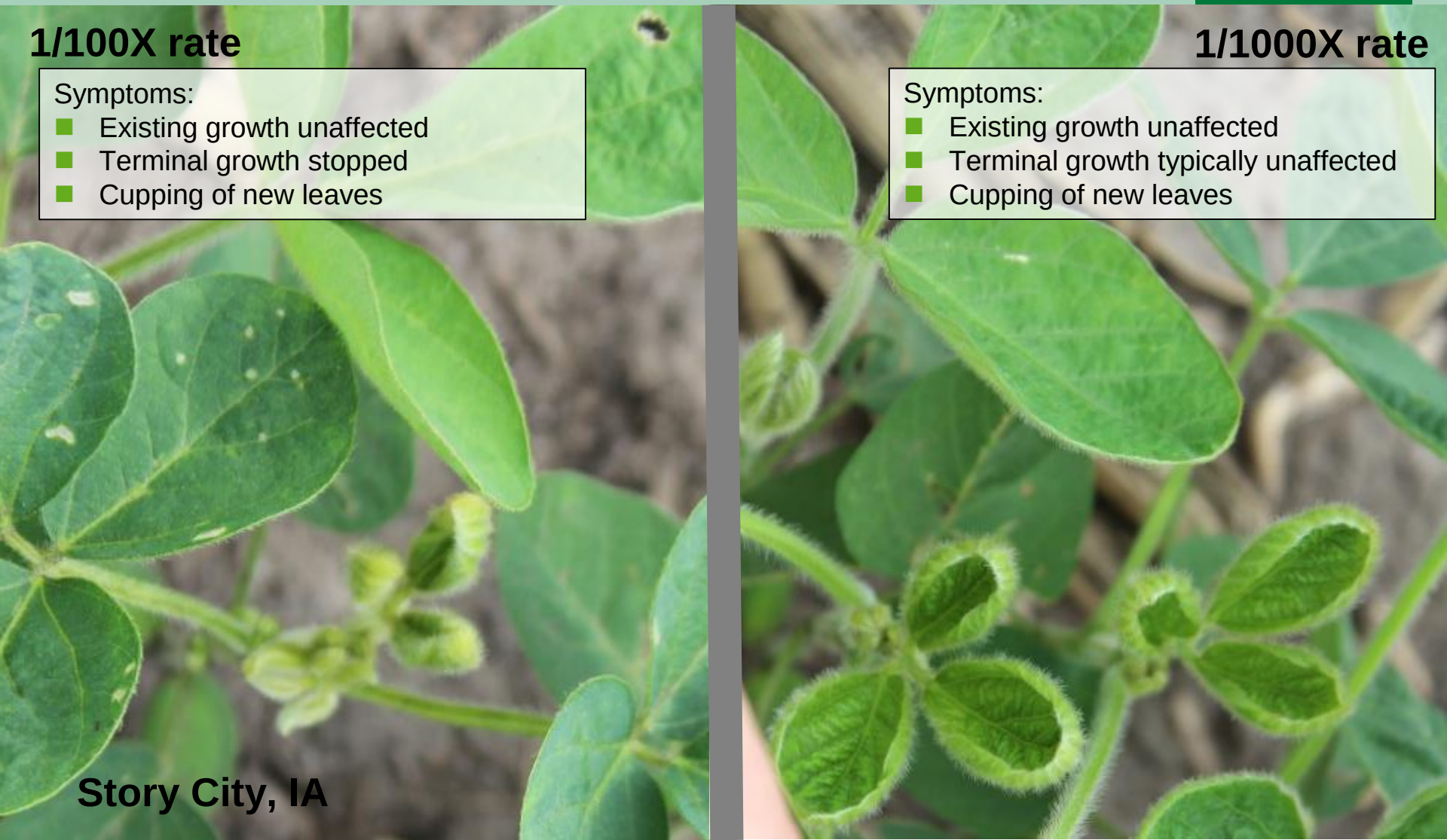
1/100X rate

Symptoms:
- Existing growth unaffected
- Terminal growth stopped
- Cupping of new leaves

