

# Surfactant Use and Proper Selection

Mike Damann

Branded Technologies Territory Manager

Wilbur-Ellis Company

# Wilbur-Ellis Rec's for Cranberries

Surfactant Suggestions for Cranberry Protection		
	Antero-EA	Spreader-Sticker designed to stick pesticide to plant (pint/a)
Insist 90 Plus	R-11	Non-Ionic Surfactant (NIS) - makes water wetter. Breaks surface tension. Coverage
ROC Crop Oil	HASTEN-EA	Crop Oil Concentrate Ethylated Seed oil great spreading and coverage
	Glacier-EA	methylated seed oil for penetration with non-ionic surfactant - provides penetration into cuticle and spreading of non-ionic surfactant
	Renegade-EA	NIS plus MSO plus nitrogen - designed grass control products like clethodim

# Insecticides and Cranberries

Product	Manufacturer	MOA (mode of action)	Sprinkler	Boom-Broadcast Adjuvant Selection	Pesticide Rate/A
<b><u>Insecticides</u></b>					
<b>Altacor</b>					
(WG)	FMC	Some contact activity	Antero EA (0.125%)	Insist 90 Plus (0.25%)	4 oz
		Most Affective through ingestion of treated material	In-Place (0.25 oz/a)	Crosshair (4 oz/a)	
<b>Delegate</b>					
(WG)	Corteva	Control or suppression of Foliage Feeding Pests	Antero EA (0.125%)	Insist 90 Plus (0.25%)	3 to 6 oz
			In-Place (0.25 oz/a)	Crosshair (4 oz/a)	
<b>Avaunt</b>					
(WG)	FMC	Most affective through ingestion of treated material	Antero EA (0.125%)	Insist 90 Plus (0.25%)	6 oz
		Thorough spray coverage is essential	In-Place (0.25 oz/a)	Crosshair (4 oz/a)	
<b>Intrepid 2F</b>					
(flowable)	Corteva	Ingestion – Causes a lethal pre-mature molt	Antero EA (0.125%)	Insist 90 Plus (0.25%)	1 pt
			In-Place (0.25 oz/a)	Crosshair (4 oz/a)	
<b>Movento</b>					
(flowable)	Bayer	Systemic up and down plant			
		Apply after petal fall, two weeks apart	ROC Crop Oil (3 pts/A)	ROC Crop Oil (3 pts/A)	
<b>Orthene 97</b>					
(WSG)	Amvac	Acetylcholine esterase Inhibitor –	Antero EA (0.125%)	Antero-EA (0.125%)	1 lb
		Contact and injection	In-Place (0.25 oz/a)	Crosshair (4 oz/a)	

Please READ and FOLLOW all label directions and restrictions

Rates of IN-PLACE may be different when tank mixing two pesticide products

# Fungicides and Cranberries

Product	Manufacturer	MOA (mode of action)	Sprinkler	Adjuvant Selection	Rate/A
<b>Fungicides</b>					
<b>Abound (Aframe)</b>					
(flowable)	Syngenta	Thorough Coverage Essential Inhibition of the QOL Site within electron transport	Antero EA (0.125%) In-Place (0.25 oz/a)	Insist 90 Plus (0.25%) OR Syl-tac (4 oz/a) Crosshair (4 oz/a)	15 oz
<b>Bravo</b>					
(flowable)	Syngenta	Multi-Site MOA – Preventative – Uniform coverage	Antero EA (0.125%) In-Place (0.25 oz/a)	Insist 90 Plus (0.25%) OR Syl-tac (4 oz/a) Crosshair (4 oz/a)	5 pts
<b>Indar 2F</b>					
(flowable)	Corteva	Systemic w/ preventative and curative properties	Antero EA (0.125%) In-Place (0.25 oz/a)	Insist 90 Plus (0.25%) OR Syl-tac (4 oz/a) Crosshair (4 oz/a)	6 -12 oz
<b>Nu-Cop 50 DF</b>					
(dry flowable)	Albaugh	Coverage essential	Antero EA (0.125%) In-Place (0.25 oz/a)	Insist 90 Plus (0.25%) Crosshair (4 oz/a)	6 lb
<b>Proline 480 SC</b>					
	Bayer	PROLINE® 480 SC Fungicide is a broad-spectrum, Group 3, systemic fungicide.	Antero EA (0.125%)	Antero-EA (0.125%)	5.7 oz

Please READ and FOLLOW all label directions and restrictions

Rates of IN-PLACE may be different when tank mixing two pesticide products

# Herbicides and Cranberries

Product	Manufacturer	MOA (mode of action)	Sprinkler	Boom-Broadcast Adjuvant Selection	Pesticide Rate/A
<b>Herbicides</b>					
<b>Roundup</b>					
(Liquid)	Bayer/Others	Systemic	Antero EA (0.125%) In-Place (0.25 oz/a)	Insist 90 Plus (0.25%) AMS (12.5 lbs/a) or Cayuse Plus (1%)	2 qts
<b>Poast</b>					
(EC)	BASF	Rapidly translocates throughout the plant	Antero EA (0.125%) In-Place (0.25 oz/a)	ROC Crop Oil (2 pts/a) Crosshair (4 oz/a)	2.5 pts
<b>Quinstar 4L</b>					
(liquid)	Albaugh	Systemic – plant uptake through both	NR-Antero EA (0.125%) In-Place (0.25 oz/a)	ROC Crop Oil (2 pts/a) OR Syl-tac (4 oz/a) Crosshair (4 oz/a)	8 oz
<b>Vaquero - clethodim</b>					
(EC)	Wilbur-Ellis	Systemic – Plant uptake through the foliage	Antero EA (0.125%) In-Place (0.25 oz/a)	Renegade-EA (1%) Crosshair (4 oz/a)	8 oz
<b>Callisto</b>					
(SC)	Syngenta	Coverage Essential Mimics Callistemon plant	Antero EA (0.125%) In-Place (0.25 oz/a)	Insist 90 Plus (0.25%) Crosshair (4 oz/a)	8 oz

Please READ and FOLLOW all label directions and restrictions

Rates of IN-PLACE may be different when tank mixing two pesticide products

# Selected Adjuvant Products



**CROSSHAIR®**

**DILIGENCE-EA®**

**GUIDANCE-EA®**

**IN-PLACE®**



**GLACIER-EA®**

**RENEGADE-EA®**

**SYL-TAC-EA®**



**SUPER SPREAD® MSO**



**ANTERO-EA®**

**RAINIER-EA®**



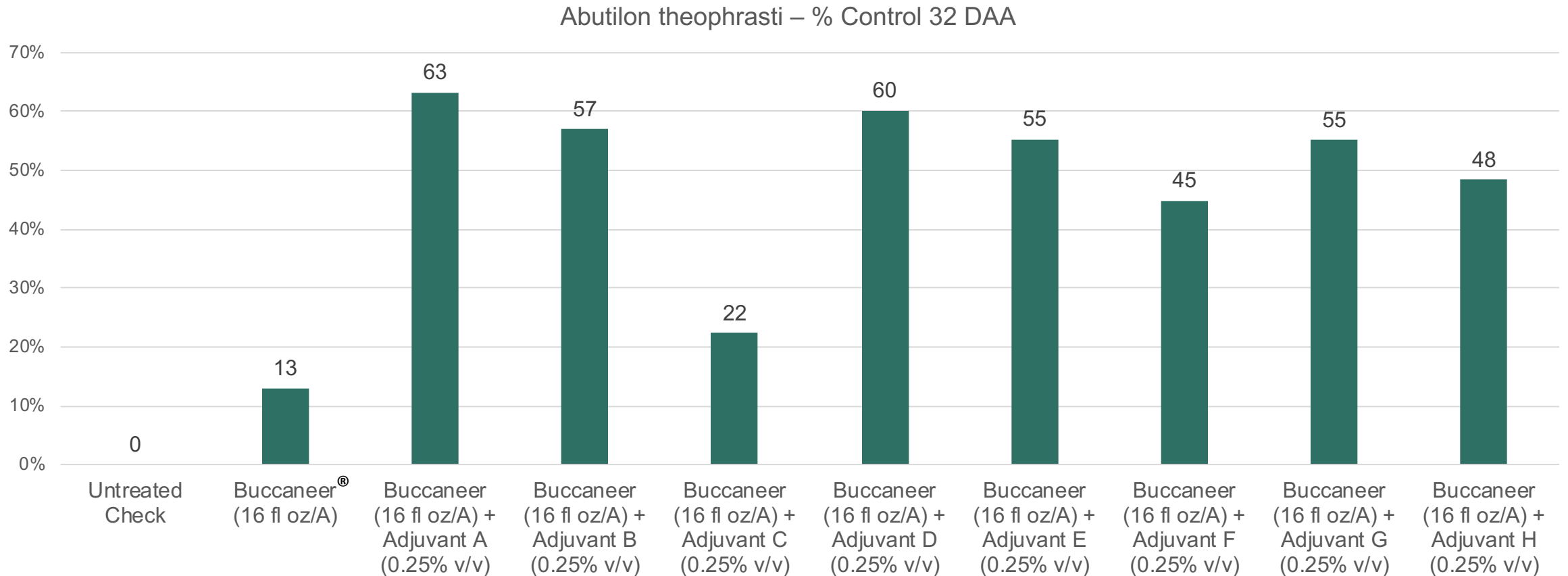
**BRIMSTONE®**

**BRONC® MAX**

**CYNDER®**

# Not All Adjuvants are Created Equal!

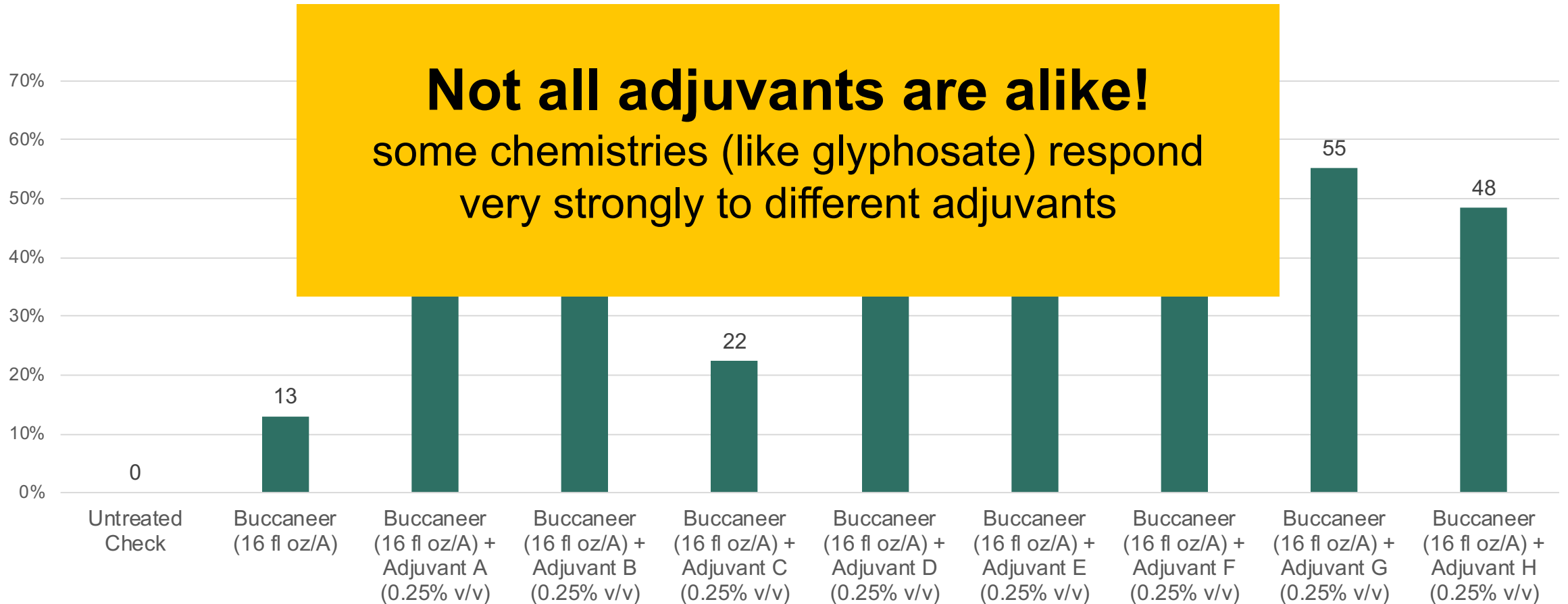
## Glyphosate alone and tank-mixed with adjuvants at 0.25% v/v



Sub-lethal amount of glyphosate used in this trial  
PDF155019CO03

# Not All Adjuvants are Created Equal!

Glyphosate alone and tank-mixed with adjuvants at 0.25% v/v





# Adjuvant

- An adjuvant is a material added to a mixture to aid or modify the action of an agrichemical, or alter the physical characteristics of the mixture.



