

Cranberry Meeting

Adjuvants 101

Dan Comingore
Wilbur-Ellis Company
Branded Product Territory Manager

UNITED we stand....

United Airlines Travel Pillows



Jeas to Grow With®

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



Ideas to Grow With®

CPDA

CPDA Certified Products



- Started Certifying Products in 2001
- Probably in excess of 2000 adjuvants in marketplace.
- Currently 102 adjuvants have received CPDA Certification
- Wilbur-Ellis – 11 products CPDA Certified
- **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 off active ingredient	10.0%
TOTAL	100.0%
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.

 **ADJUVANTS**
Surfactant


WILBUR-ELLIS®
Ideas to Grow With®

R-11®

SPREADER ACTIVATOR - NONIONIC SURFACTANT

Surfactant Content.....80%

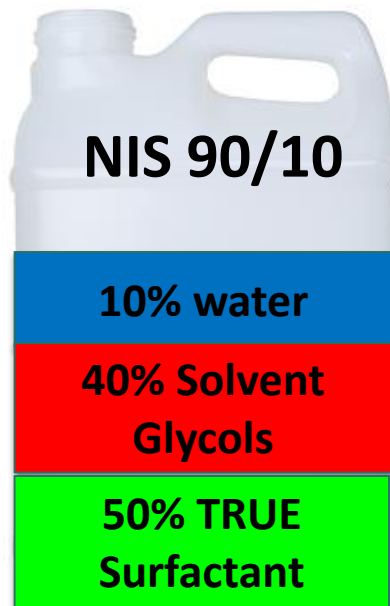
CA Reg. No. 2935-50142



NIS Comparison SOLVENT or SURFACTANT?