1/1000X rate

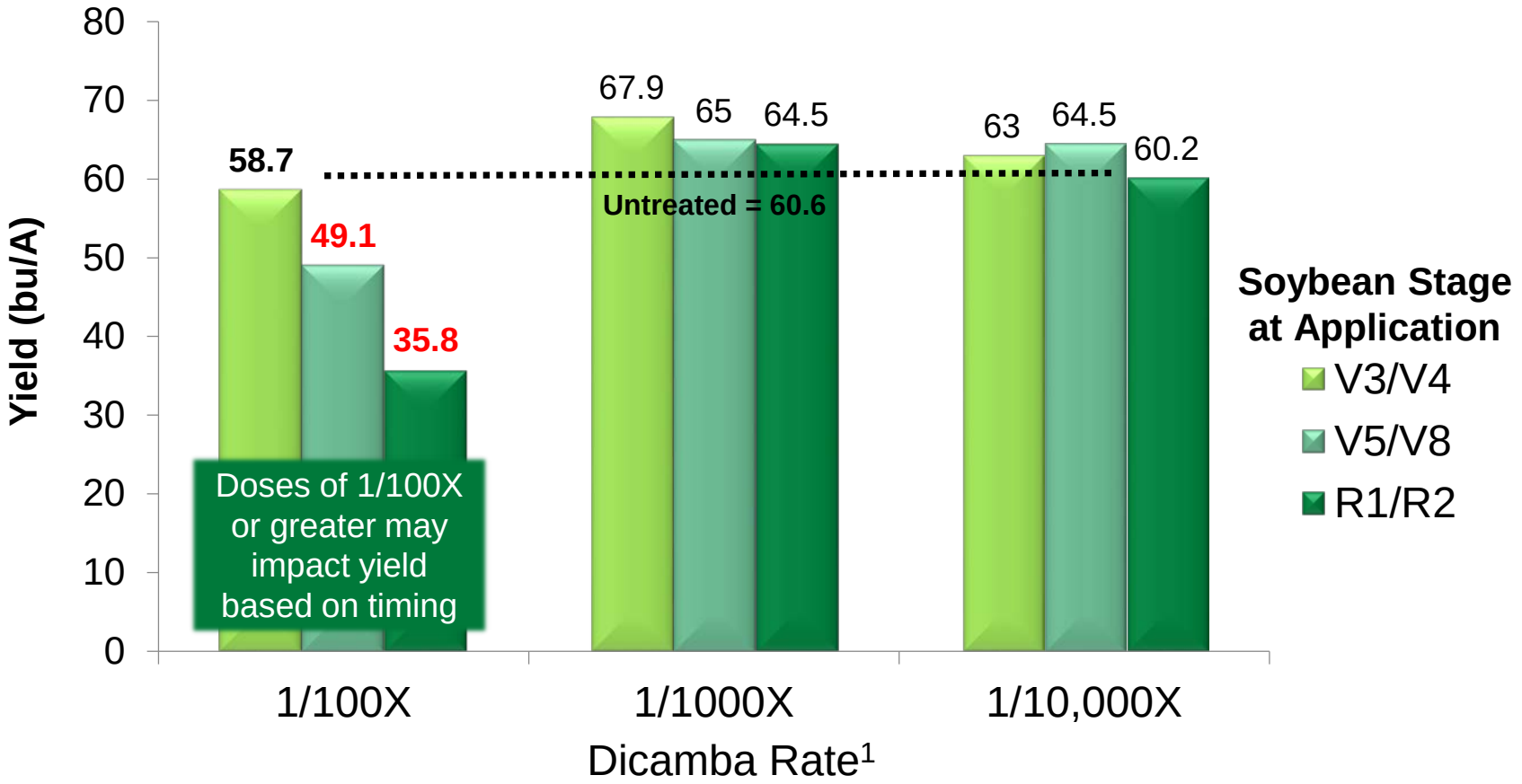
Symptoms:
- Existing growth unaffected
- Terminal growth typically unaffected
- Cupping of new leaves



Story City, IA

Dicamba Response in Soybean

Rate & timing of exposure - yield response



Doses of 1/1000X or below do not impact yield

[1]Rate expressed as fraction of labelled use rate of 0.5 lbs ae/A.
2015 BASF sponsored trial at Purdue University. Non-dicamba tolerant soybeans planted on May 14, 2015.

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Most Flexible and Advanced for DT Crops

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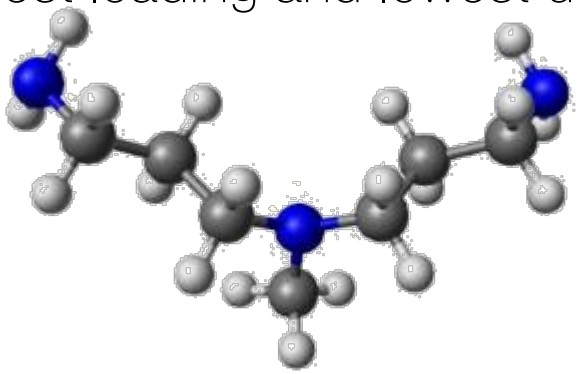
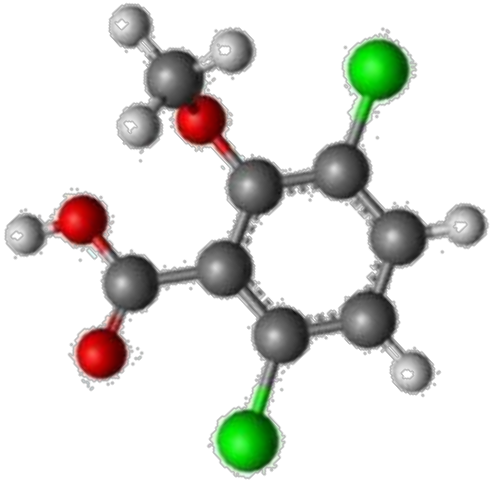
Most Advanced Dicamba