**American Society for Testing and Materials**

# Adjuvant Types

- Spreaders
- Spreaders + AMS
- Spreader-Activators
- Penetrator-Activator
- Spreader-Stickers
- Sticker-Extenders
- Silicones
- Crop Oil Concentrates
- High Surfactant Oil Concentrate
- Modified Seed Oils
- Modified Seed Oil + Organosilicone Blend
- Modified Seed Oil + Nitrogen
- Acidifier/Buffers
- Alkaline/Buffers
- Water Conditioners
- Deposition and Drift Management

# State Adjuvant Registration

- In some states adjuvants are required to be registered; WA, CA, ID, UT and WY in the western states.
- In order to be registered these adjuvants must comply with the definitions established by ASTM.



**American Society for Testing and Materials**

# CPDA

## Council of Producers & Distributors of Agrotechnology

- **Voluntary Adjuvant Certification Program**
- Only organization representing adjuvants to the EPA.  
(EPA sets some of the requirements needed to be CPDA certified, along with U.S. Dept. of Transportation, U.S. OSHA)
- Certification program that sets viable minimum standards
  - Toxicology on all products required
  - Must meet ASTM definitions
  - Standards for active ingredients.
  - Certified formulation facilities



# CPDA

## CPDA Certified Products



- Started Certifying Products in 2001
- Probably in excess of 2000 adjuvants in marketplace.
- Currently 102 adjuvants have received CPDA Certification
- **Supporting companies are Wilbur-Ellis, Winfield Solutions, Helena, Loveland/CPS, United Suppliers, Intec and others.**



# CPDA Certified Products

- **Helena**
  - Agri-Dex®
  - Crop Oil Concentrate
  - Induce®
  - Kinetic®
  - Penetrator® Plus
  - Vegetable Oil Concentrate®
- **Winfield Solutions LLC**
  - Alliance®
  - Class Act® NG™
  - Destiny® HC
  - Droplex™
  - InterLock®
  - Level 7®
  - Powerlock®
  - Superb® HC
- **Loveland**
  - Choice® Weather Master™
  - MSO® Concentrate with Leci-Tech
- **Monterey AgResources**
  - Magnify
  - Monterey Cop Oil
- **Wilbur-Ellis**
  - BRONC® MAX
  - CAYUSE® PLUS
  - R-11®
  - RAINER-EA™
  - HASTEN®
  - CROSSHAIR®
  - IN-PLACE®
  - RENEGADE-EA™
  - SUPER SPREAD® 7000
  - SUPER SPREAD® MSO
  - SYL-TAC®
- **Rosen's**
  - Array®
  - Enact™
  - Diplomat® HSOC
  - Ortech®
  - Powerhouse
  - Putity 100
- **Rosen's**
  - R-Way®
  - Sundance® II
  - Tradition® 93
- **United Suppliers, Inc.**
  - Air Force®
  - AMSol Plus®
  - AmSurf Xtra™
  - Between® HSOC
  - Chemsurf 80
  - Chemsurf 90
  - Double Down®
  - Downdraft®
  - Fastrack™
  - Formula® 1
  - Premium Crop Oil Concentrate
  - Speedway®
  - Sprint™ADT
  - Succeed®
  - Ultra-Lite®
  - Ultra Surf AMS



# INDUCE®

## A Nonionic Low Foam Wetter/Spreader Adjuvant

**\*ACTIVE INGREDIENTS:**

Alkyl Aryl Polyoxylkane ethers, alkanolamides, dimethyl siloxane, and Free Fatty Acids .....	90.0%
Components in effective adjuvant .....	10.0%
<b>TOTAL</b> .....	<b>100.0%</b>
Surfactant Content: .....	70.0%

When you are CPDA Certified it is a requirement that you have to show your actual Surfactant Content on your Label.



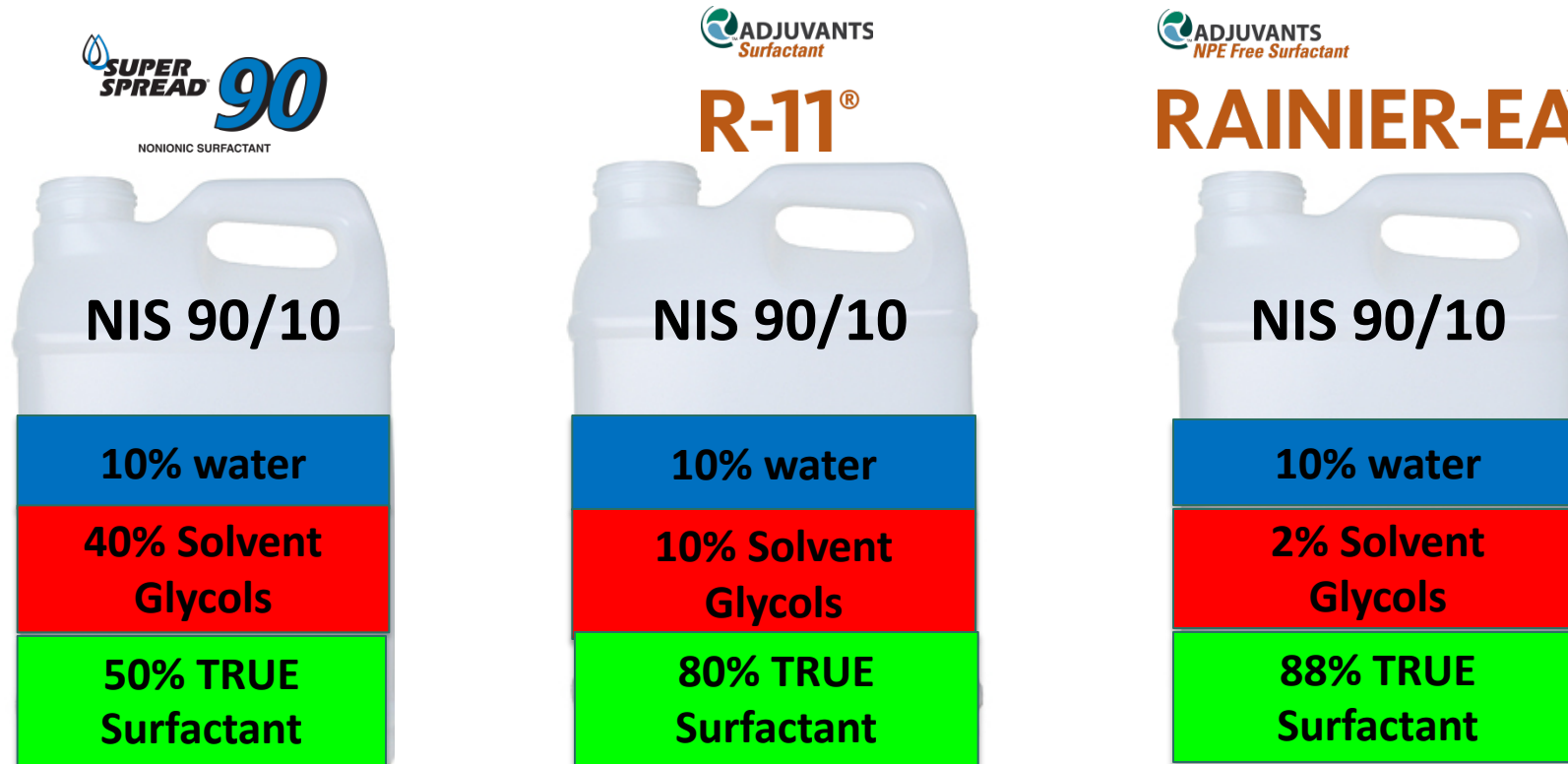

# R-11®

**SPREADER ACTIVATOR**  
NONIONIC SURFACTANT




CA Reg. No. 2935-50142      WA Reg. No. 2935-50142  
Surfactant Content.....80%

## NIS Comparison SOLVENT or SURFACTANT?








# Texas Refinery Corp.



**HYDRATE PLUS NF**

- 

**Uniquely Formulated Surfactant**  
 HYDRATE PLUS NF is a uniquely formulated surfactant. HYDRATE PLUS NF is a non-foaming wetting agent that drastically reduces surface tension of water and chemicals. This uniquely designed product is for today's spraying systems. The non-foaming formulation reduces foam in the chemicals that HYDRATE PLUS NF is combined with eliminating in most cases the need for an additional defoamer to be added.  
 By breaking surface tension, the bead of water/chemical is forced to break down, sheet, and penetrate quickly. This allows for a more potent application with less runoff and evaporation resulting in a more efficient treatment that lowers the cost of application.
- 

**For Use With Fertilizers, Herbicides, Water, Insecticides, and Fungicides**  
 HYDRATE PLUS NF eliminates potential headaches for farmers. It allows products such as pesticides that are naturally water resistant to bond and stay mixed thoroughly. Another challenge is application of chemicals on waxy leaf plants. Chemicals alone will not penetrate these type plants. HYDRATE PLUS NF allows the surface tension to break and the chemical applied to penetrate much more efficiently. Contact kill products, when mixed with HYDRATE PLUS NF, have a stronger, longer lasting kill. Chemicals or irrigation water mixed with HYDRATE PLUS NF are far more effective. HYDRATE PLUS NF can even be applied with the use of crop dusters. HYDRATE PLUS NF actually benefits spraying equipment by reducing salt and mineral deposits on spray nozzles; thus, helping to keep nozzles clean, clear, and spraying properly.
- 

**Safe and Environmentally Friendly**  
 HYDRATE PLUS NF is a non-toxic biodegradable surfactant that is designed to be used on deciduous trees, edible crops, vegetation, and grasses. It contains a pH level in the range of 9-11.5. Due to HYDRATE PLUS NF being non-corrosive, it is safe on the applicator and the application equipment.

Made In The U.S.A. Since 1922

pH of 9 – 11.5

20% Surfactant????



- CPDA Certified Products Means Something

 ADJUVANTS  
NPE Free DRT  
**IN-PLACE®**

 ADJUVANTS  
NPE Free DRT  
**CROSSHAIR®**

 ADJUVANTS  
Oil  
**HASTEN®**

 ADJUVANTS  
Oil  
**SUPER SPREAD® MSO**

 ADJUVANTS  
NPE Free Oil  
**RENEGADE-EA™**

 ADJUVANTS  
Oil  
**SYL-TAC®**  
With Translam® Technology

 ADJUVANTS  
Surfactant  
**R-11®**

 ADJUVANTS  
NPE Free Surfactant  
**RAINIER-EA™**

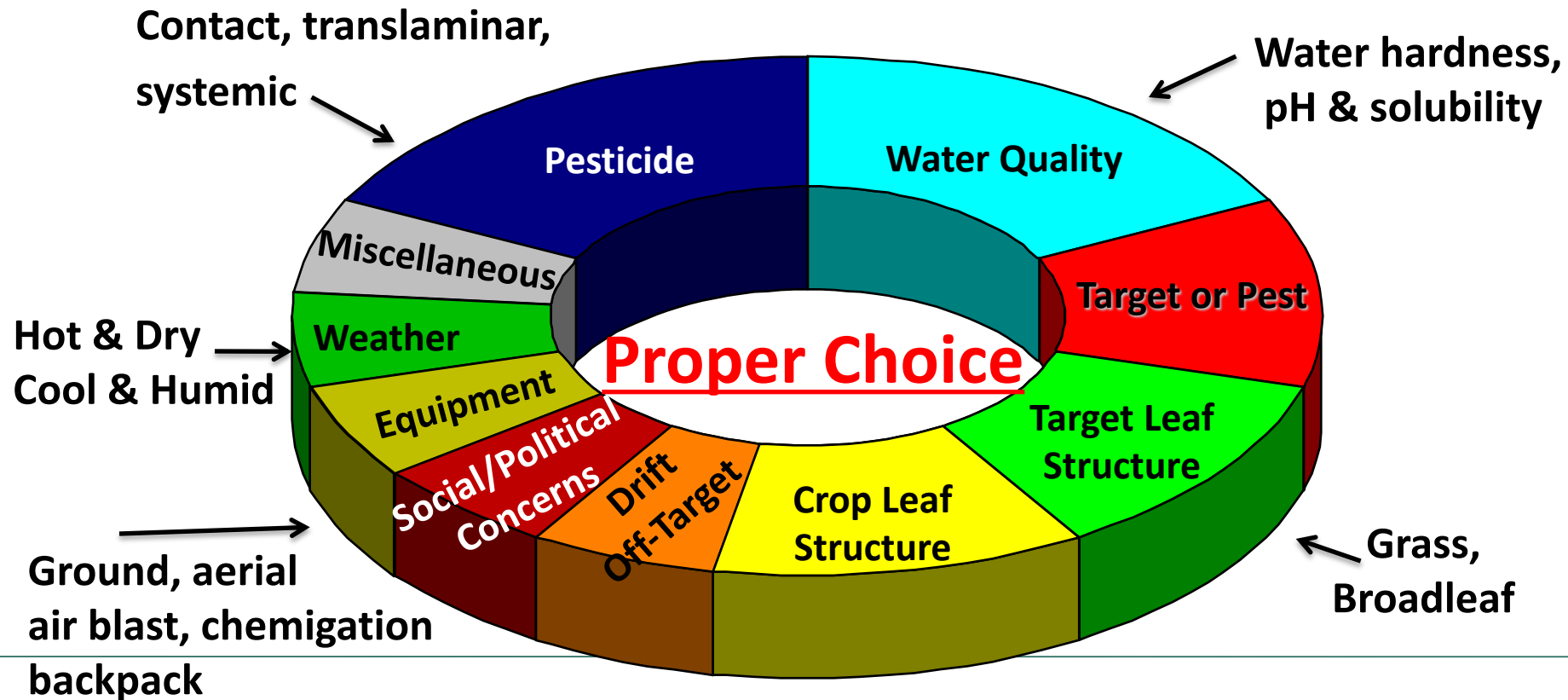
 ADJUVANTS  
Surfactant  
**SUPER SPREAD® 7000**

 ADJUVANTS  
NPE Free Water Quality  
**BRONC® MAX**

 ADJUVANTS  
NPE Free Water Quality  
**CAYUSE® PLUS**

# Adjuvant Selection Factors

- Consider all factors and your experiences to make the proper adjuvant choice.



