



» Roundup Ready® Xtend Crop System Update



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EXHIBIT
PLTF-197

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Disclaimer

- ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. XtendiMax® herbicide with VaporGrip® Technology is a restricted use pesticide. It is a violation of Federal and state law to use any pesticide product in a manner inconsistent with its labeling. XtendiMax® herbicide with VaporGrip® Technology is not registered in all states and may be subject to use restrictions in some states. Check with your local Monsanto dealer or representative for the product registration status in your state.
- NOT ALL formulations of dicamba or glyphosate are approved for in-crop use with Roundup Ready 2 Xtend® soybeans or cotton with XtendFlex® Technology. ONLY USE FORMULATIONS THAT ARE SPECIFICALLY LABELED FOR SUCH USES AND APPROVED FOR SUCH USE IN THE STATE OF APPLICATION. Contact the U.S. EPA and your state pesticide regulatory agency with any questions about the approval status of dicamba herbicide products for in-crop use with Roundup Ready 2 Xtend® soybeans or cotton with XtendFlex® Technology.
- Roundup Ready 2 Xtend® soybeans contains genes that confer tolerance to glyphosate and dicamba. Glyphosate will kill crops that are not tolerant to glyphosate. Dicamba will kill crops that are not tolerant to dicamba. Glufosinate will kill crops that are not tolerant to glufosinate. Contact your Monsanto dealer or refer to Monsanto's Technology Use Guide for recommended weed control programs.
- Individual results may vary.
- Always read and follow IRM, where applicable, grain marketing and all other stewardship practices and pesticide label directions.
- Roundup Ready®, Roundup Ready 2 Xtend®, XtendiMax®, and VaporGrip® are trademarks of Monsanto Technology, LLC. All other trademarks are the property of their respective owners. ©2017 Monsanto Company

Roundup Ready® Xtend Crop System



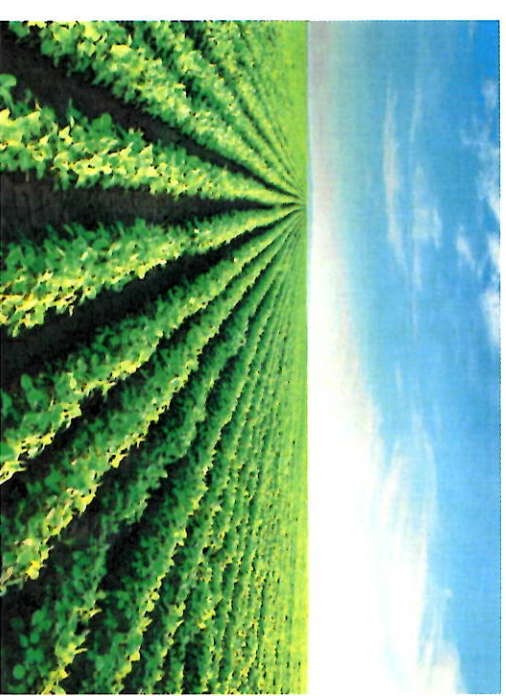
Agenda

- Key Learnings from 2017 Season
- Volatility Research
- Updated Label Highlights
- What Can You Expect for 2018

Roundup Ready® Xtend Crop System

- **Strong Demand in 2017 Season**
 - 20+M acres of Roundup Ready 2 Xtend® soybeans
 - 6+M acres of cotton with XtendFlex® Technology

**Monsanto + licensee partners expected
to have supply for 40+M acres of
Roundup Ready 2 Xtend® soybeans
in the 2018 season**





XtendiMax® with VaporGrip® Technology Grower Survey – August 2017

97% of soybean growers surveyed who applied XtendiMax® in 2017 were satisfied with weed control

Satisfaction With Weed Control



All growers surveyed were required to have 50+ acres of Roundup Ready 2 Xtend® soybeans or cotton with XtendFlex® Technology and treat at least some acres with XtendiMax® with VaporGrip® Technology to qualify



Learnings from 2017 Season

Summary of Inquiries (as of 10-26-17)

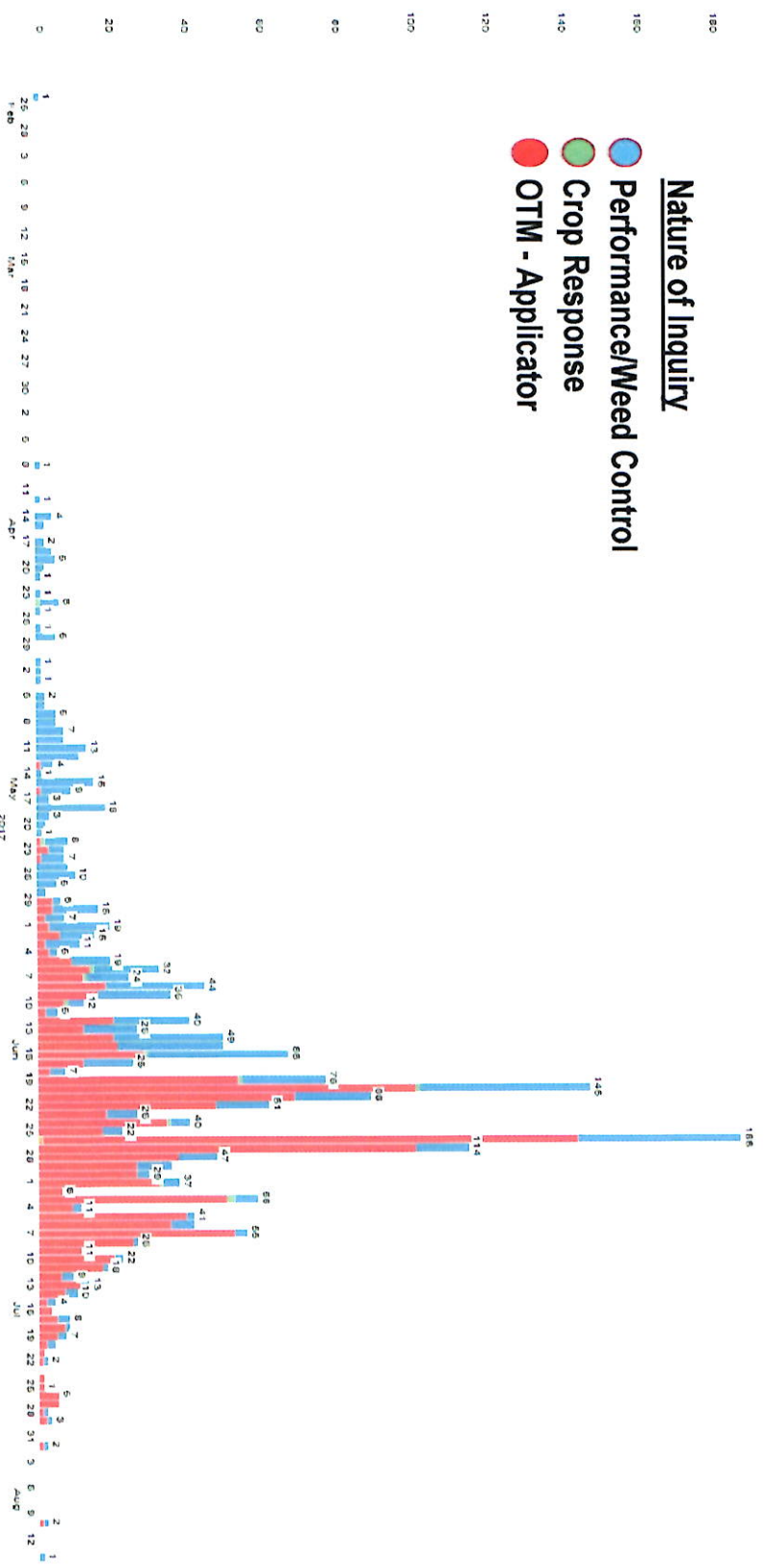
- If a customer experienced weed performance issues or symptomology regarding possible off-target movement, Monsanto deployed Field Engagement Specialist (FES)
 - Objective was to gather information as to the nature of inquiry and offer opportunity to educate during field visit