- We Create Chemistry: Dicamba BAPMA
  - Patented molecule exclusive to BASF
  - N,N-Bis[aminopropyl] methylamine
- Lowest volatility salt of dicamba
- Highest loading and lowest use rate



BAPMA

Dicamba



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Most Flexible and Advanced for DT Crops

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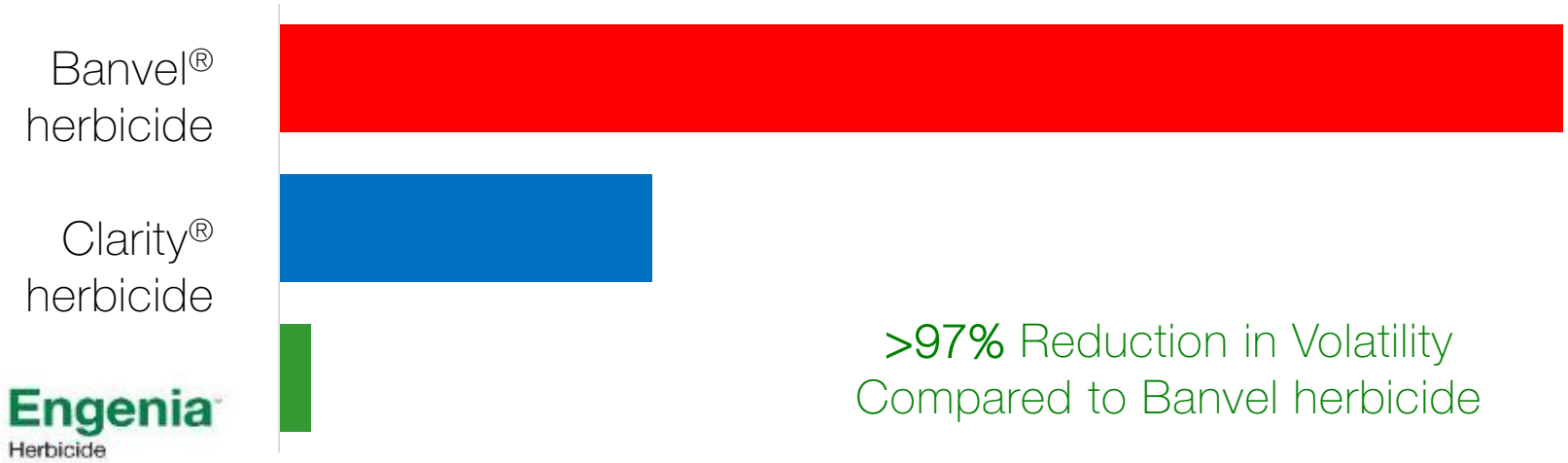
Thermogravimetric Analysis

% Relative Volatility



>97% Reduction in Volatility
Compared to Banvel herbicide

Formulation Stability Provides Application Peace of Mind

Test conditions: Temp = 100° C/212° F, Time = 20 hours, Air flow = 60 mL/min, RH = 0%

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Most Advanced Dicamba

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Untreated	Dicamba acid	Banvel® herbicide	Clarity® herbicide	Engenia™ herbicide

Most Advanced Dicamba To Provide Peace Of Mind

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Use Rates and Timings for DT Crops

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Engenia herbicide application timings by DT crop

Dicamba Tolerant Crop	Preplant	Preemerge	Postemerge	
Soybeans	✓	✓	✓	• Emergence through R1 • Do not apply once soybeans reach R2

Rainfast: 4 hours

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Use Rates and Timings for DT Crops

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Engenia Herbicide Application Timing		DT Soybeans (fl oz/A)
Preplant/ PRE	Maximum Single	12.8
	Maximum Total	25.6
Postemerge	Maximum Single	12.8
	Maximum Total	25.6
All Applications Combined Total Per Season		51.2

One Rate at 12.8 fl oz/A PRE or POST

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Systems Approach for DT Soybeans

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Preplant/PRE	POST 1	Optional POST 2
Zidua® PRO herbicide (4.5 to 6.0 fl oz/A)	Engenia™ herbicide (12.8 fl oz/A)	+ Glyphosate*

* Add clethodim for volunteer RR corn control

An effective Engenia™ herbicide program for DT soybean includes PRE and POST applications

Always read and follow label directions. Visit www.engeniatankmix.com for a list of approved tank-mix partners.

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Effective Weed Management

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Why use a PRE herbicide in a multiple SOA program?