# Surfactants

- Surfactant is a word derived from the term “surface-active agent.” Surfactants are adjuvants that reduce the surface tension of water or increases its wettability. They aid the emulsifying, spreading, wetting or other surface-modifying properties of liquids.

## ASTM Definition

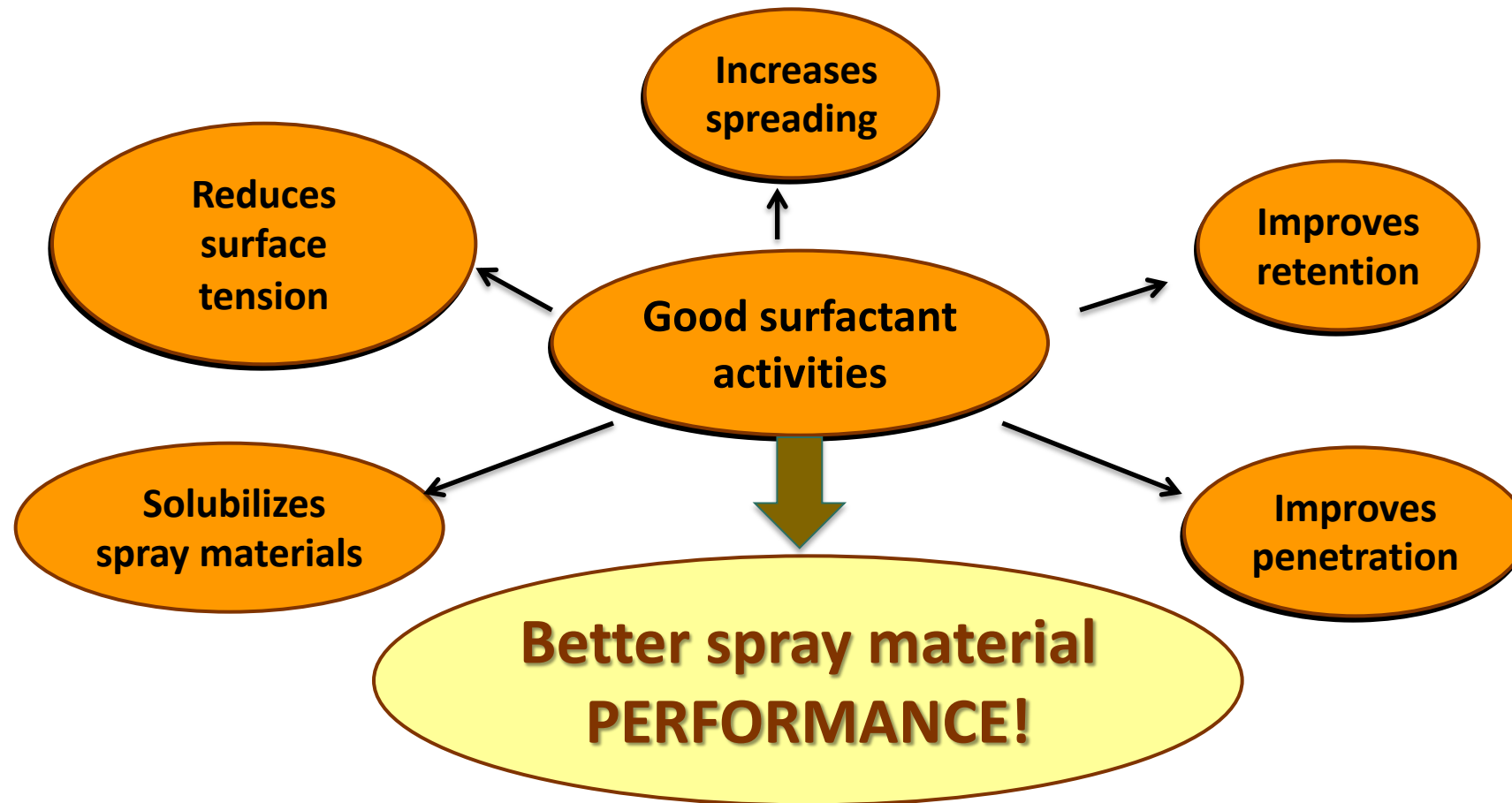
# Surfactant Types

**ANIONIC** - surfactant that has a negative (-) charge and **limited compatibility**.

**CATIONIC** - surfactant that has a positive (+) charge and **limited compatibility**.

**NON-IONIC** - surfactant that has no electrical charge and is generally **compatible with all pesticides**.

# Functions of a High Quality Surfactant



# Spray Droplet Without Surfactant

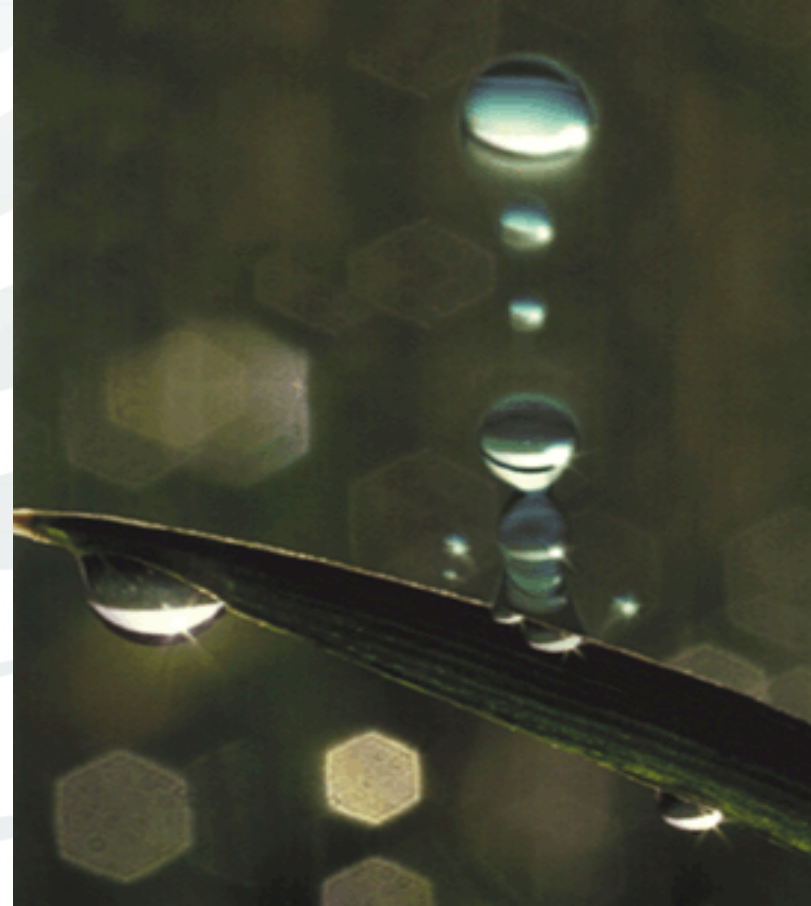
- **Surface tension of water is 72 dynes/cm**
- Droplets sit on leaf hairs or leaf surface
- Little leaf contact
- Reduced spray activity





# Proper Use of Wetting Agent

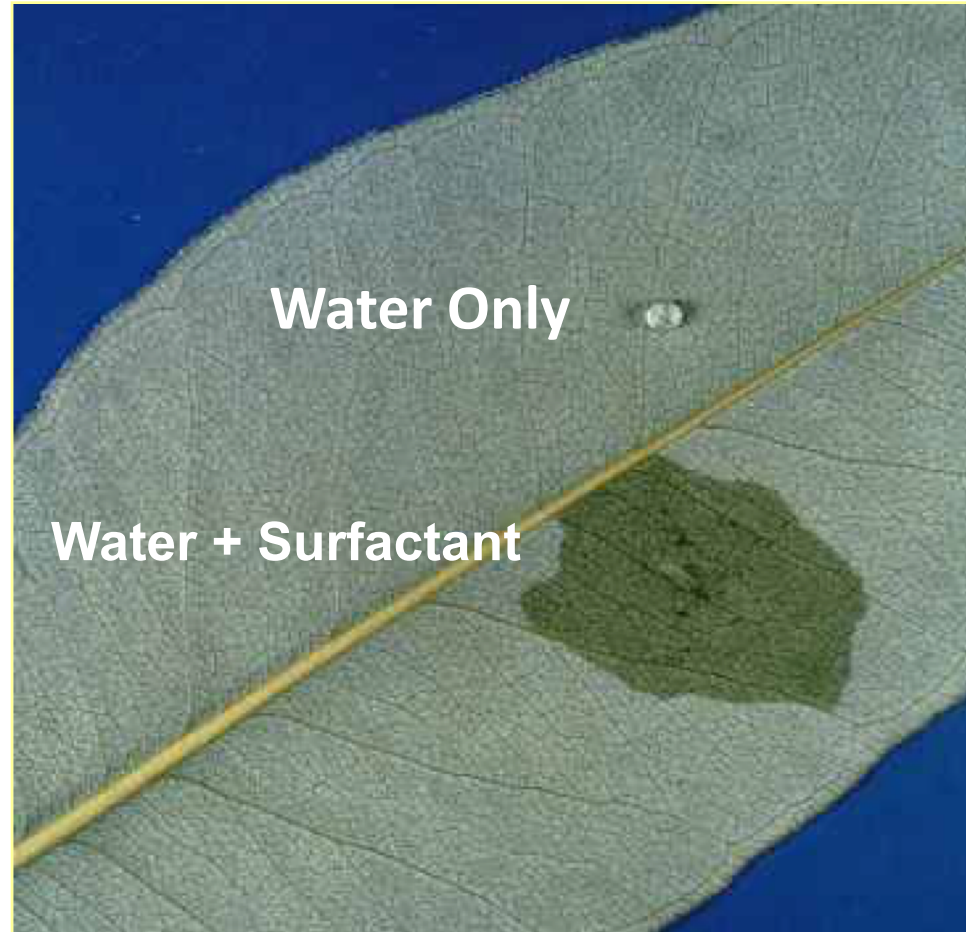
- Drastically increases plant surface area covered by spray.
- Reduces spray run-off from treated surfaces.
- Reduces spray droplet rebound



Time elapsed photography showing droplet compressing and rebounding from plant leaf. **Wetting agents reduce spray droplet surface tension and energy needed for this rebound to occur. Drops spread over surface rather bounce of surfaces.**

# Surfactant Effects

- Surfactant reduces surface tension to 20-40 dynes/cm.
- Droplets spread over leaf, penetrate hairy surface
- Increased leaf contact
- Increased spray activity