<u>Nature of Inquiry</u>	<u># of Inquiries</u>
Performance/Weed Control	769
Crop Response	16
OTM - Applicator	1,464
OTM - Other Crop	23
OTM - Non-Ag/Urban	5
OTM - Non-Applicator	1,579
Total	3,856



Learnings from 2017 Season

Total Inquiries – By Application Date (as of 10-26-17)



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Learnings from 2017 Season

XtendiMax® Weed Performance Inquiries - Summary

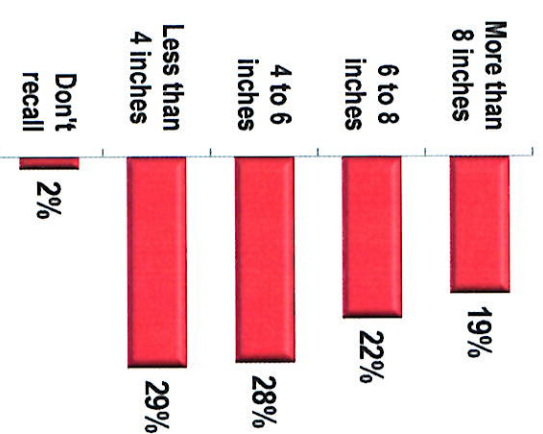


- Applications to areas with excessive weed populations
- Inadequate coverage caused by:
 - Use of multiple Drift Reducing Adjuvants (DRA) in tank mix
 - Spray volume <15 GPA when utilizing required DRA in tank mix
 - Incorrect mixing order & lack of agitation in spray tank
- Expectations of dicamba activity
 - Cooler temperatures can delay response (early season)
 - Timing of activity similar to glyphosate (up to 2 weeks)

Best Management Practices

Apply in a minimum of 15 GPA of spray solution (label updated to require)
 When DRA required DO NOT combine with other DRA containing products
 Apply utilizing upper end of specified pressure range at boom
 Reduce ground speed in areas with excessive weed populations
 Spray weeds less than 4"

Height of Broadleaf Weeds When Sprayed
 With XtendiMax® in 2017 (Soybeans)



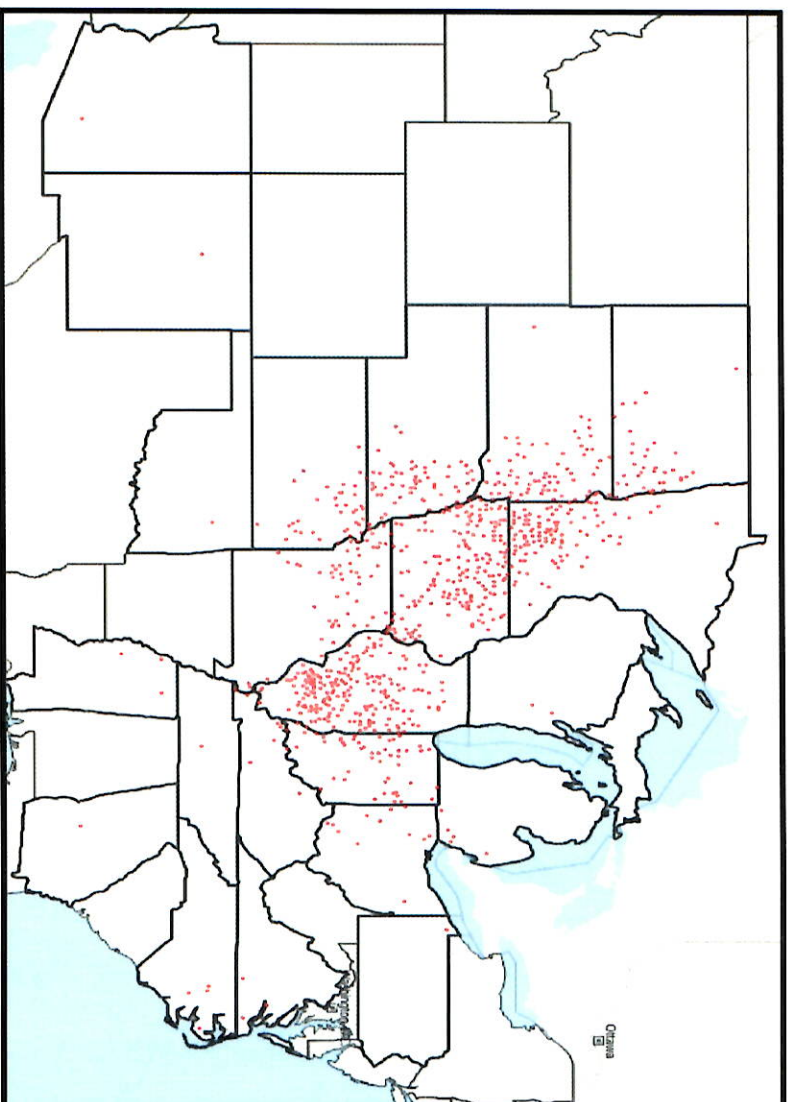
XtendiMax® with VaporGrip® Technology Grower Survey – August 2017

Learnings from 2017 Season

Applicator OTM Inquiries - National (as of 10-26-17)