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
- Buffer zone management

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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Effective Weed Management

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2016 – BASF Trial – 30 Days After Post – Story City, IA

POST: 12.8 fl oz Engenia +
32 fl oz Powermax®

PRE: 6 fl oz Zidua® PRO herbicide
POST: 12.8 fl oz Engenia herbicide +
32 fl oz Powermax

PRE Residual Followed By POST Engenia Preserves Yield Potential

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Effective Weed Management Summary

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1. Engenia herbicide is the most **flexible** and **advanced** dicamba for DT crops
   - Lowest volatility salt of dicamba unique to BASF
   - Lowest use rate
2. Engenia herbicide is part of a complete weed control system
   - Reliable POST herbicide following a residual
   - Portfolio with the most SOA for DT crops

Mechanisms of Off-Target Movement

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- Primary:
  - Wind transport of spray particles
- Secondary:
  - Vapor movement (volatility)
  - Water: run off or leaching
  - Soil: erosion or dust (soil particles <100µm)
  - Transfer by equipment or other human mechanism

Spray particle drift is by far the biggest risk for off-target movement

Evaluating the Risk of Off-target Movement of Dicamba

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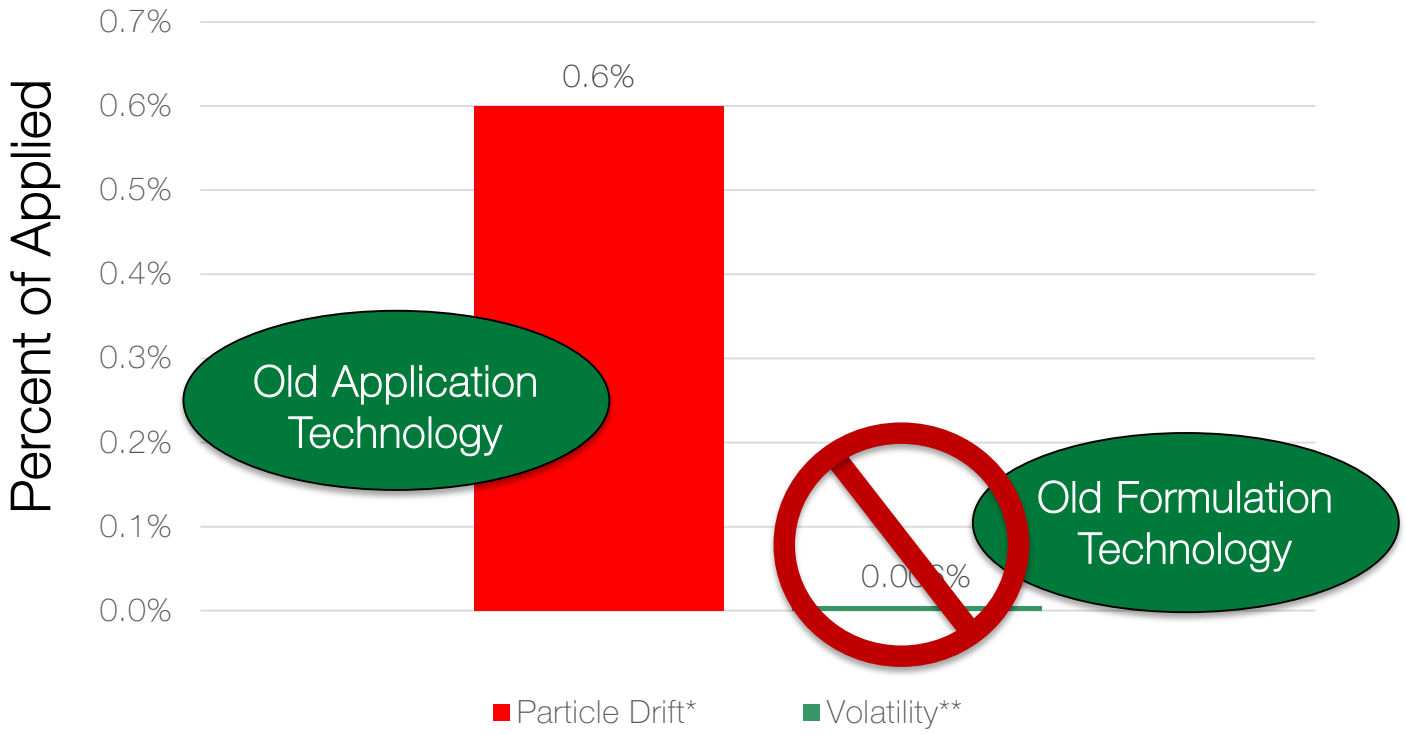
Comparison of movement of Banvel® Herbicide collected 20 - 25 feet downwind from the application zone



Data from EPA Drift Task Force
*Particle drift measured at 25 feet and derived from 24 standard Spray Drift Task Force applications with ground rig.
**Volatility (secondary drift) measured at 20 feet with vacuum pumps.