## Japanese Maple with and without ProNatural® Spreader-Sticker



**With Surfactant**

**Without Surfactant**

# PESTICIDES - BARRIERS OF ENTRY

## Leaf angle

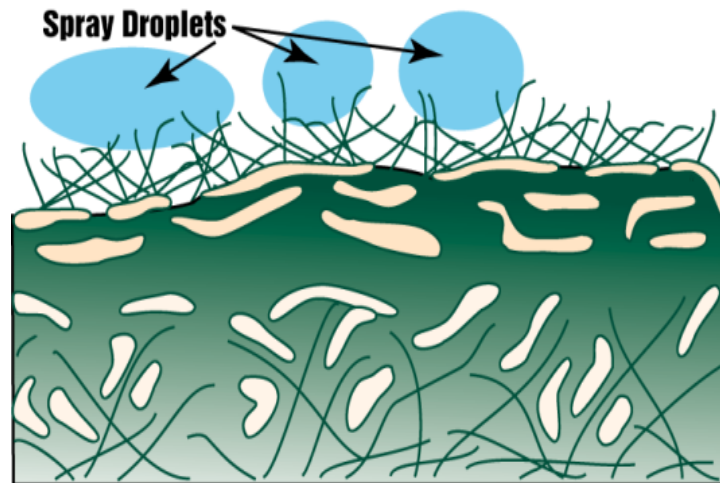


**Droplets Roll Off Leaf**

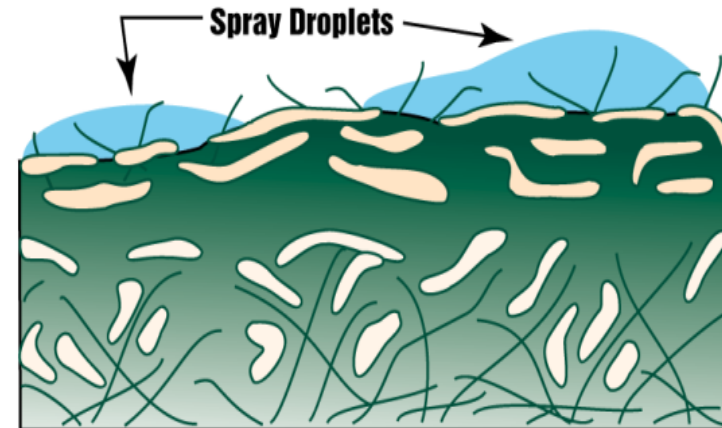


# PESTICIDES - BARRIERS OF ENTRY

## Leaf hairs (pubescence)



**Dense pubescence prevents wetting**



**Sparse pubescence may increase wetting.**

# PESTICIDES - BARRIERS OF ENTRY

## Leaf surface or cuticle

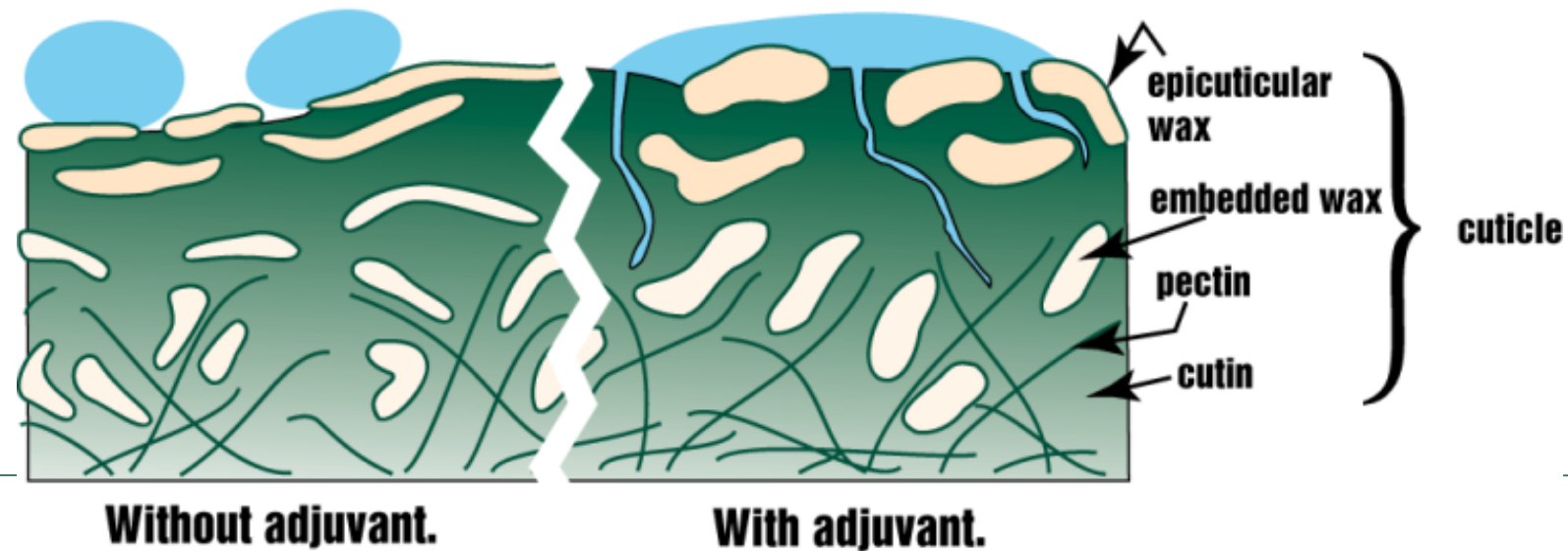
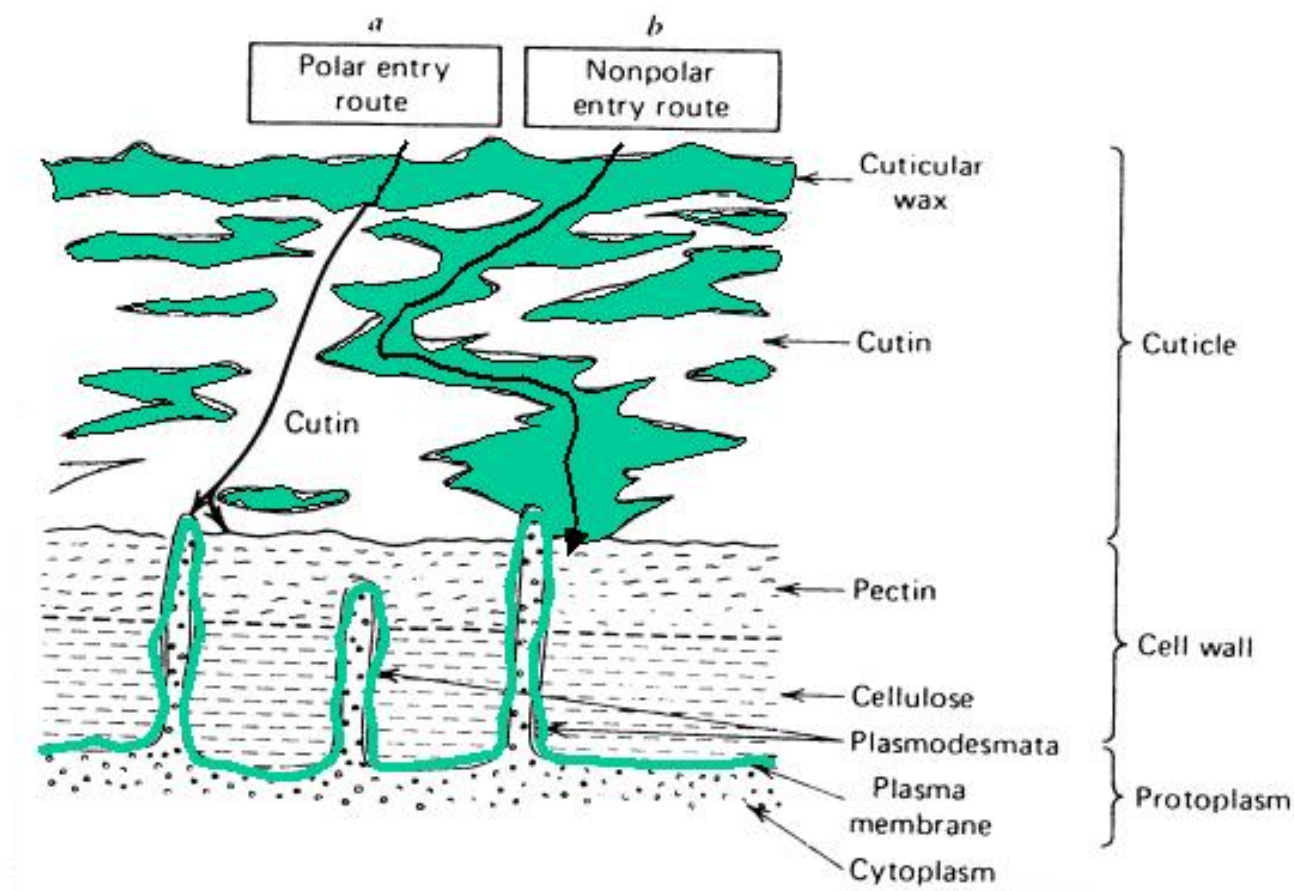


Figure 2. Absorption routes from leaf surface to cytoplasm. (Ashton and Crafts. 1981.)

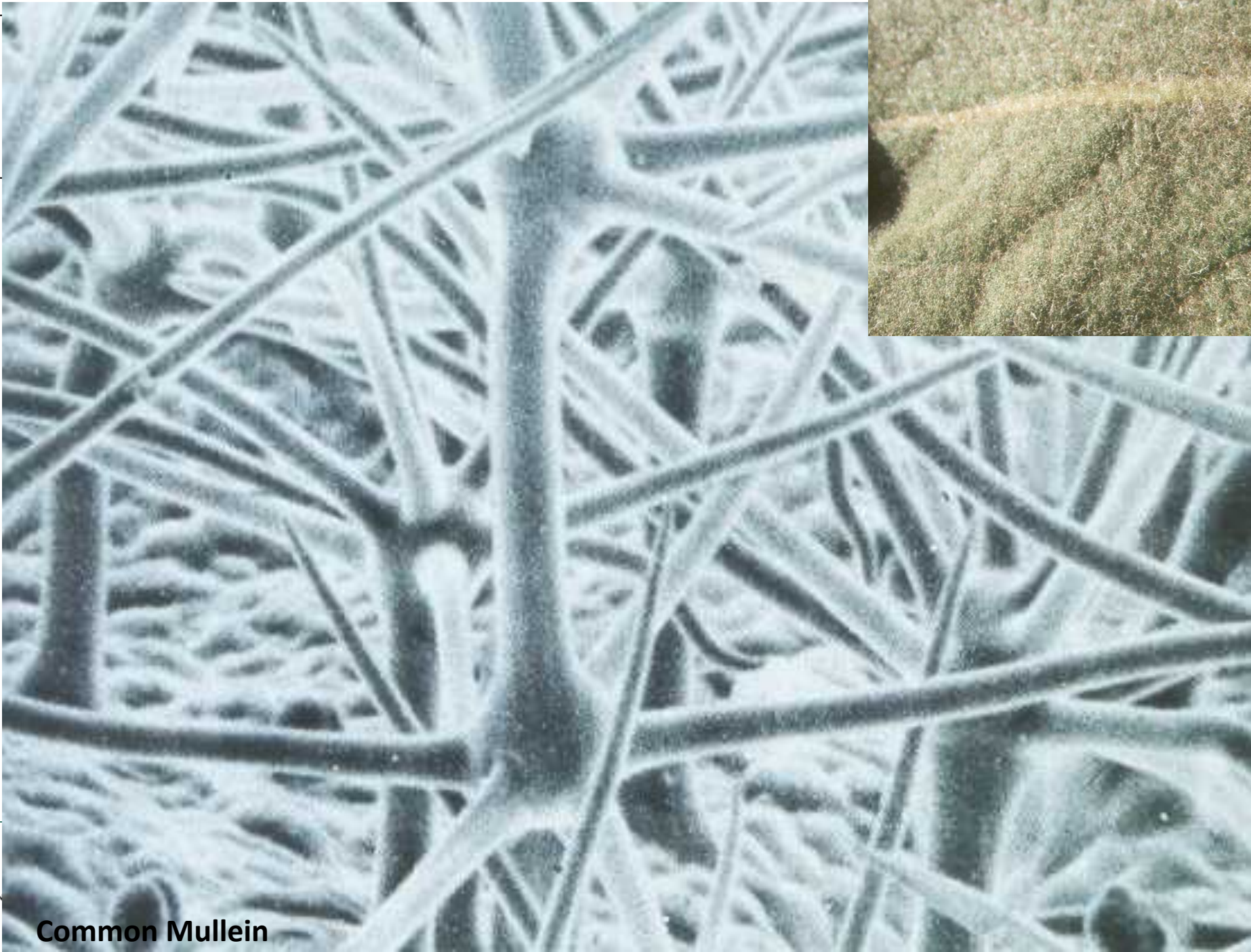


Green areas represent lipophilic regions: epicuticular wax, cell membrane (plasma membrane).