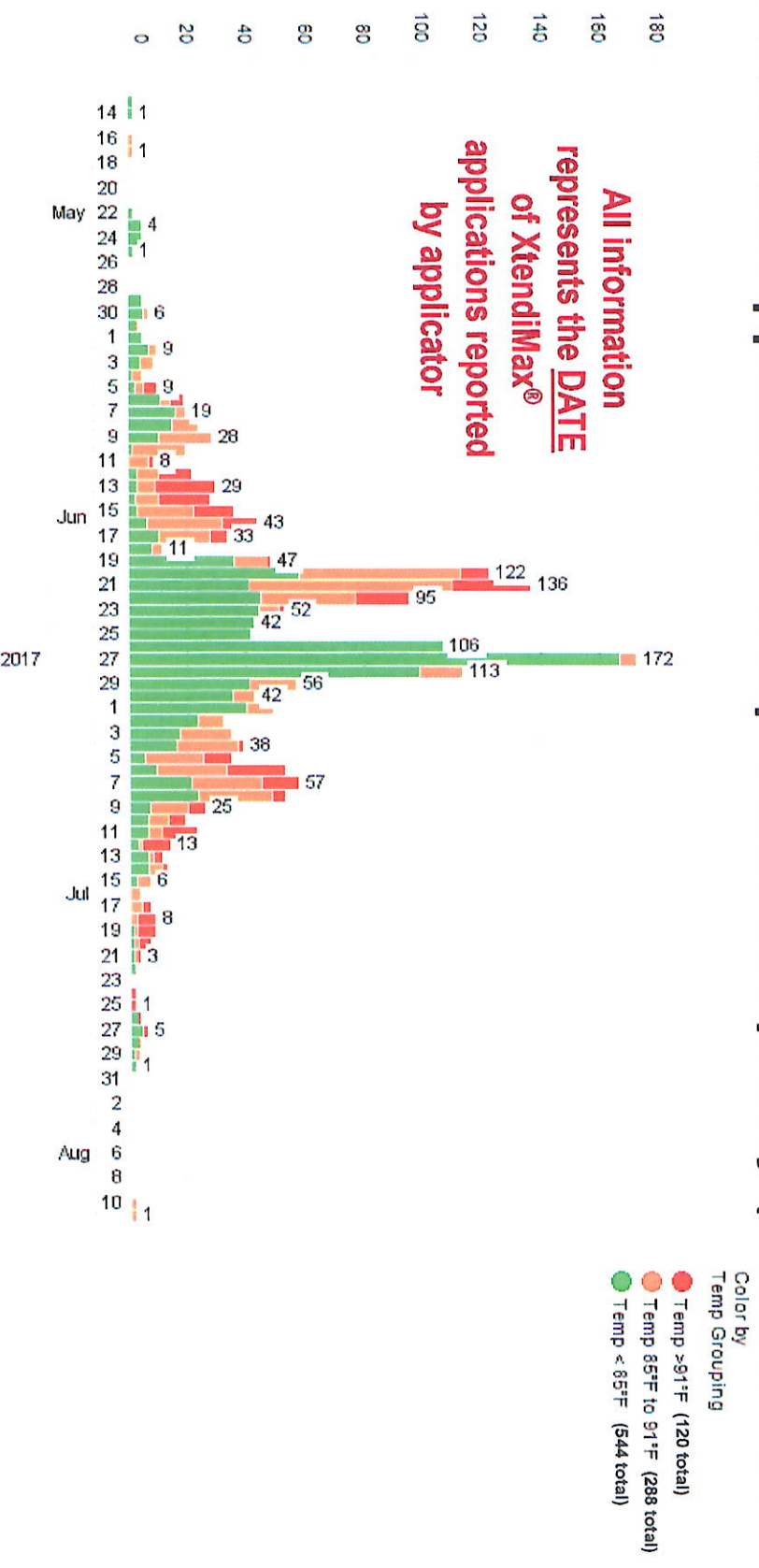
Each red dot
represents the
LOCATION of
XtendiMax®
applications reported
by applicator





Learnings from 2017 Season

Inquiries OTM Applicators – Temperature Frequency (No Correlation)



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Learnings from 2017 Season

Applicator OTM Inquiries & Regional Maps



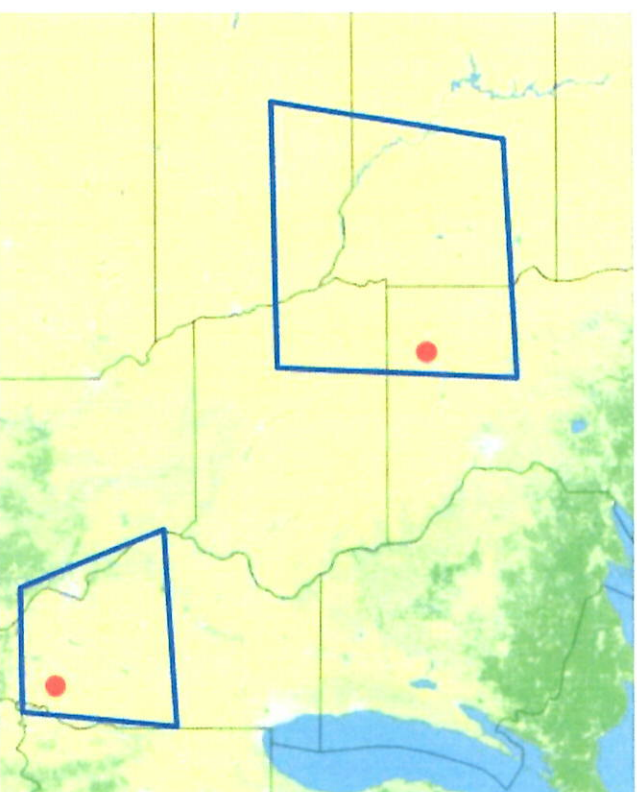
XtendiMax® Applications from May 1 – August 24 reported by applicator

North Region

- Total Monsanto Inquiries: 256
- Cottonwood County, MN
 - Total Monsanto Inquiries: 20

Central Region

- Total Monsanto Inquiries: 282
- Wayne County, IL
 - Total Monsanto Inquiries: 26