Understanding Spray Drift

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Definition: Particle drift is the movement of spray droplets that are formed during application

Three key factors influencing particle drift:

1. Droplet size
2. Wind speed and other climatic conditions
3. Equipment and method of application

Managing these factors is key to an on-target application

Visualizing Spray Particle Drift Through Soil Wind Movement

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- Soil particles <100µm are prone to move long distances similar to water droplets
- You can't see spray drift but you can observe wind blown soil
- Note how the soil is lifted into the air
- This shows how important it is to reduce the fine spray droplets <100µm

Nozzle Selection
Advancement In Application Technology

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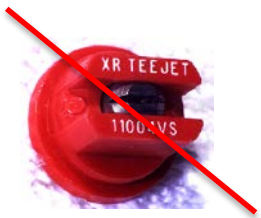
- Nozzle technology has improved dramatically over the last 50 years
- TTI nozzles are the most advanced for reducing drift
- **TTI11004 is** required for Engenia™ herbicide



Flat-Fan 1960-1980

Chamber 1980-1990

Venturi 1990-2005

TTI

Best current nozzle design for drift control

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TTI nozzle required by label

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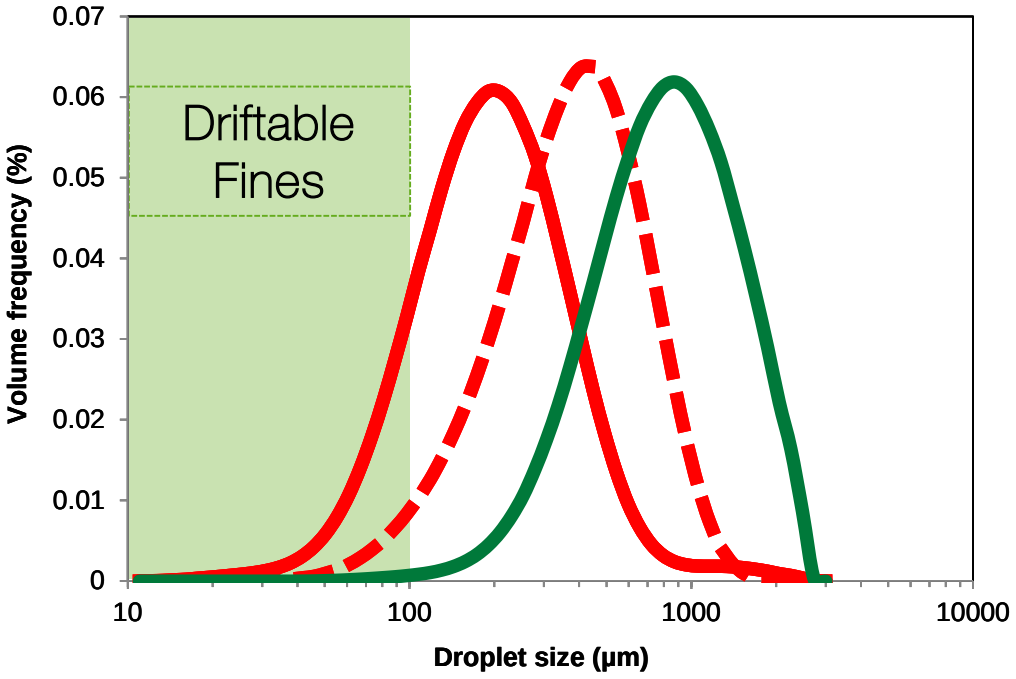
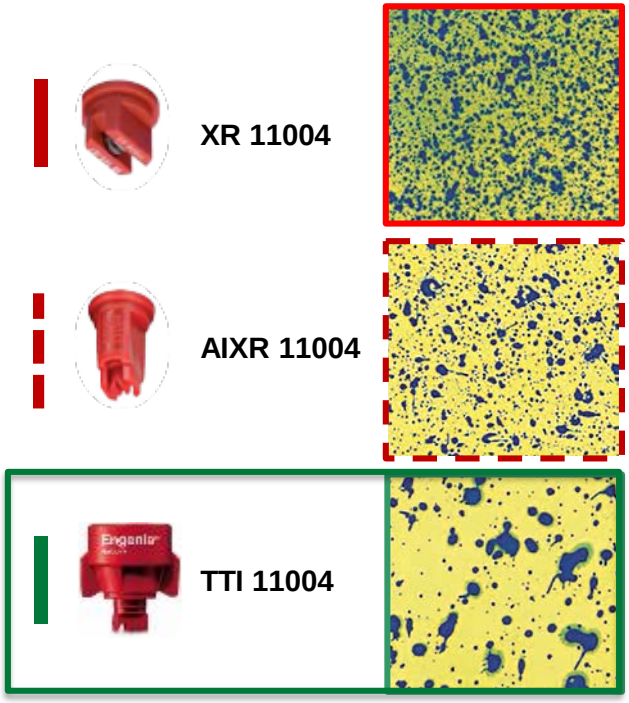
Engenia herbicide + glyphosate





TTI nozzle provides the most consistent on-target application

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Why TTI Nozzles?