# Leaf Pubescence







# Droplet on Hairy Leaf

Without Surfactant



WILBUR-ELLIS®



No surfactant, hairy leaf

By Dr. Heping Zhu, USDA-ARS-ATRU

IDEAS TO GROW WITH®

# Droplet on Hairy Leaf

With Surfactant



WILBUR-ELLIS®

With surfactant, hairy leaf



By Dr. Heping Zhu, USDA-ARS--ATRU

IDEAS TO GROW WITH®

# Hairs, trichomes, and glands



# Differences Between Spreaders, Spreader-Activators and Penetrator-Spreader-Activators

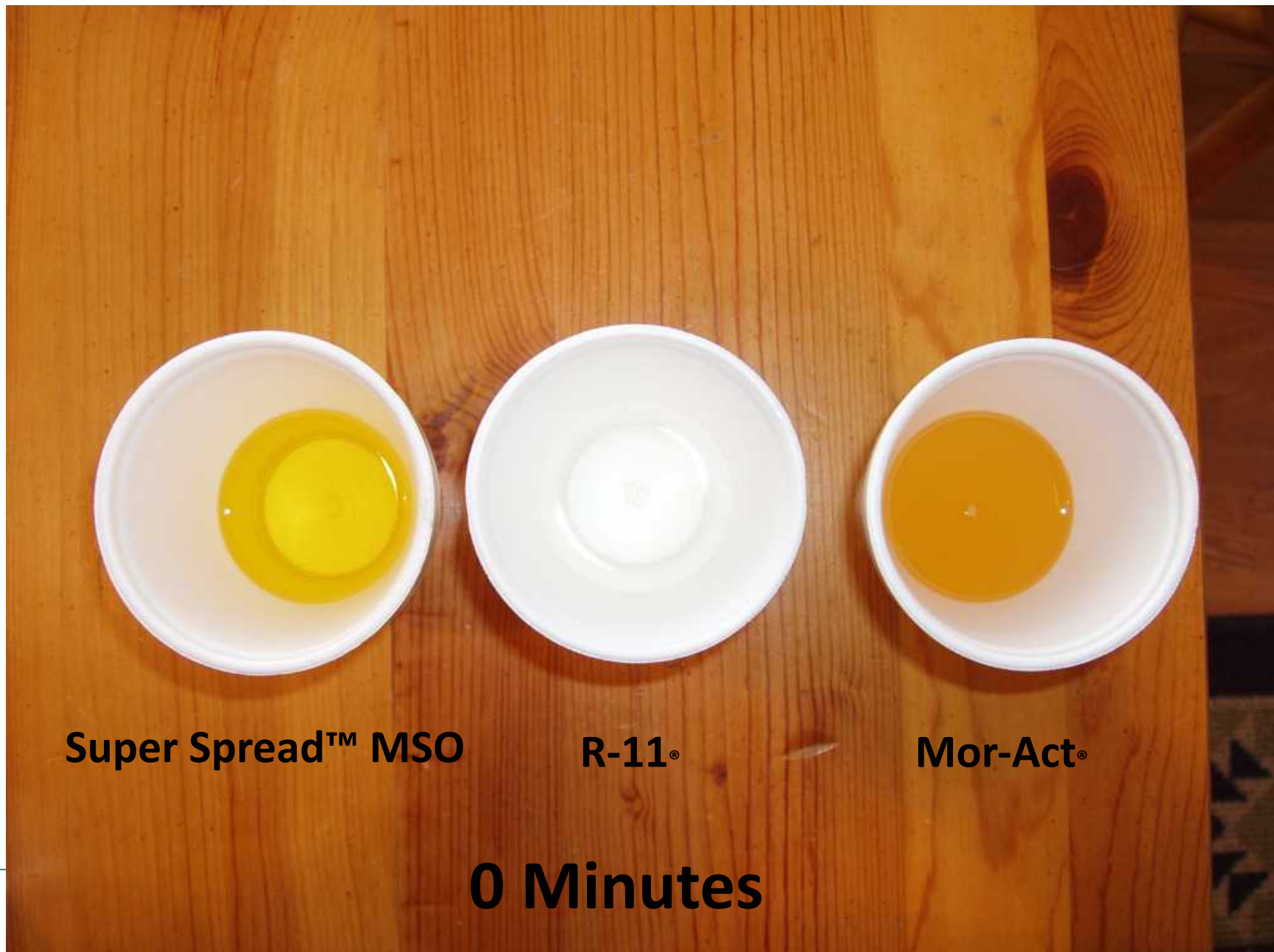
- **Spreader** – reduces the surface tension and increase the surface area covered by the pesticide.
- **Spreader-Activator** – reduces surface tension, increases the surface area covered and **moves pesticide around, under and into the water channels of the leaf.**
- **Penetrator-Spreader-Activator** – **Lifts and dissolves the wax on the leaf surface allowing the pesticide to enter the leaf.**

# Penetration vs Coating

- Modified Seed Oil (**MSO**)
  - Exceptional penetration
- Non-Ionic surfactant (**NIS**)
  - Spreader-Activator
- Crop Oil Concentrate (**COC**)
  - Coats versus penetrate

# Where do you want the product?

- Do you want to spread and coat the outside of the leaf/plant?
- Do you want the product inside the leaf, so it can move throughout the leaf and entire plant?
  - Is it a Contact product?
  - Is it a Translaminar product?
  - Is it a Systemic product?



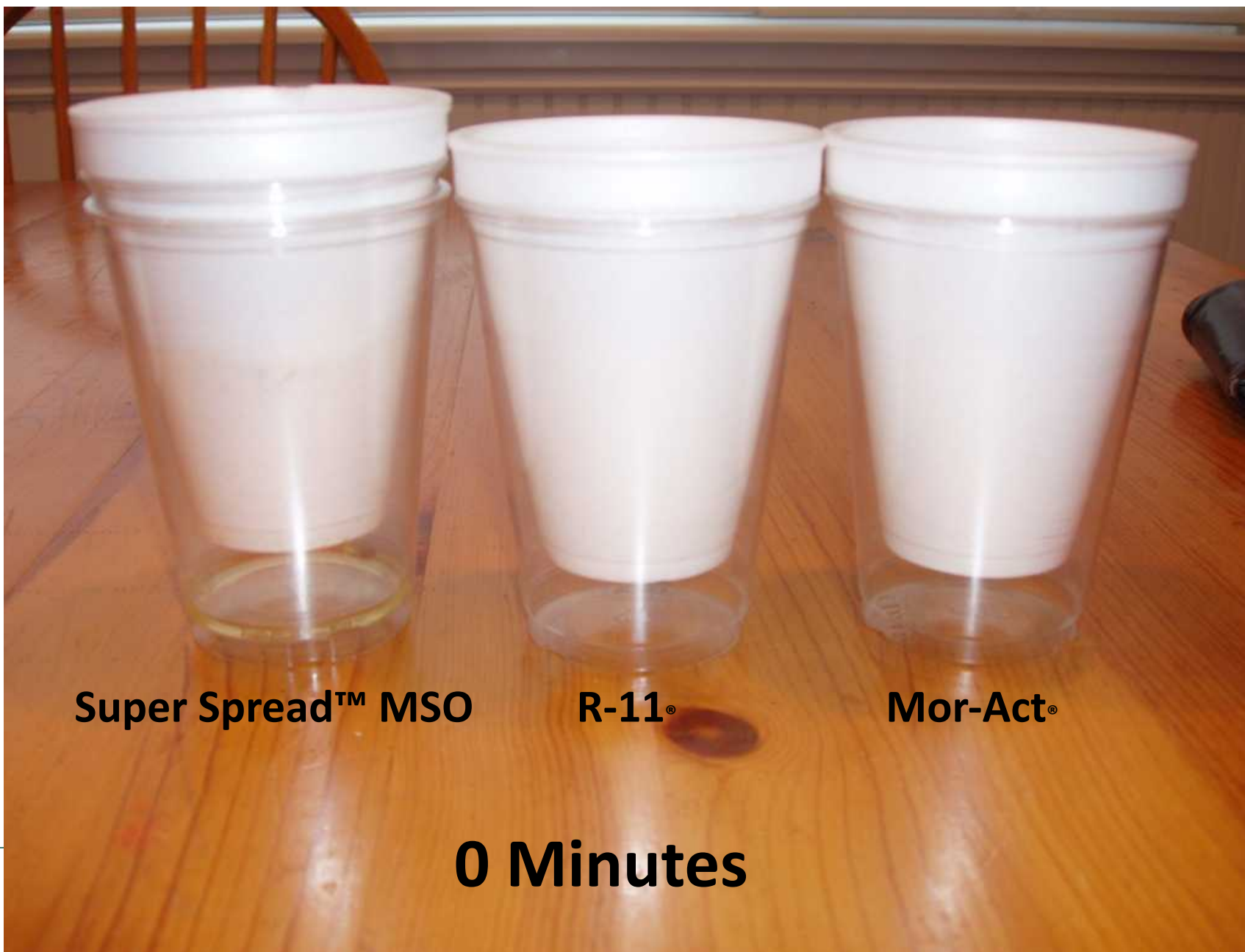
**Super Spread™ MSO**

**R-11®**

**Mor-Act®**

**0 Minutes**





**Super Spread™ MSO**

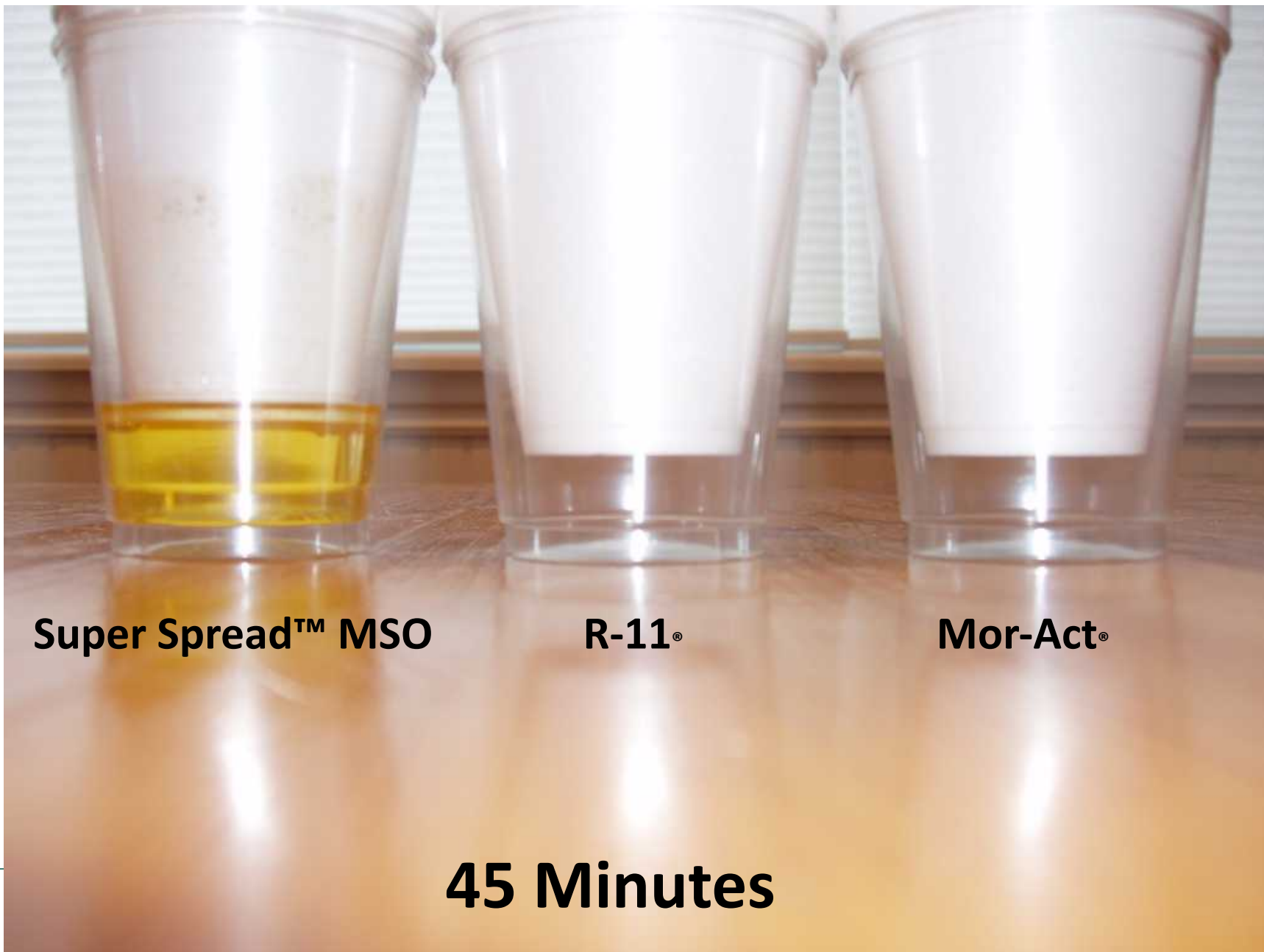
**R-11®**

**Mor-Act®**

**0 Minutes**



ILBUR-ELLIS®



**Super Spread™ MSO**

**R-11®**

**Mor-Act®**

**45 Minutes**

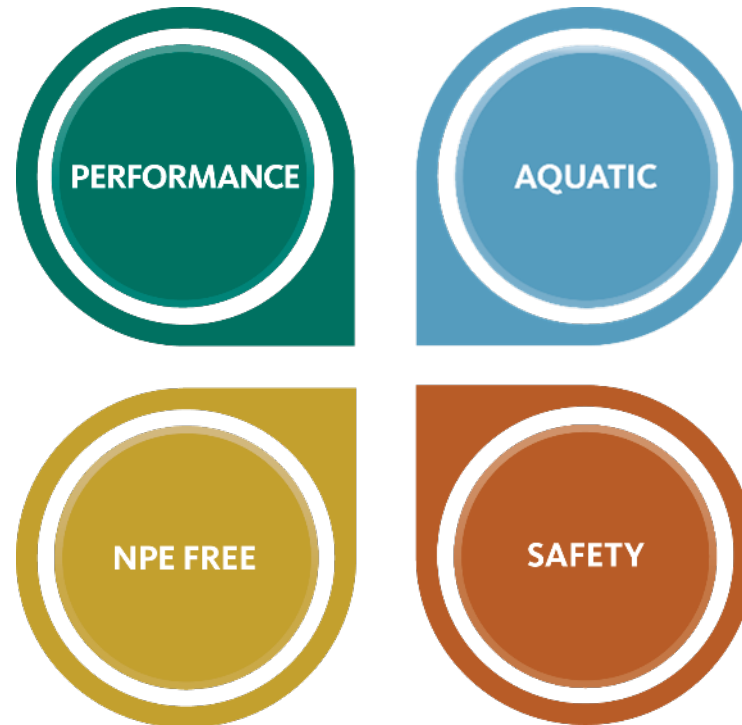


# ECO ADVANTAGE™

The newest portfolio of premier adjuvants.