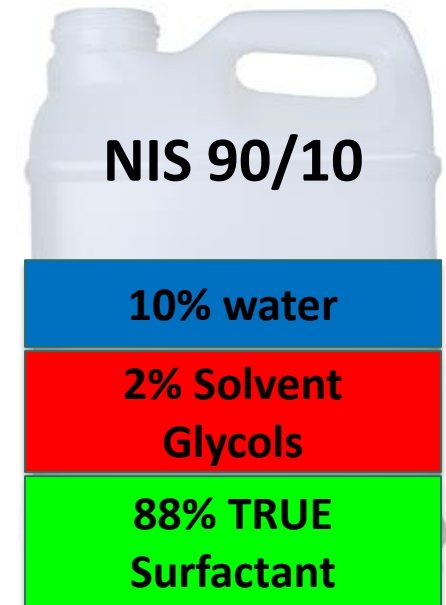
SUPER SPREAD® 90



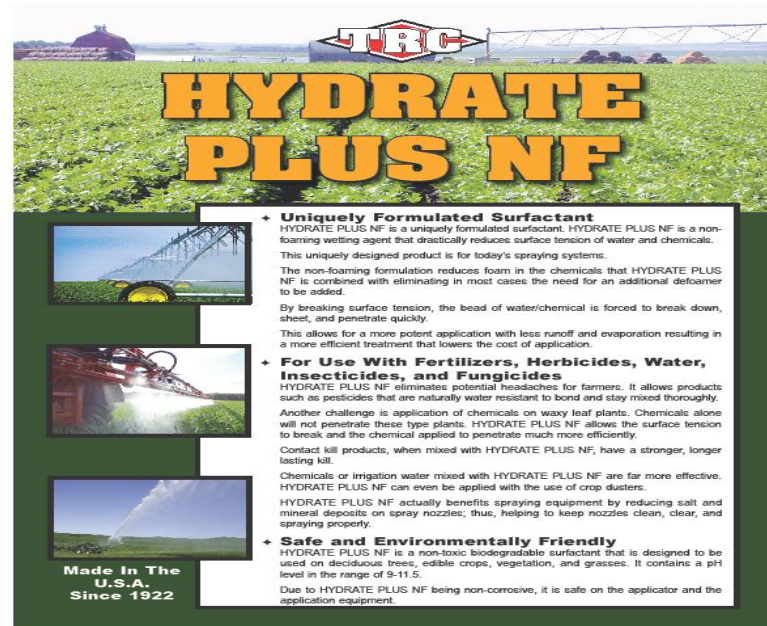
R-11®



RAINIER-EA™



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™

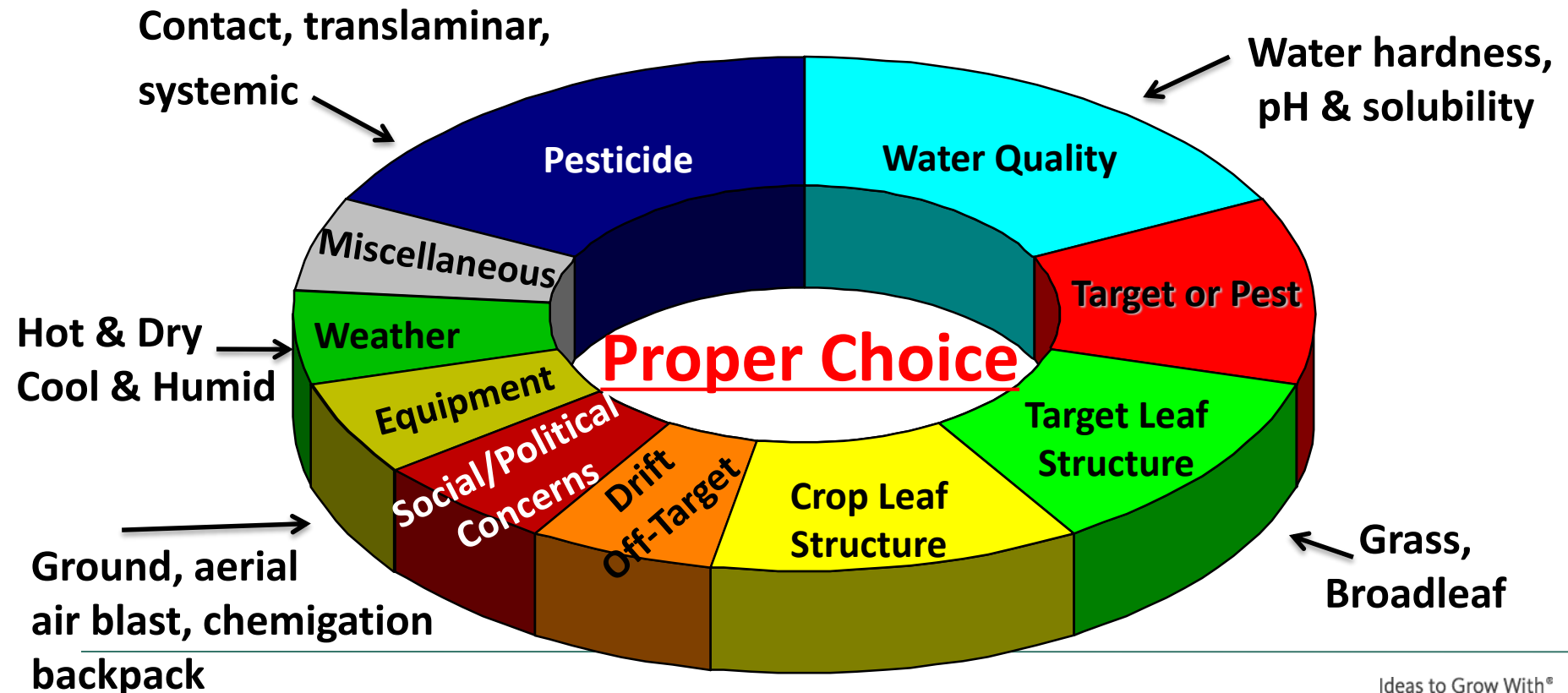
 **ADJUVANTS**
Surfactant
SUPER SPREAD® 7000