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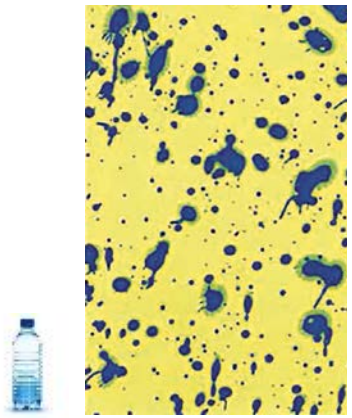
Nozzle	 XR 11004	 TTI 11004
Percent Fine Droplets	33%	1%
		
Equivalent Water in 10 GPA	~3 gallons	~12 fl oz

Apply Engenia with TTI nozzles

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Sprayer setup and operation requirements*

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Nozzle: TTI 11004

GPA: 10 or more

Travel speed: 15 mph or less

Boom height: 24 inches or lower

TTI

Best current nozzle design for drift control

Spray Additives:

Go to www.EngeniaTankMix.com for the approved list of adjuvants

- NO ammonium salts (e.g. AMS, UAN)
- NO acidifying water conditioners

*These requirements are specific to the dicamba tolerant crop uses

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Planning Ahead of Application

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Goal: To locate sensitive areas around your dicamba tolerant crop field and to develop an application plan

- Survey surroundings for potential neighboring sensitive areas/crops
- Consult sensitive crop registries
- Record areas of potential buffer zones
- Use this information to plan when and how to spray your field

Improve decision making with prior knowledge of your surroundings

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Definition of non-sensitive areas

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The following areas do not need a buffer if they exist downwind:

- Agricultural fields that have been prepared for planting
- Fields planted to dicamba tolerant soybeans and cotton
- Fields planted to asparagus, corn, sod farms, grass grown for seed, sorghum, proso millet, small grains and sugarcane
- Roads, paved or gravel surfaces
- Areas covered by the footprint of a building, shade house, silo, feed crib, or other man made structure with walls and or roof

Non-sensitive areas can be included in buffer

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Definition of sensitive areas

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Sensitive Areas include the following categories:

1. Areas potentially harboring threatened or endangered species
   - Examples: woodlands, native pastures, bodies of water
2. Non-specialty crops
   - Examples: non-dicamba-tolerant soybeans and cotton, alfalfa, sunflowers, rice
3. Sensitive specialty crops
   - Examples: fruiting vegetables (e.g., tomato), cucurbits, grapes, fruit trees, peas, potato, tobacco, flowers, ornamentals (including residential areas)

EPA mandates placement of buffer zones downwind to sensitive areas

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Wind and buffer zone requirements by for dicamba tolerant crops

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Downwind	Category**	Wind Speed & Buffer Zone
Sensitive Areas	Threatened and Endangered Species	• 110' buffer downwind • 0*-15 MPH wind
	Non-Specialty Crops	• 110' buffer downwind • 0*-10 MPH wind
	Specialty Crops	• DO NOT spray if any wind is blowing toward neighboring fields/areas
Non-Sensitive Areas	Dicamba labeled crops and other areas specified on label	• No downwind buffer needed • 0*-15 MPH wind

*0-3 MPH if there is no field level inversion
**Consult label for specific details

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Example of no buffer required

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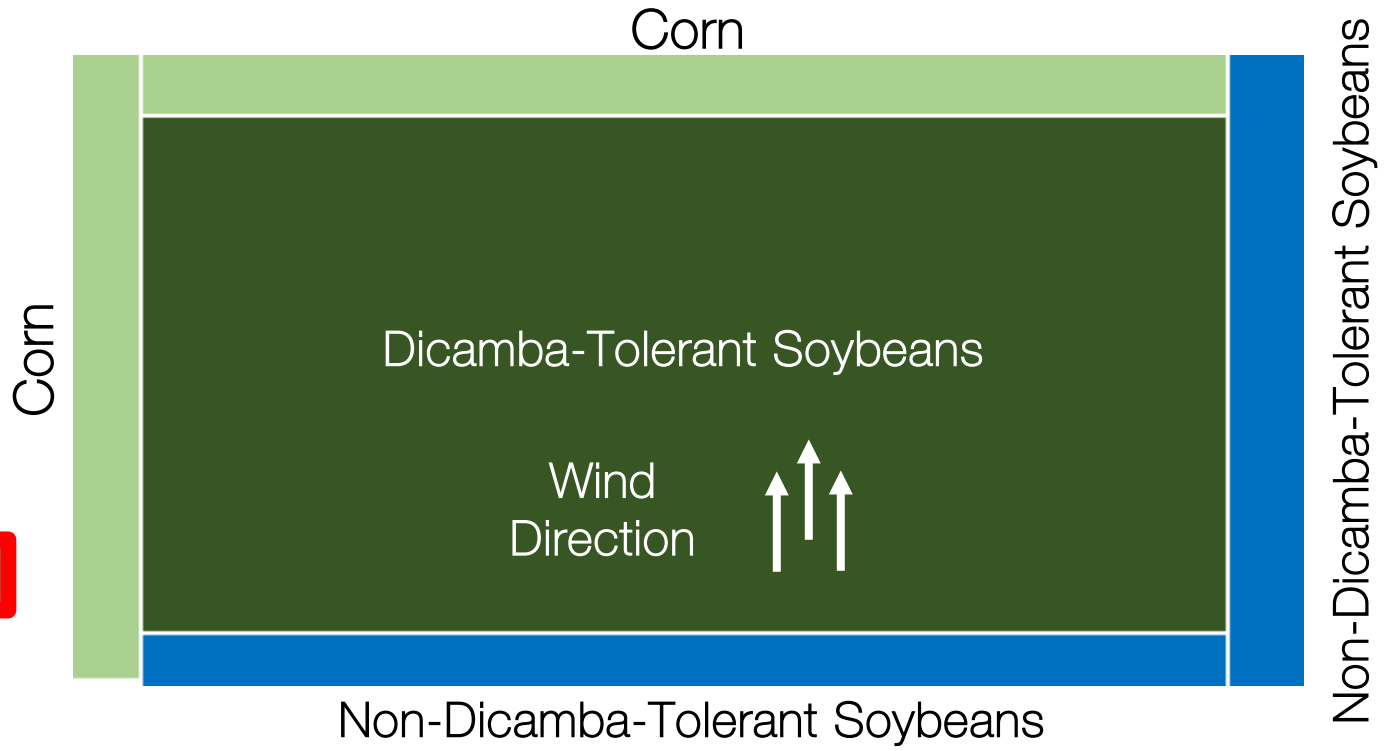
Buffer Zone: Maintain a 110 foot downwind buffer adjacent to non-specialty crop sensitive areas