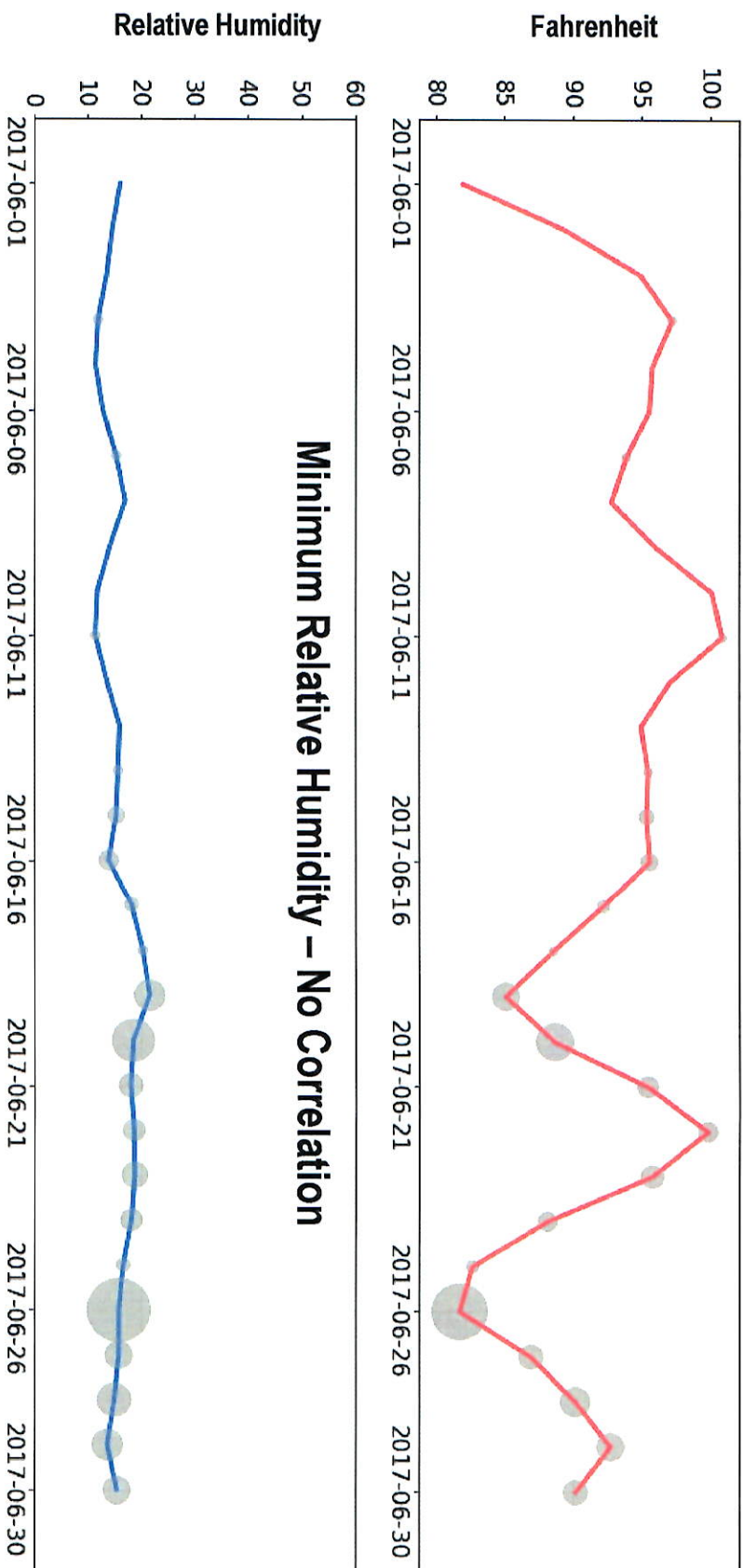


North Region



Maximum Temperature – No Correlation

● Five Inquiries



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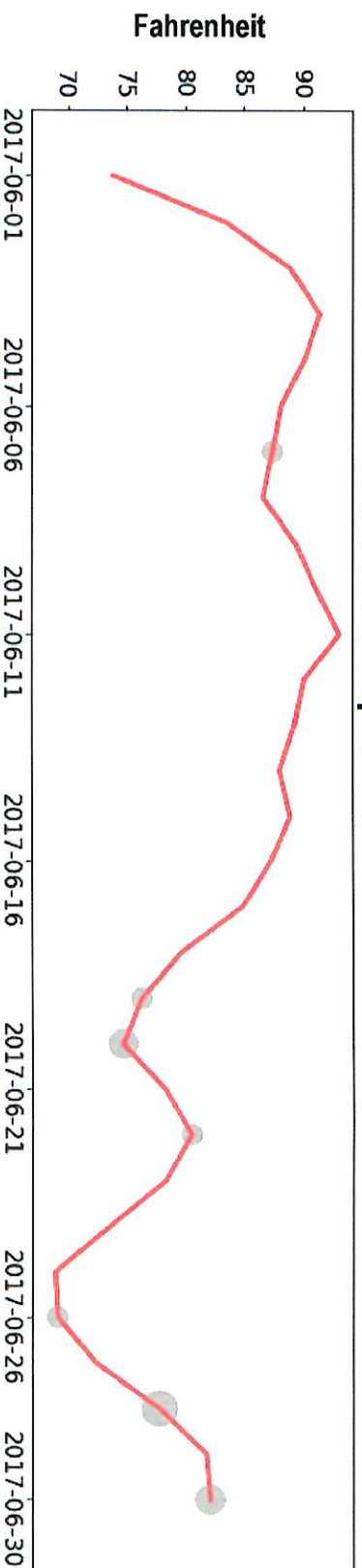
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Cottonwood County, MN