 **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

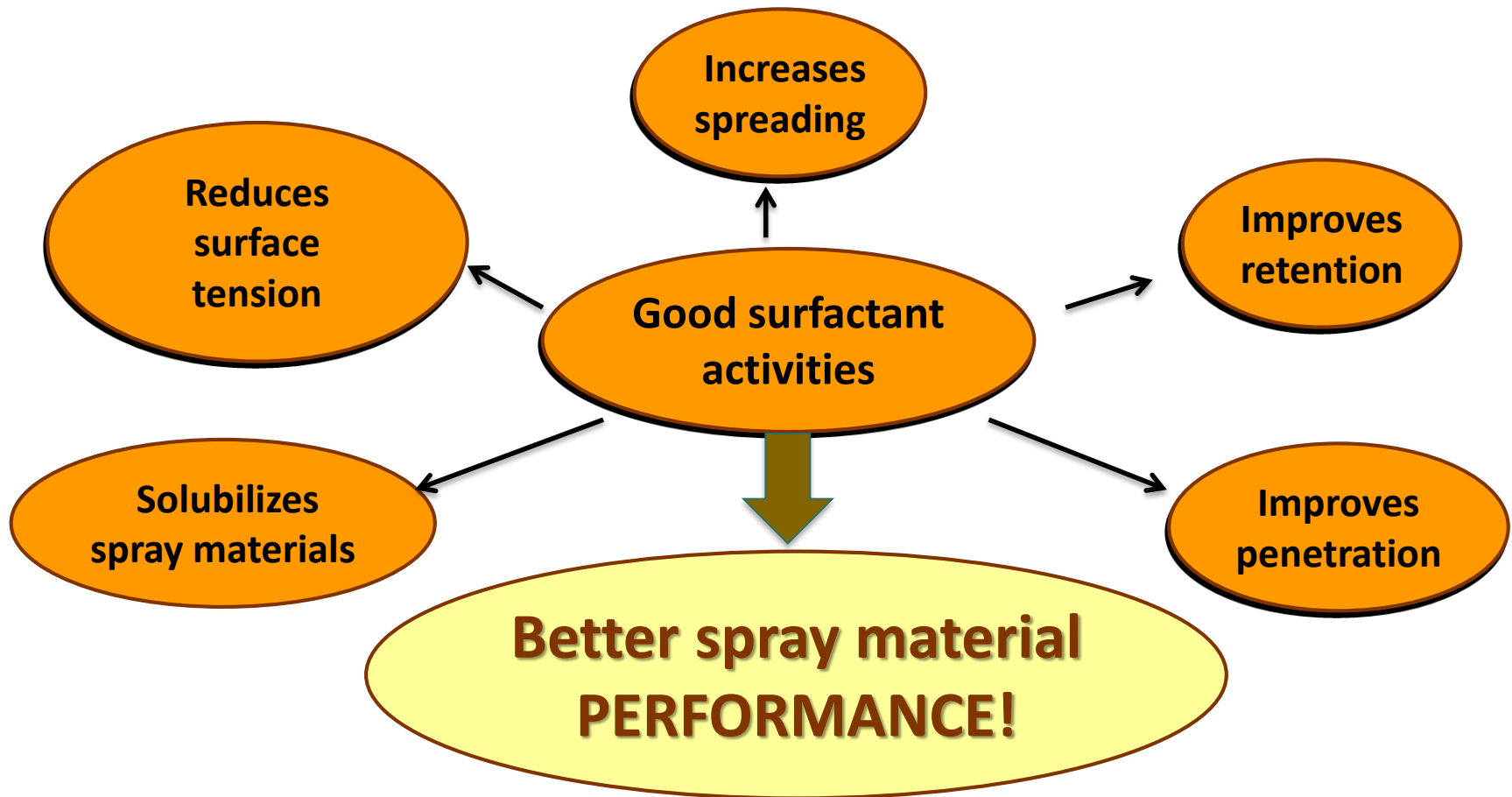
Surfactant Types

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



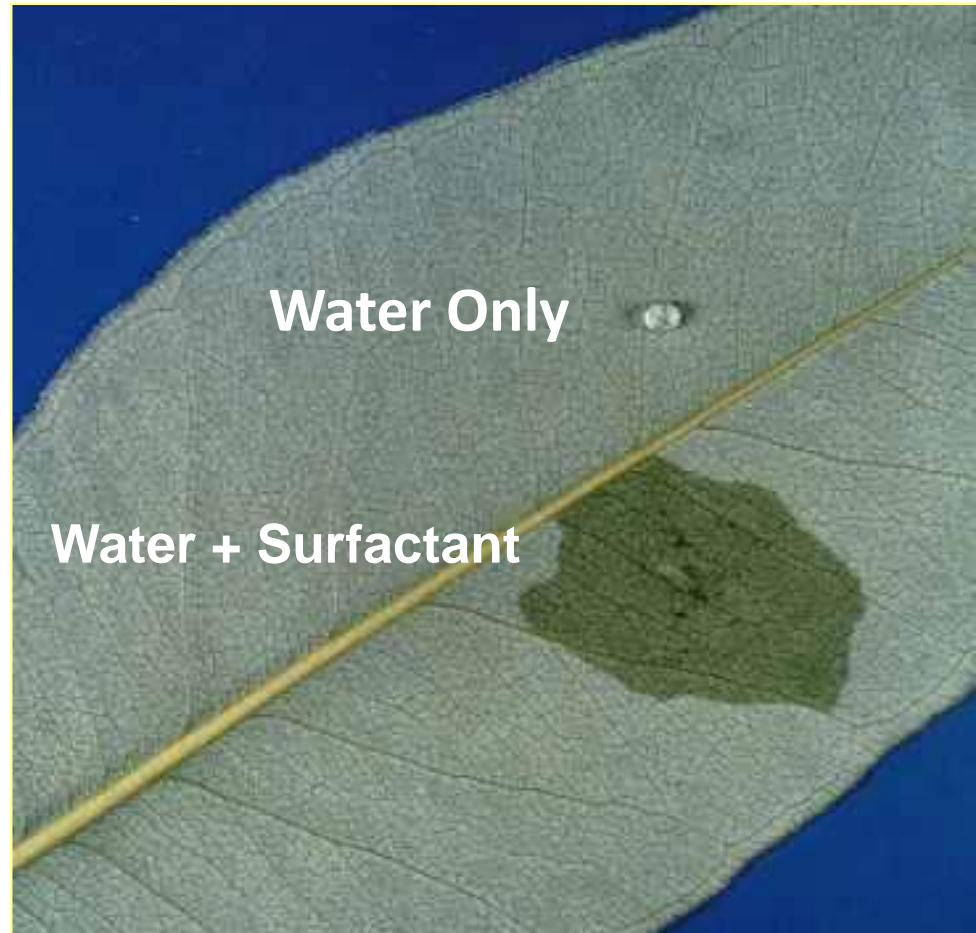
Spray Droplet Without Surfactant

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