- Do not allow spray to come into contact with neighboring sensitive vegetation
- Additional state restrictions may apply

Example #1:

- 80 acre DT soybean field
- South wind blowing 0 - 15 MPH with no field level inversion

No buffer needed



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Example of required buffer

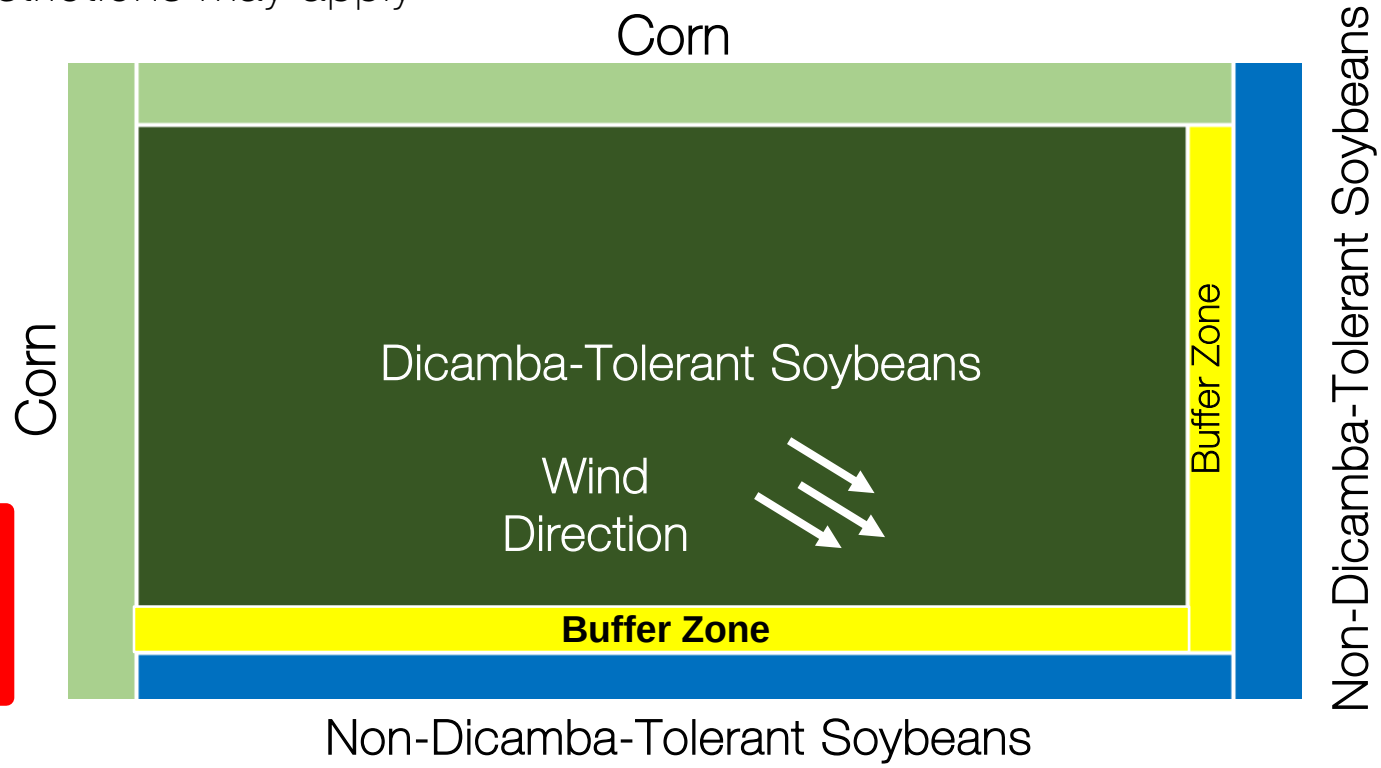
Buffer Zone: Maintain a 110 foot downwind buffer adjacent to non-specialty crop sensitive areas