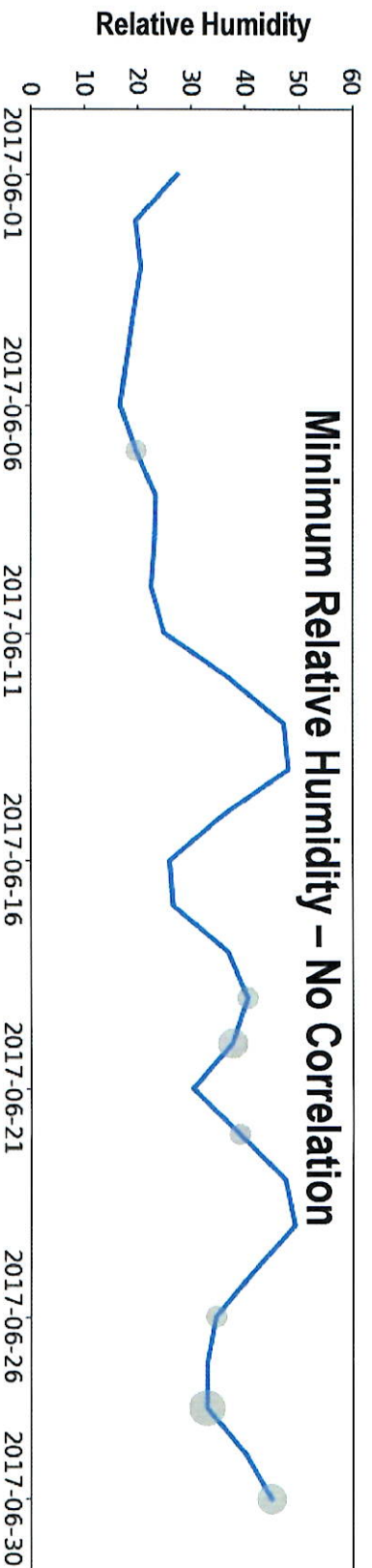


Maximum Temperature – No Correlation

● One Inquiry



Minimum Relative Humidity – No Correlation



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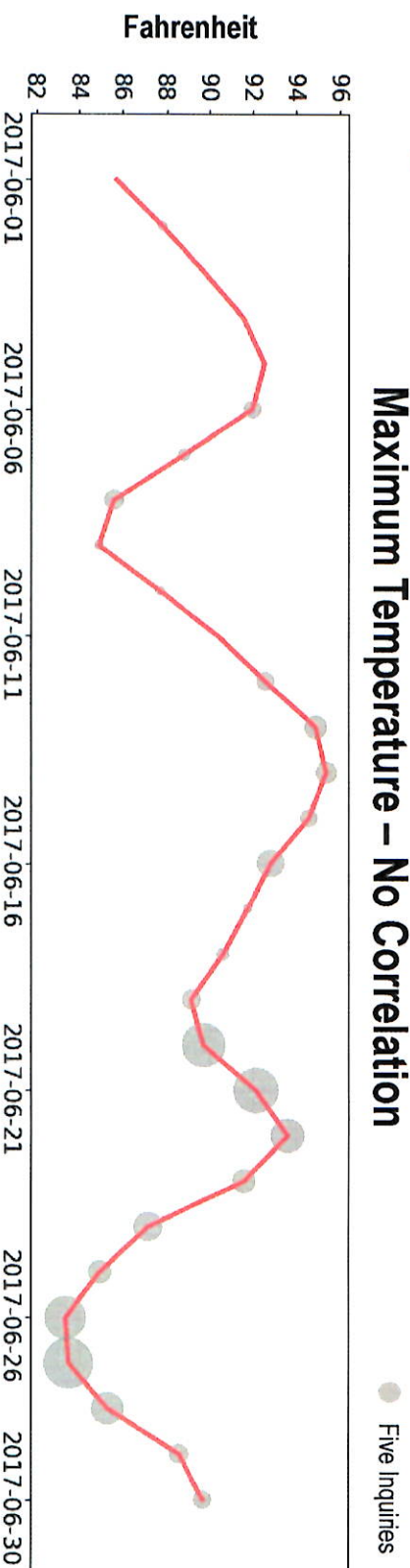
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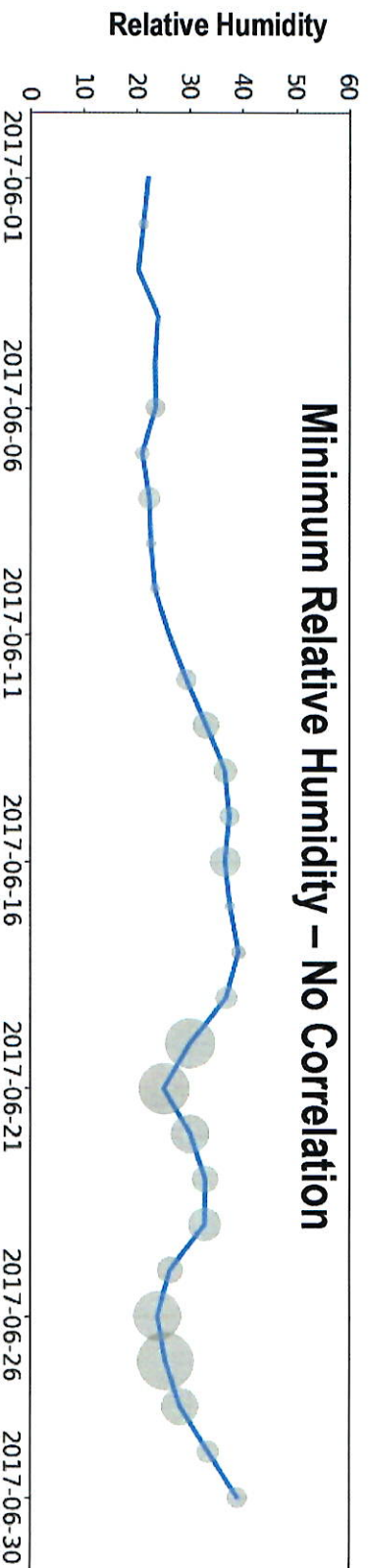
Central Region



Maximum Temperature – No Correlation



Minimum Relative Humidity – No Correlation



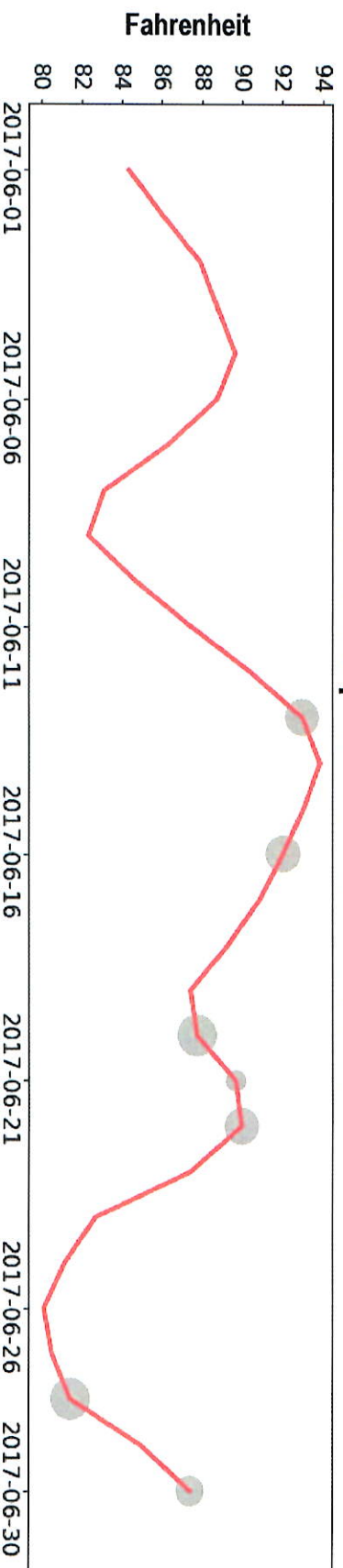
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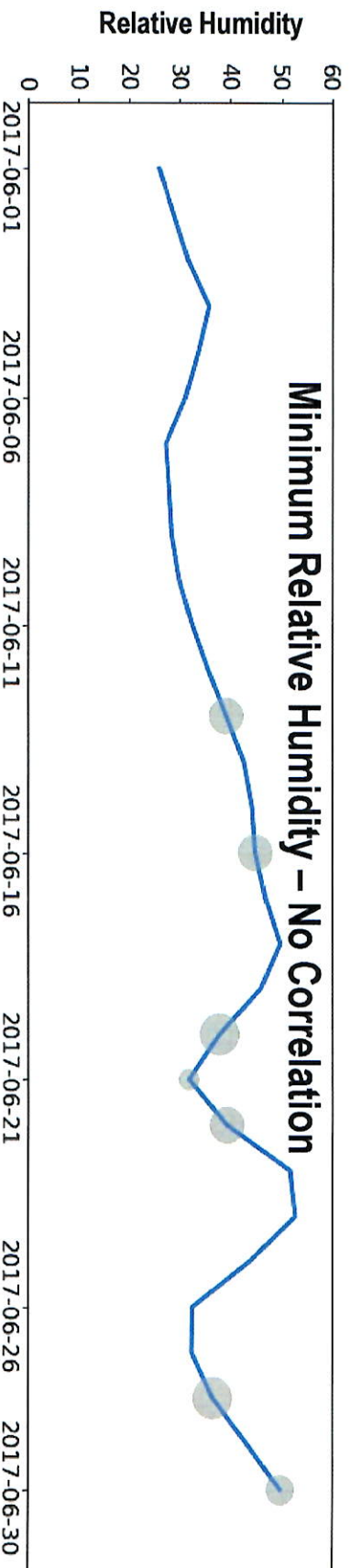
Wayne County, IL



Maximum Temperature – No Correlation



Minimum Relative Humidity – No Correlation



Learnings from 2017 Season



Applicator OTM Inquiries – National (as of 10-26-17)

- Inquiries by applicators of XtendiMax® with VaporGrip® Technology regarding possible off-target movement
- Evaluating compliance with 10 key label requirements based on applicator self-reported data including:
 - ✓ Required Buffer
 - ✓ Approved Nozzle
 - ✓ Application Rate
 - ✓ Application Volume
 - ✓ Ground Speed
 - ✓ Boom Height
 - ✓ Wind Speed
 - ✓ Approved Tank Mixes & Use of DRAs
 - ✓ Nozzle Pressure
 - ✓ No Sensitive Crops Downwind
- Validating environmental conditions and analyzing publicly available weather data with support from the Climate Corporation