Surfactant Effects

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

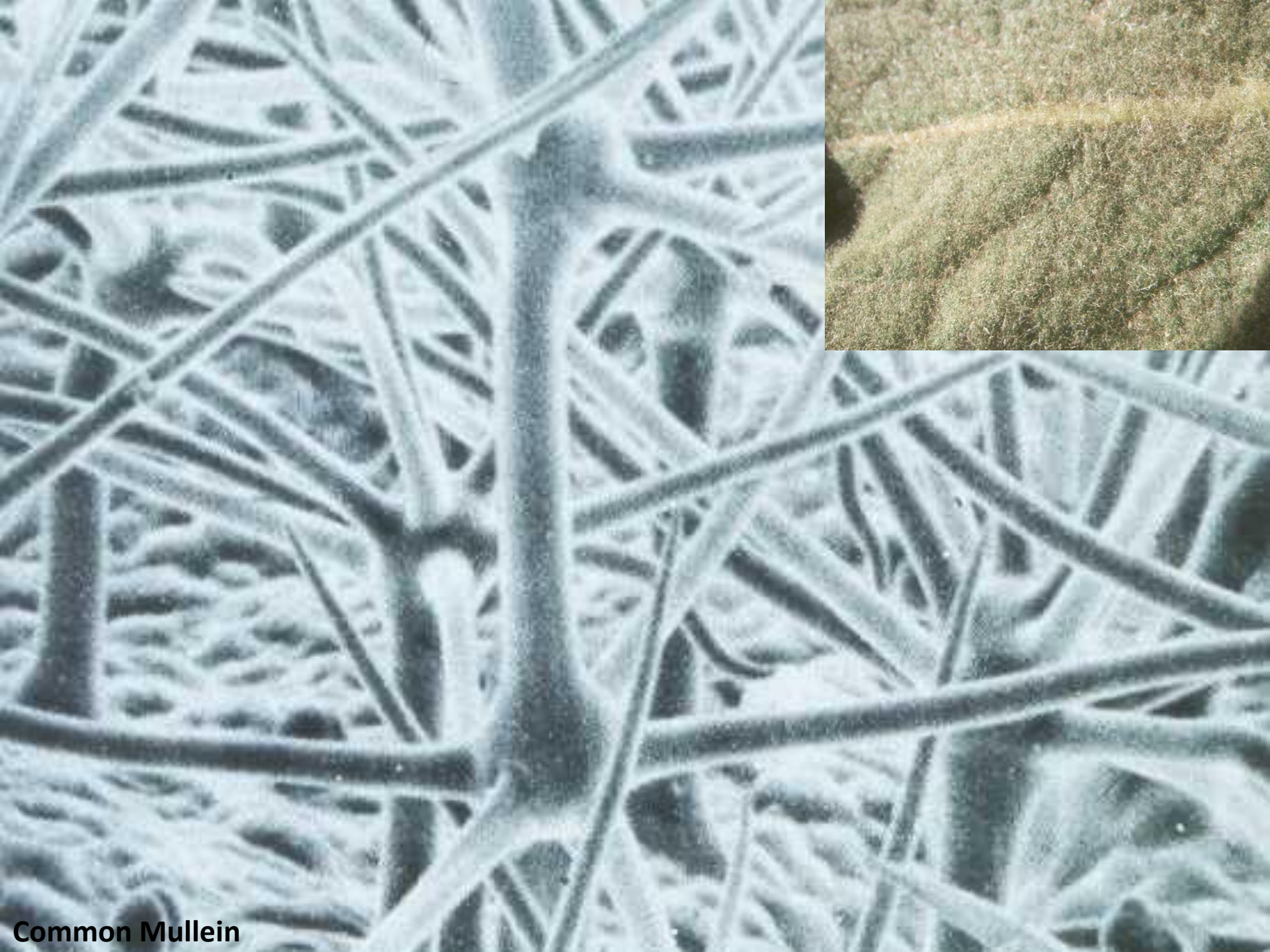


Japanese Maple with and without ProNatural® Spreader-Sticker



With Surfactant

Without Surfactant



Common Mullein

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

- Super Spread MSO® is an Modified Seed Oil (**MSO**)
 - Exceptional penetration
- R-11® is a nonionic surfactant (**NIS**)
 - Spreader-Activator
- Mor-Act® is a Crop Oil Concentrate (**COC**)
 - Coats versus penetrate

Where do you want the product?