All **ECO ADVANTAGE** products have the four EA pillars in order to provide a superior product with less impact on the land.

# ECO ADVANTAGE™





SUPERIOR PERFORMANCE

All **ECO ADVANTAGE**  
products meet or exceed  
competitors' **performance**.



LABELED FOR AQUATIC USE

**ECO ADVANTAGE**  
products are labeled  
for use in and around  
**bodies of water**.



## IMPROVED SAFETY & HANDLING

Improved **SAFETY**  
handling means all **ECO**  
**ADVANTAGE** products  
have:

- Lower eye toxicity
- Lower dermal toxicity



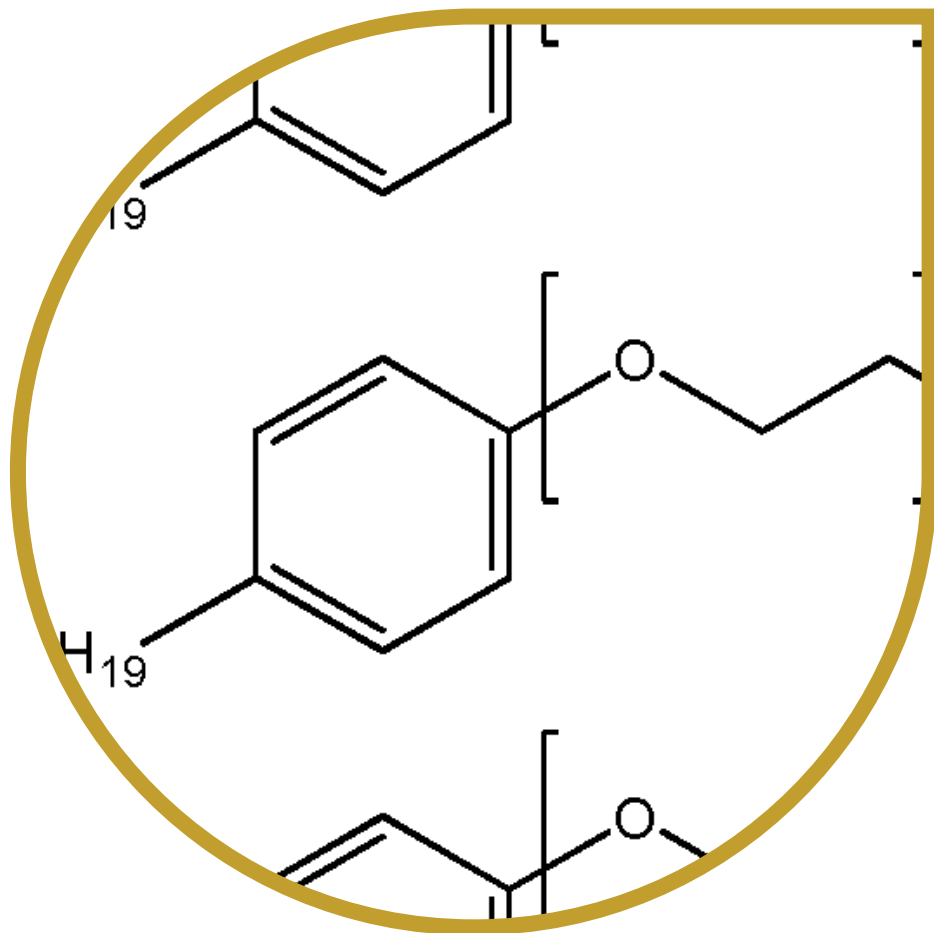
LABELED FOR AQUATIC USE

## **ECO ADVANTAGE**

products are labeled  
for use in and around  
**bodies of water.**



NPE FREE



Many Wilbur-Ellis customers may be impacted by various **NPE** use restrictions. This impact will mainly be felt through product exports to other countries.

- **What are NPEs?**
- NPE = Nonylphenol Ethoxylates
- Wetting agent, dispersant and emulsifier





# RAINIER-EA<sup>®</sup>

Penetrant, Spreading, Wetting

## Features

- High concentration NIS formulated to increase uptake from spray droplet deposits
- Reduces surface tension of spray droplets and provides uniform foliage coverage
- Low foaming technology
- Labeled for Aquatic use
- NPE Free

## Benefits

- Quickly wets and spreads, allowing for uniform coverage
- Increases absorption and translocation of systemic products into the plant tissue
- Ease of use with less foam resulting in the final tank solution
- Can be used with aquatically labeled pesticides
- Excellent safety and handling

**Roundup PowerMax 24 oz/ac  
R-11® 24 oz/100 gal  
6/2/14**



  
WILBUR-ELLIS®  
2014 Agronomist Trial  
Knox, TN  
Plot 123  
Roundup PowerMax @ 24 oz/ac  
R-11 @ 1.5 qt/100



  
WILBUR-ELLIS®  
  
2014 Adjuvant Trial  
Farwell, TX  
  
Plot 124  
Roundup PowerMax @ 24 fl oz/ac  
NIS-EA @ 1.5 qt/100

**Roundup PowerMax 24 oz/ac  
Rainer-EA™ 24 oz/100 gal  
6/2/14**

# NPE-Free Surfactant Products



**ANTERO-EA<sup>®</sup>**

# Antero-EA Video



# ANTERO-EA<sup>®</sup>

Multi-Functional, Spreading, Wetting, Retention/Sticker, Adhesion

## Features

- Premium Spreader-Sticker
- High quality formulation
- Labeled for aquatic use
- NPE Free

## Benefits

- More uniform coverage
- Improves adhesion, reduces surface tension
- Resists wash-off
- Works well with WP formulations
- Excellent crop safety
- Ability to use with aquatically labeled chemistry



# ANTERO-EA<sup>®</sup>

**ANTERO-EA** is composed of surface active agents and organic polymers that help reduce surface tension and aid in pesticide retention on plants. **ANTERO-EA** can be used with a wide range of agricultural chemicals, especially wettable powders or dry flowable formulations of fungicides and insecticides.

- Adheres product to plant surface
- Resists "wash off" during wet conditions.
- Uniform coverage of fungicides, herbicides, insecticides, and defoliants
- Applied by air or ground (including backpack), and may be used in chemigation applications.



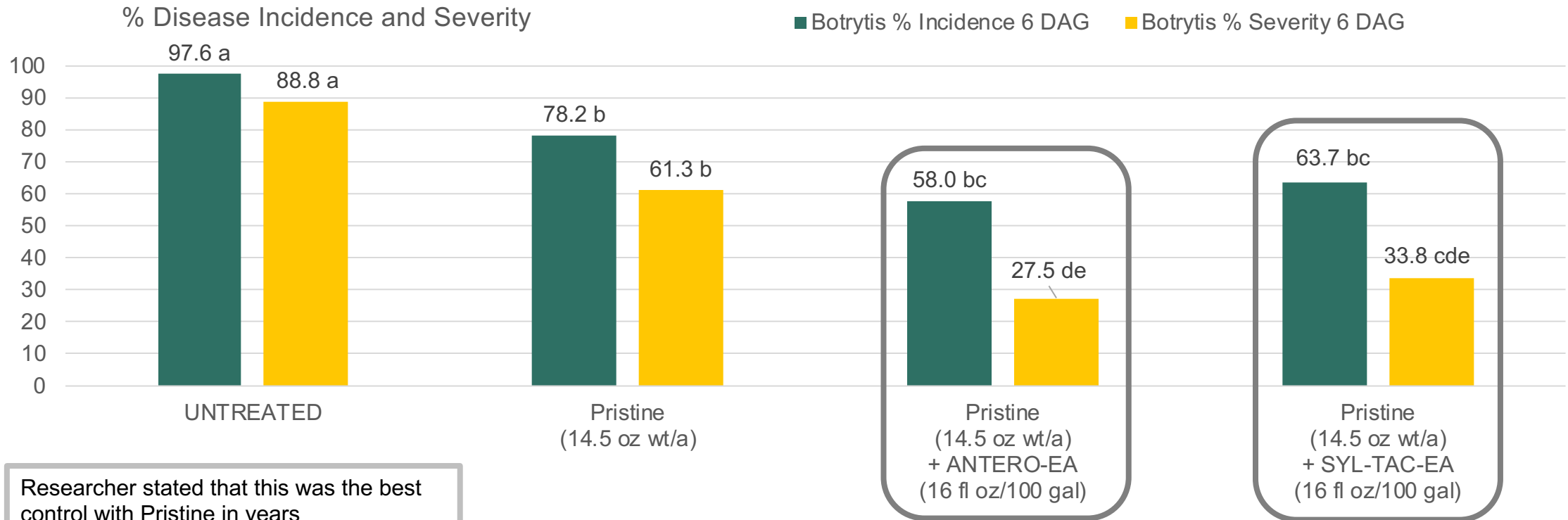
# ANTERO-EA<sup>®</sup> The Science

- Resin-containing formulation improves adherence of spray deposit
- Resin also reduces washoff
- Surfactant blend allows for movement across target surface for improved coverage



# Adjuvants for Increased Disease Control in Onion

No phytotoxicity observed



Researcher stated that this was the best control with Pristine in years

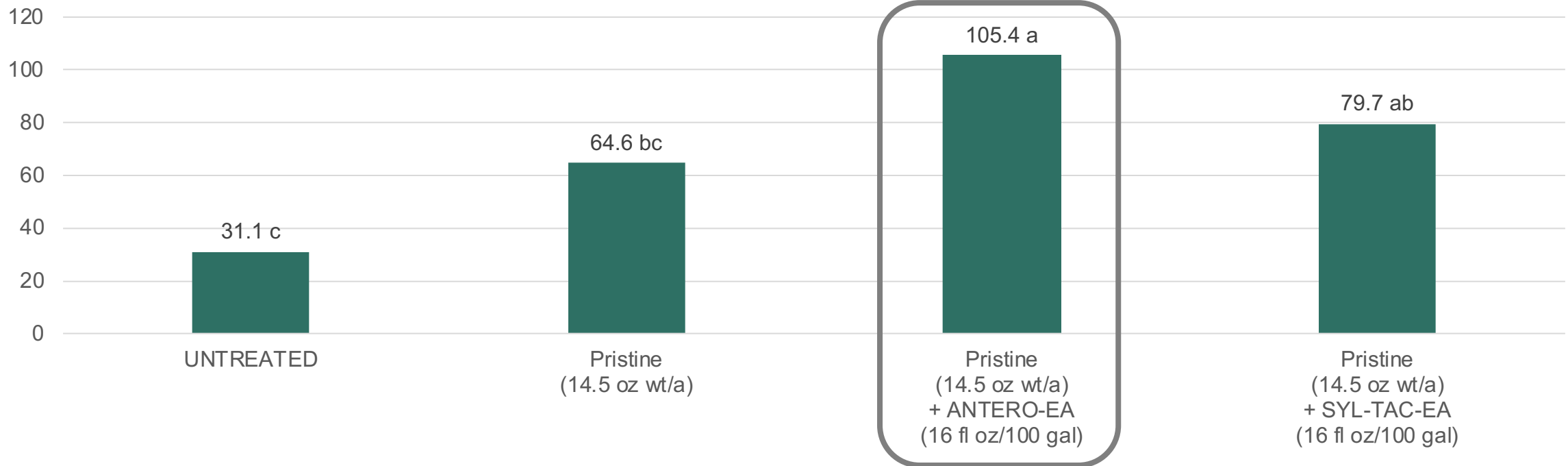
ANTERO-EA (16 fl oz/100 gal) and SYL-TAC-EA showed the best improvement of incidence and severity of disease