Learnings from 2017 Season

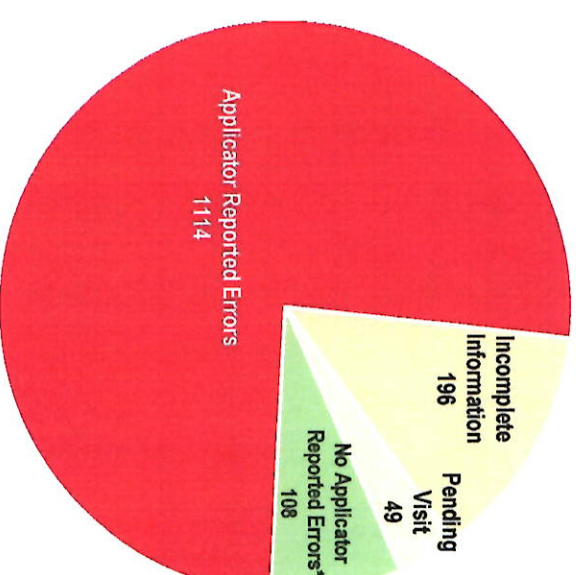
Applicator OTM Inquiries - National (as of 10-26-17)



Inquiries by applicators of Xtendimax® with regarding possible off-target movement

- 1,467 applicator inquiries to date
- 1,418 site visits thus far
- 1,222 applicators supplied sufficient data for review and climatological evaluation
- **In 91% of the cases evaluated to date in which complete information was available (1,114 of 1,222), applicators have self-reported errors from one or more label requirements checked that could have contributed to OTM**

**Applicator OTM Inquiries (National)
(as of 10-26-17)**



*Still evaluating and confirming reported information and climatic conditions

Learnings from 2017 Season



Applicator OTM Inquiries - National (as of 10-26-17)

Application Requirement*	Applicator Reported Deficiencies
Required Buffer/Do Not Spray Susceptible Downwind Crop**	959
Tank Mix	269
Boom Height	157
Nozzle Selection	104
Nozzle Pressure****	66
Application Rate	64
Wind Speed	39
Ground Speed	10
Application Volume	9

- Most commonly self-reported cases was Inadequate Buffer in 78% of cases (959 out of 1,222)
- Some applicators self-reported multiple application errors

Continuing to Evaluate Following Aspects:

- Application delivery check (nozzle, pressure, speed & GPA)
- Details for downwind susceptible crops
- Climate Corp's environmental & weather data on wind speed, direction and inversion potential
- Supporting applicators concerned about possible contamination through testing

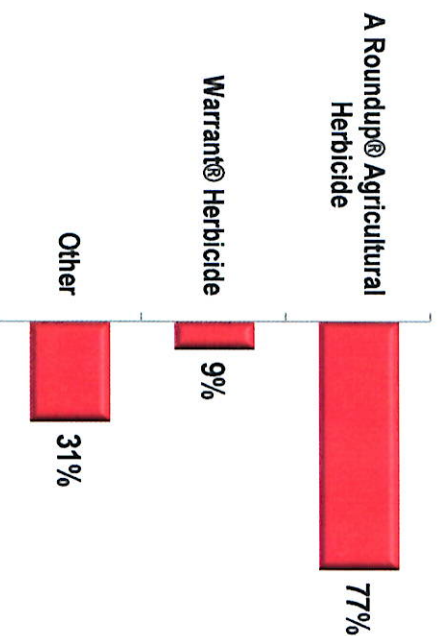
*Applicators may have reported 1 or more deficiency
**Includes no/inadequate buffer and applicator reported sensitive crop downwind
***Nozzle pressure is only evaluated after correct nozzle was reported



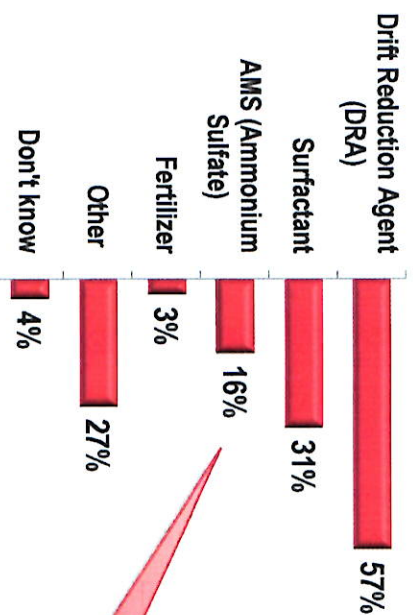
XtendiMax® with VaporGrip® Technology Grower Survey – August 2017

Grower Survey: Most common products tank mixed with XtendiMax® during soybean applications in 2017

Herbicides Tank Mixed With XtendiMax®



Additives Tank Mixed With XtendiMax®



DRA's required for several tank mixes including Roundup® Agricultural Herbicides

AMS is NOT an approved tank mix

Note: Products only shown if 3% or greater

All growers surveyed were required to have 50+ acres of Roundup Ready 2 Xtend® soybeans or cotton with XtendFlex® Technology and treat at least some acres with XtendiMax® with VaporGrip® Technology to qualify

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Summary - Applicator OTM Inquiries (as of 10-26-17)

- In 91% of the cases evaluated to date in which complete information was available applicators self-reported errors from one or more label requirements checked that could have contributed to OTM
- Also modeled in-field conditions at the time of application, based on the historical weather data from NOAA, to see how it compared with what the applicator reported
 - Obtained reliable weather data in 1,163 of the 1,418 total cases
 - 16% of the time or 190 cases, weather data suggests that isothermic conditions were conducive to an inversion based on HRRR modeling of NOAA weather information. A large majority of these were night-time applications.
 - 24% of the time or 279 cases, NOAA weather data suggests that the wind speed during the reported application window either exceeded 15 mph (or 10 mph in states with a 10 mph restriction) or was less than 3 mph
- Proximity to fields where unapproved products may have been utilized may also be factors in some cases

OTM Applicator Inquiries - Follow-up Efforts

- Field Engagement Specialists in process of following up with applicators that were visited this past season
- Using additional weather related insights for specific field conditions

Weather Station Summary: 170018759

Claim Number	170018759
Coordinates	
Application Start Date (C DT)	6/21/17 13:00
Application End Date (C DT)	6/21/17 19:30
Nearest Weather Station (miles)	1.35
ETS Wind Information	



Claim field (claim) and nearest weather station (green). Data for the claim field is found in Table 1 and for the nearest weather station can be found in Table 2.