- Do not allow spray to come into contact with neighboring sensitive vegetation
- Additional state restrictions may apply

Example #2:

- 80 acre DT soybean field
- Northwest wind blowing 0 - 10 MPH with no field level inversion

110' Buffer needed on south and east edge



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Example of when not to spray

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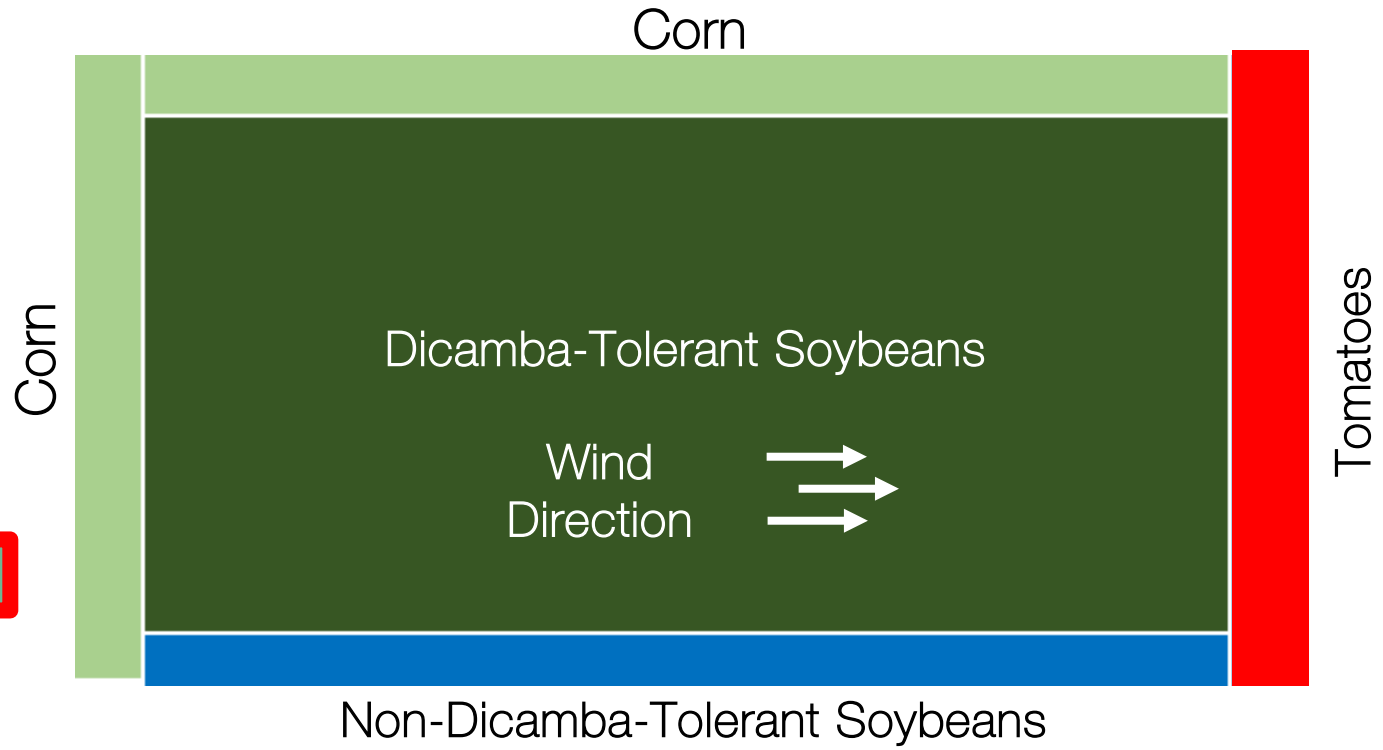
DO NOT spray when any wind is blowing towards neighboring sensitive specialty crops

Example #3:

- 80 acre DT soybean field
- West wind blowing at any speed

DO NOT spray



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Label summary*

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The HOW

Sprayer set-up and operation

Nozzle: TTI 11004

Spray volume: 10 GPA or greater

Travel speed: 15 mph or less

Boom height: 24 inches or less

Spray additives:

- Go to www.EngeniaTankMix.com for the approved list of adjuvants
- NO ammonium salts (e.g. AMS, UAN)
- NO acidifying water conditioners

The WHEN

Decisions at application

Wind speed at 10 mph or less:

- Leave 110 foot buffer if non-specialty sensitive areas are downwind
- DO NOT spray during temperature inversion
- DO NOT spray if wind is blowing toward neighboring specialty crops (e.g., fruiting vegetables, cucurbits, grapes, tobacco, tree fruit, residential areas)

Wind speed >10 – 15 mph

- DO NOT spray if wind is blowing toward sensitive crops

Avoiding spray drift is manageable

*These requirements are specific to the dicamba tolerant crop uses

Always read and follow label directions

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- We have a new solution in soybeans to control tough weeds
- Stewardship is required
- Avoiding drift is manageable

Untreated

Zidua® PRO herbicide PRE fb
Engenia + glyphosate POST

Story City, IA 2015

We create chemistry