Means followed by the same letter are not statistically different (LSD, P=0.05)

# Adjuvants for Increased Disease Control in Onion

All adjuvant treatments statistically improved yield over untreated check

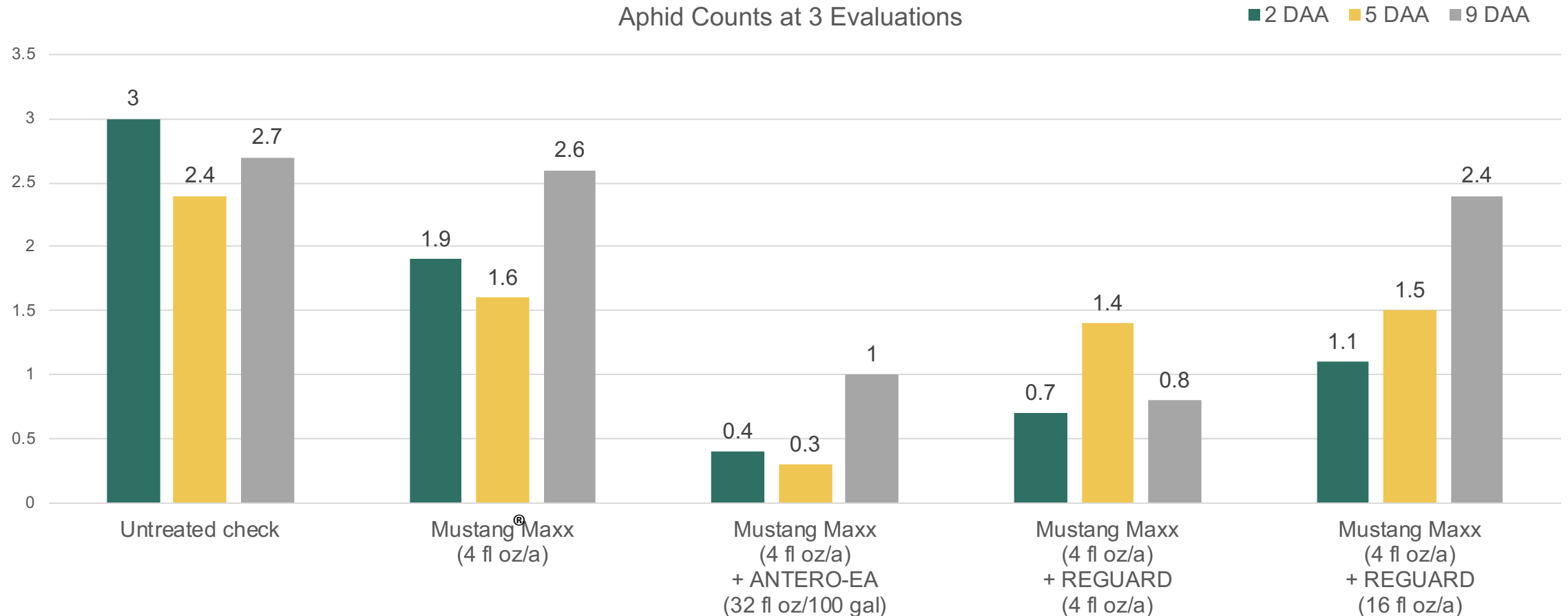
Yield Fresh Weight (lb/plot)



ANTERO-EA (16 fl oz/100 gal) produced statistically higher yield over Pristine alone.

Means followed by the same letter are not statistically different (LSD, P=0.05)

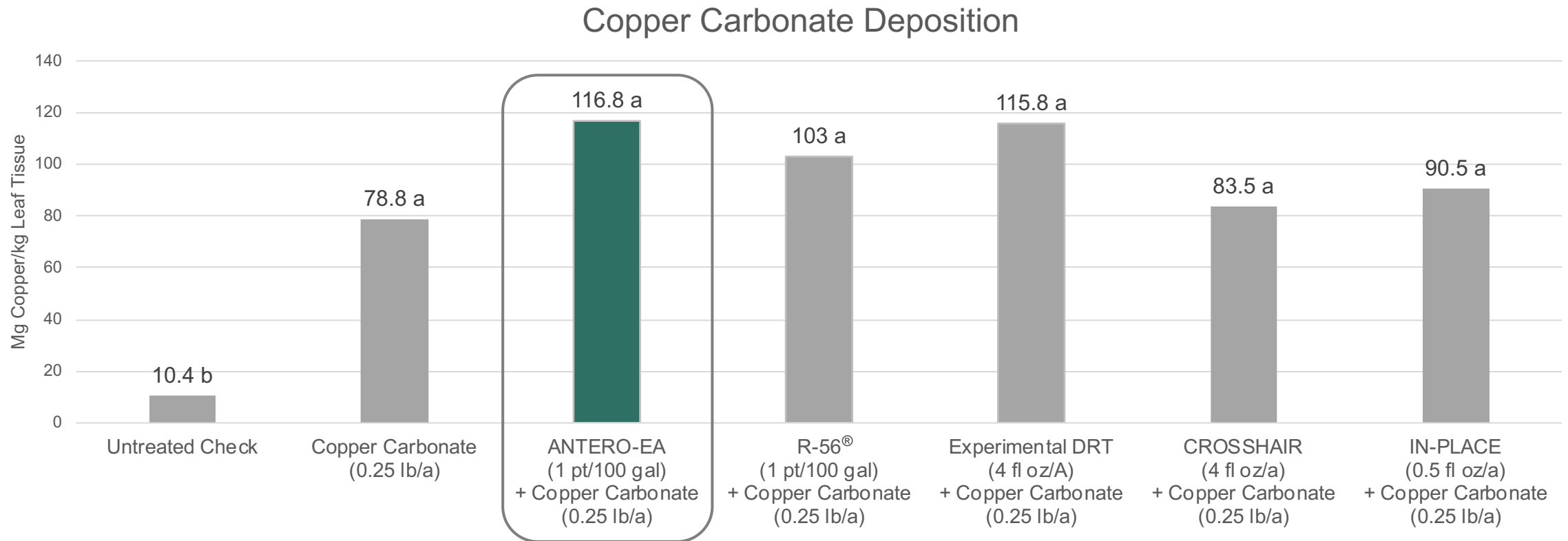
# Adjuvants for Increased Insect Control in Peas



No statistical differences

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# Improved deposition with ANTERO-EA



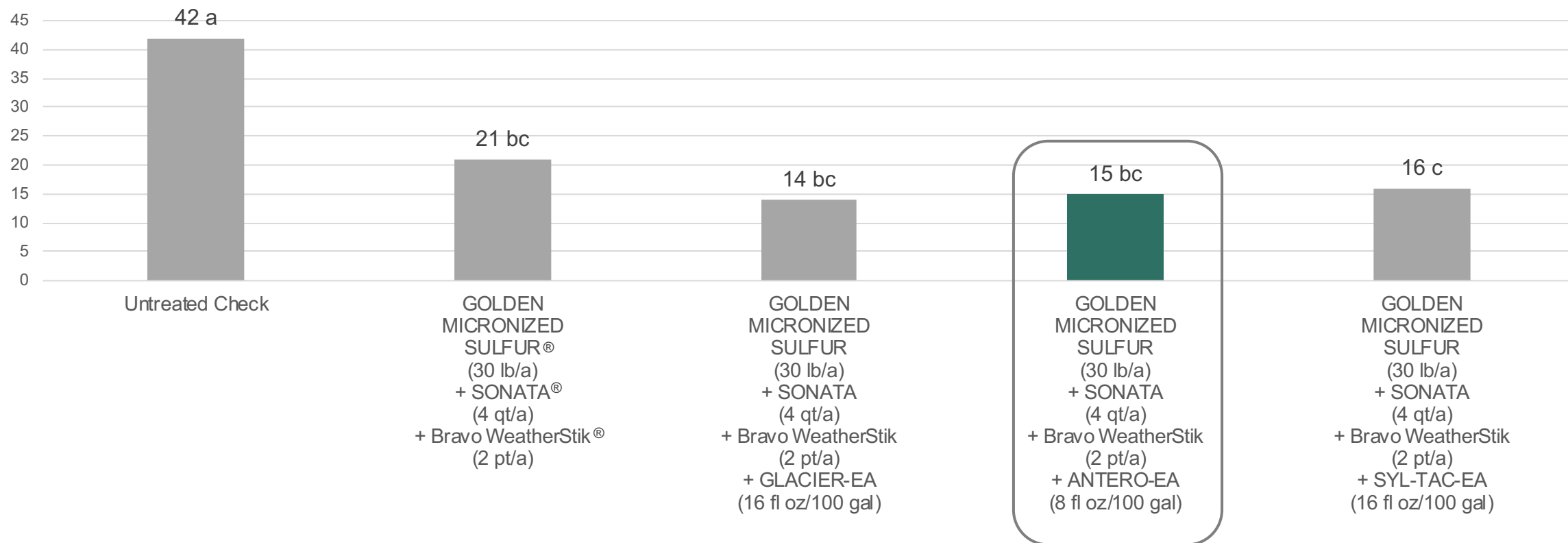
GPA: 40

Means followed by the same letter do not statistically differ (LSD,  $p=0.05$ ).

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# Improved Fungicide Activity

Tomato Powdery Mildew % Incidence – 7 DAH

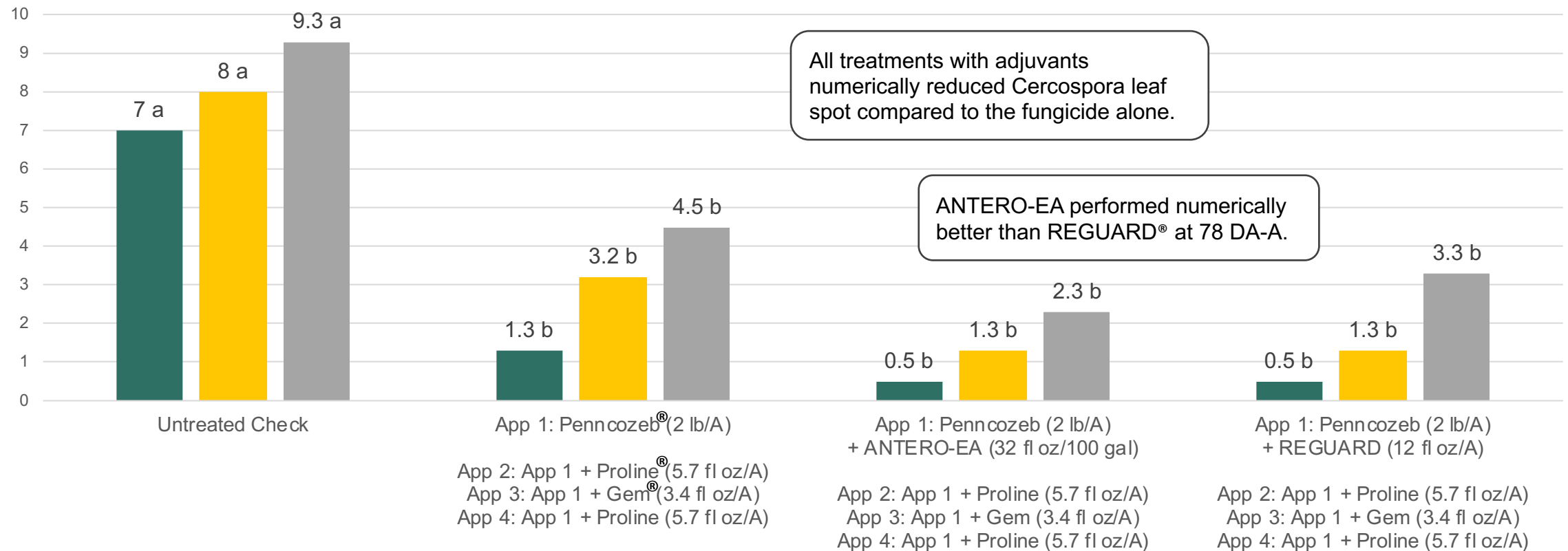


Means followed by the same letter do not statistically differ (LSD, p=0.05).