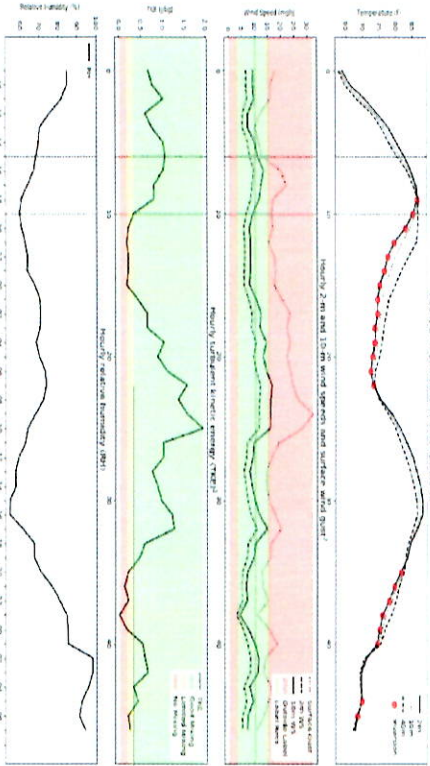


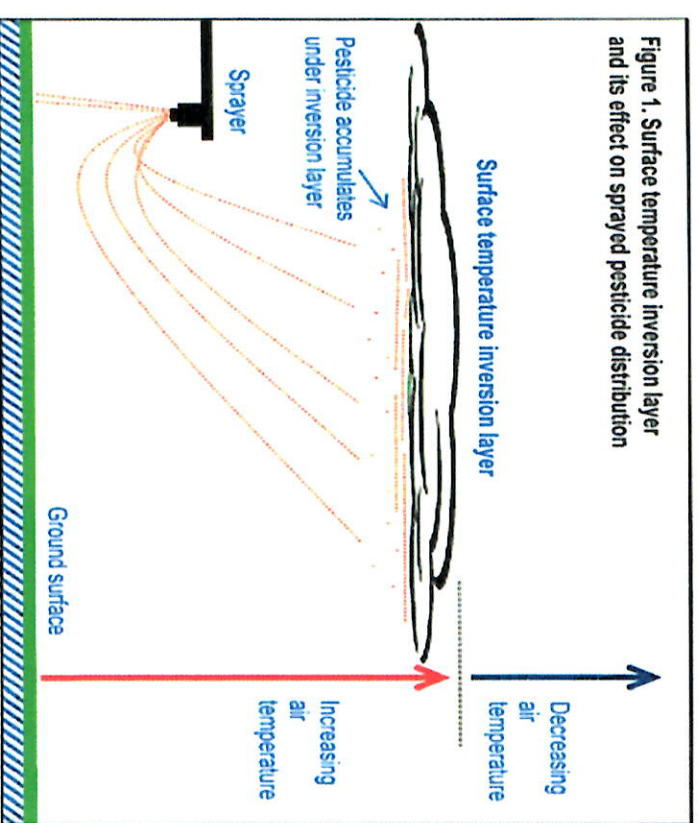
Figure 2: A multi-panel graph showing weather data for the field and the nearest weather station. The top panel shows Temperature (F) vs. Time (hr). The middle panel shows Humidity (2m and 10m) and Wind Speed (m/s) vs. Time (hr). The bottom panel shows Wind Speed (m/s) vs. Time (hr). The graph includes data for the field (red line) and the nearest weather station (green line). The field data shows a significant increase in temperature and a decrease in humidity and wind speed compared to the weather station data.

Learnings from 2017 Season



OTM - Temperature Inversions (form of physical drift)

- Initial assessment suggests that inversions did play a role in some instances in 2017
 - Important to highlight that the label for XtendiMax® specifically states not to apply during an inversion as drift potential can be high
 - Exploring additional tools that may be available for growers to identify an inversion



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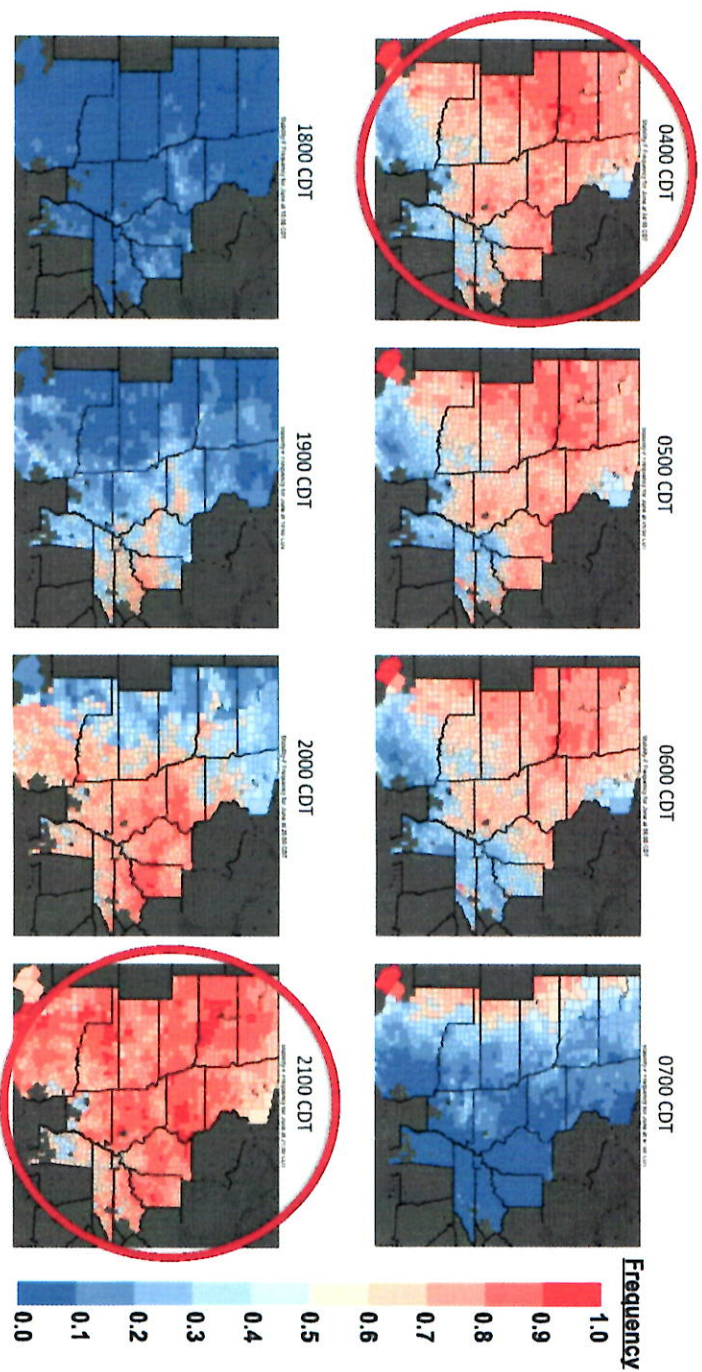
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Temperature Inversions – Consistent & Predictable

Temperature
inversions are
common
especially
during night
time hours

























































Stability Class-F Frequency for a given hour in June, 2017



Importance of Nozzle Selection & Boom Height

Physical Drift Can Cause Broad Uniform Symptomology

Monsanto Deposition Trials Predict Effects from Off-Label Nozzle Selection & Boom Height

DROPLETS		DISTANCE		NOZZLES	DRIFTABLE FINES
Category	Microns	Boom Ht. 20"	Boom Ht. 50"	Type	% Fines
UC Ultra-Coarse	 > 612	50 ft.	90 ft.		< 1.5%
XC Extremely Coarse	 428-622	69 ft.	138 ft.	                   	1.5-3.3%
VC* Very Coarse	 349-128	108 ft.	207 ft.	               	3.4-5.6%
M Medium Coarse	 177-218	358 ft.	544 ft.	            	11.7-22.3%

Distance to 15% visual response were estimated from spray drift models and Monsanto field studies at wind speeds of ~10 mph