# Improved Fungicide Activity

Cercospora Disease Severity in Sugarbeets (0-10 scale)

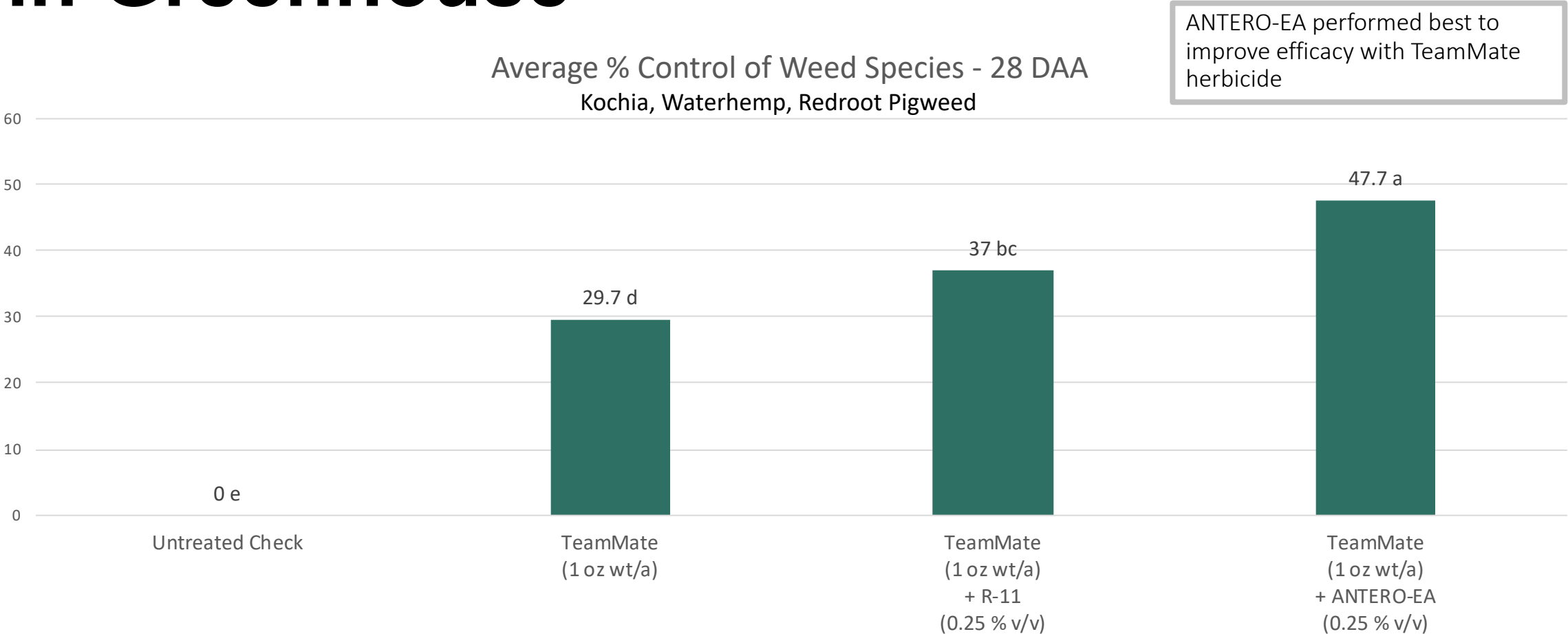
■ 49 DA-A ■ 64 DA-A ■ 78 DA-A



25 GPA

Means followed by the same letter do not statistically differ (LSD, p=0.05), and means from different evaluations (different colored bars) do not correspond.

# Adjuvants for Increased Weed Control in Greenhouse



Means followed by the same letter are not statistically different (LSD, P=0.05)



# RENEGADE-EA<sup>®</sup>

**Unique blend of methylated seed oil, UAN solution and a nonionic surfactant**

## **Benefits:**

- Enhanced retention, penetration and deposition
- Allows for use with non-selective tank mix combinations
- Improves pesticide efficacy
- Greater tank mix stability
- Aquatically labeled
- Excellent safety and handling





# ECO ADVANTAGE™



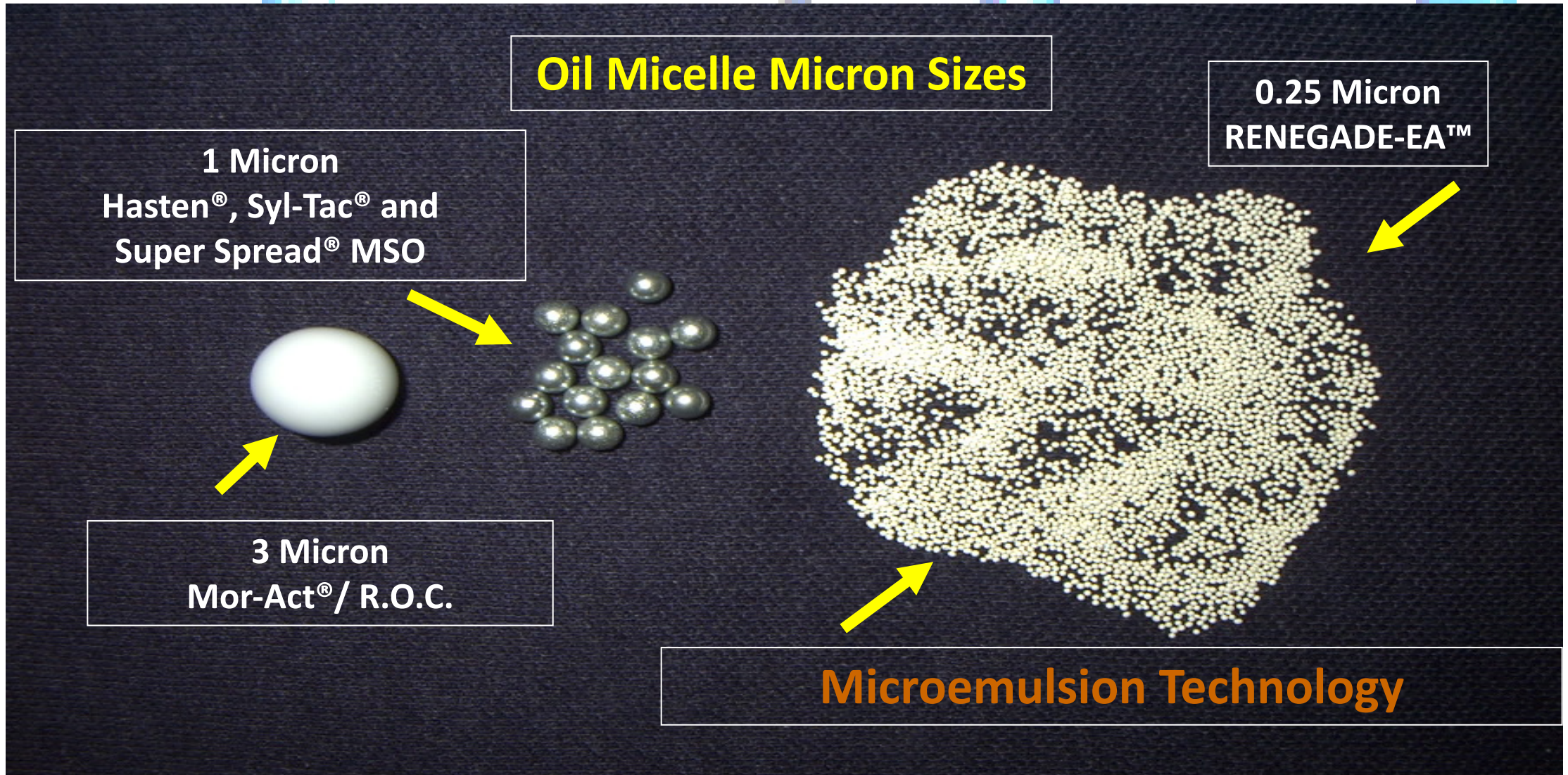
**RENEGADE-EA™** offers a unique blend of methylated seed oil, UAN solution and a nonionic surfactant. **RENEGADE-EA** improves wetting and stability in spray tank mixtures, as well as increases retention and penetration of herbicides on weed surfaces.



# RENEGADE-EA™

# Patented Microemulsion Technology

The technology reduces the oil/active ingredient molecule micron size in solution, greatly improving coverage and penetration for the targeted plant/weed.





# GLACIER-EA<sup>®</sup>

## Methylated seed oil (HSMSO) adjuvant

### Benefits

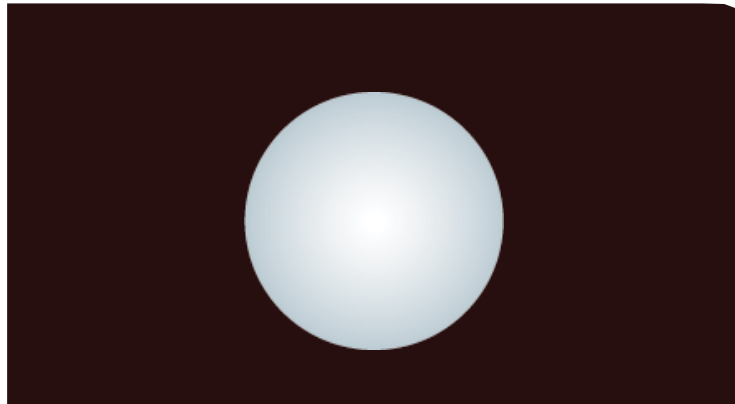
- Lower use rates than standard methylated seed oils
- Increased wetting and penetrating of the pesticide(s)
- Compatible with non-selective tank mixes – improves performance
- Improves desiccation and burndown
- Aquatically labeled
- Excellent safety and handling

# Hasten-EA vs. Glacier-EA

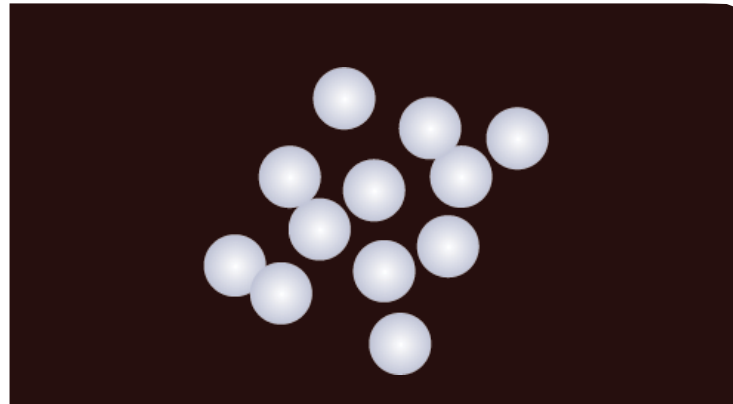
- ~ \$29.20/gal selling cost Hasten-EA cost per acre to grower at qt/100 and 100GPA \$7.30 50GPA \$3.65
- ~ \$55.62 per gallon gal Glacier-EA cost per acre to grower at 16 oz /100 and 100GPA \$6.95 50GPA \$3.47



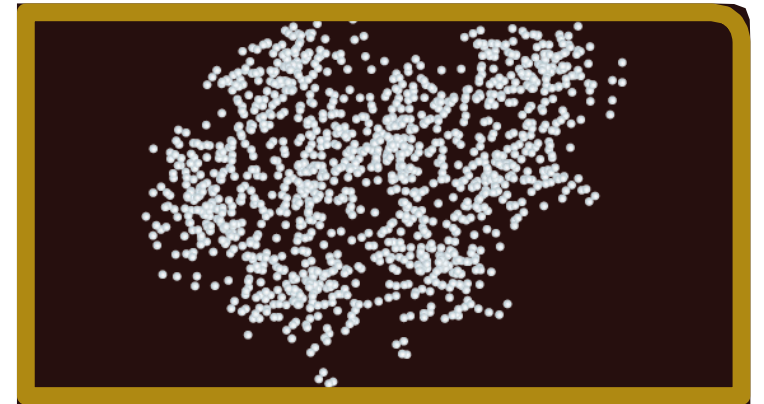
# Oil Micelle Micron Sizes



3 MICRONS  
CROP OIL CONCENTRATES  
(MOR-ACT®)



1 MICRON  
MODIFIED SEED OILS  
(HASTEN-EA®)



0.25 MICRON  
MICROEMULSION TECHNOLOGY  
(RENEGADE-EA and GLACIER-EA)

Microemulsion Technology creates a stable solution, allowing active ingredients better ability to absorb into the surface of the plant tissue.

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# GLACIER-EA™

## GLACIER-EA Features:

- High load methylated seed oil plus a proprietary nonionic surfactant.
- Designed to work with most pesticides, including herbicides, fungicides and insecticides.
- Formulation provides excellent tank mix compatibility properties.
- Low foaming technology.
- Labeled for aquatic use.
- NPE free product.

## GLACIER-EA Benefits:

- Allows Glacier-EA to be used at lower use rates than standard methylated seed oils.
- Increases wetting and penetrating of the pesticide(s) into the plant tissue
- Compatible with glyphosate tank mixes – improves performance.
- Improves desiccation and burndown over standard methylated seed oils
- Ability to use with aquatically labeled pesticides.
- Excellent safety and handling characteristics.

## Glacier E.A.

Most oil adjuvants antagonize glyphosate.

Most herbicides applied with glyphosate are lipophilic.

These include group 1,2,4,5,14,15 and 27.

Glyphosate is very water soluble. High water solubility causes slow absorption through plant cuticle.