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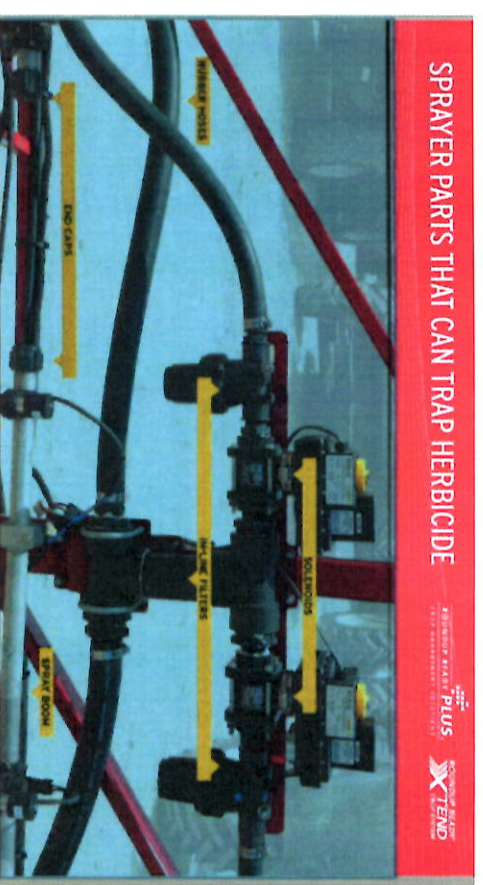
- Smoke Test (Nebraska)
- Less 10 mph.MP4
- Temp Inversion.MP4
- Greater 15 mph.MP4
- Impact of Hedge
- rows on wind flow.MP4

Learnings from 2017 Season



Other Potential Causes That Must Be Considered

- Applications of other products to fields in proximity to field with reported symptomology (e.g. corn)
- Application equipment hygiene
- Bulk handling and mixing
- Misdiagnosis of symptomology
- Product contamination



Learnings from 2017 Season

Summary

- Based on our evaluation in the vast majority of cases where XtendiMax® was used the factors that are leading to off-target movement are readily identifiable
- Because our evaluation was with XtendiMax® users, illegal use of non-approved dicamba products and possible contamination of other products are important factors not reflected in our evaluation
- Majority of the cases drift (not volatility) appears to be the cause of off-target movement

Identifiable factors that contributed to drift are controllable and can be readily addressed through education, training and following the product label for successful application of XtendiMax® with VaporGrip® Technology





»» What Have We Learned from Volatility Research



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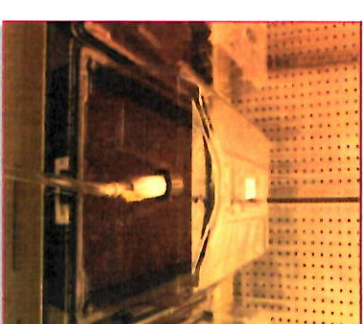
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Confidence in XtendiMax® with VaporGrip® Technology



What Have We Learned from Volatility Research

- **Monsanto has conducted extensive volatility testing since 2009**
 - 1200+ controlled tests and field studies
 - Controlled tests in various laboratory environments (humidome & hoophouse)
 - Field studies that were representative of multiple field conditions including varying geographies, environmental conditions & surfaces
- **Based on Monsanto's extensive testing and field observations**
 - Confident the symptomology in the fields is not attributable to volatility when applying XtendiMax® and following all label requirements



Humidome Studies



Field Studies

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Dicamba Off Target Movement

- Symptomology normally appears on new growth in soybeans typically 7 to 21 days after exposure
 - Weeds will often demonstrate symptomology more quickly following application
 - Timing of exposure, level of exposure and growing conditions after exposure are some of the factors that could impact potential yield response



New leaf growth 7 to 21 days
after dicamba exposure

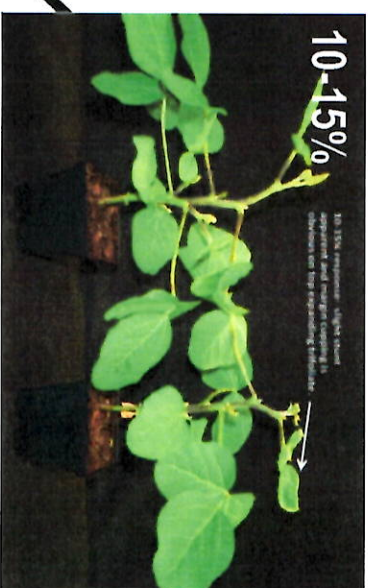
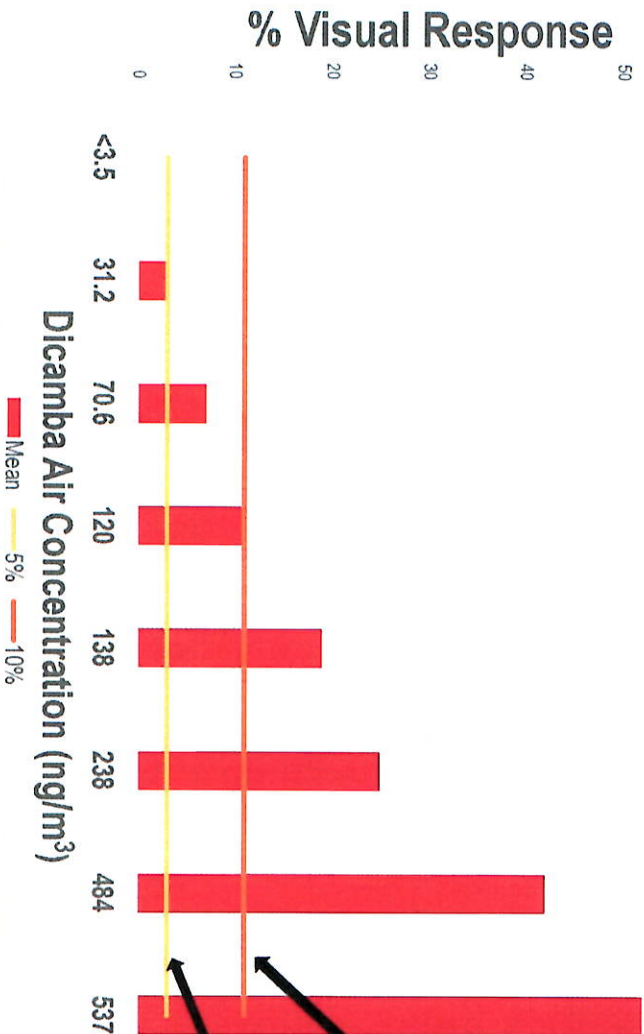
Existing leaves at time of
dicamba exposure

Confidence in XtendiMax® with VaporGrip® Technology



Relationship between dicamba vapor and visual response has been established in humidome

Dicamba air concentrations can be related to levels of visual response



Confidence in XtendiMax® with VaporGrip® Technology



Field volatility studies do not demonstrate levels that would produce a visual response outside of the treated fields

- Test locations were representative of typical growing areas (Texas & Georgia)
- Compared applications to bare ground (1lb/acre) and in-crop to plant tissue (0.5lb/acre)
- Data generated at the highest testing standards (GLP or similar)
- Modeled air concentration was measured 5 meters from edge of field
- 90% of any potential volatility occurs within the first 24 hours