- Do 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

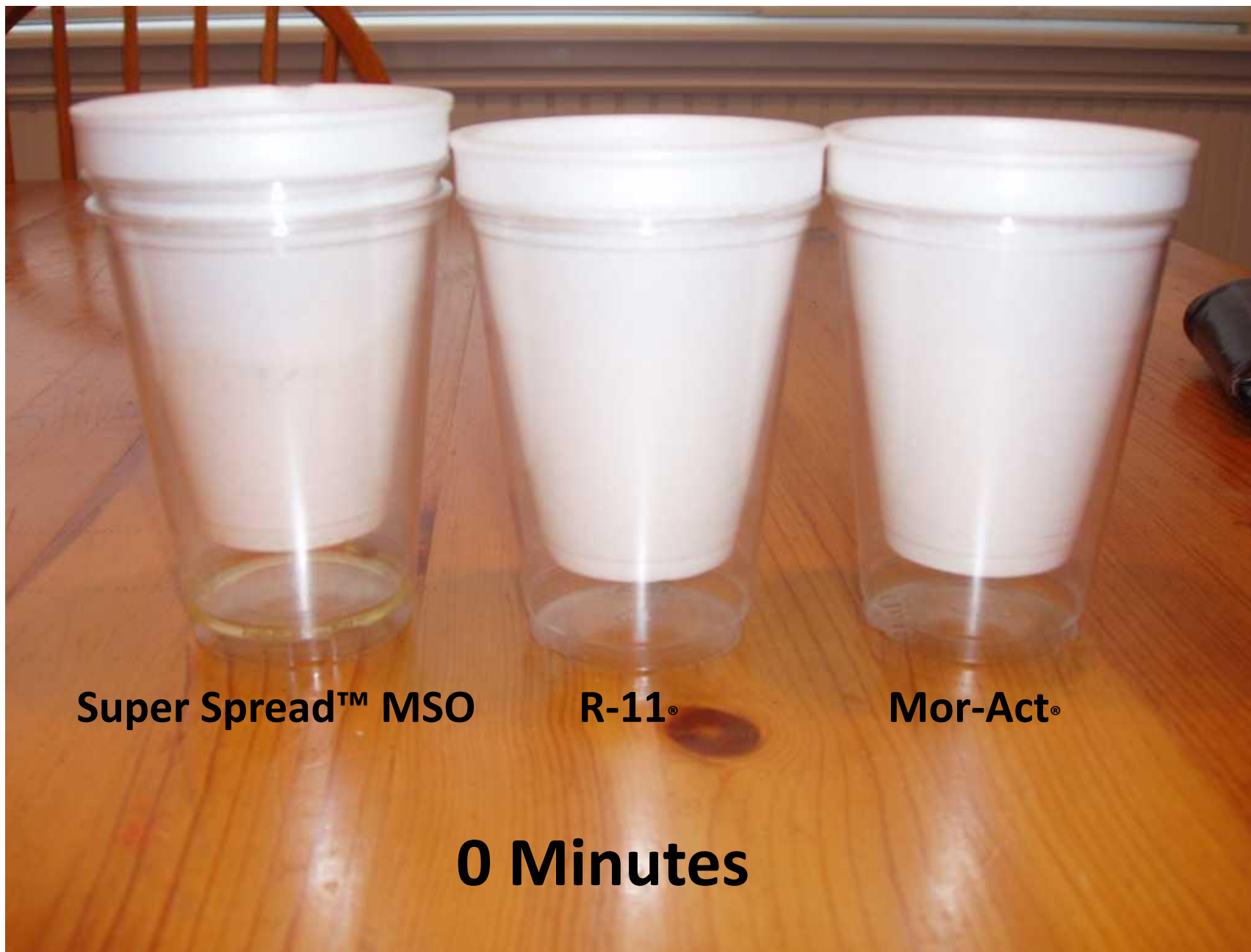


R-11®



Mor-Act®

0 Minutes

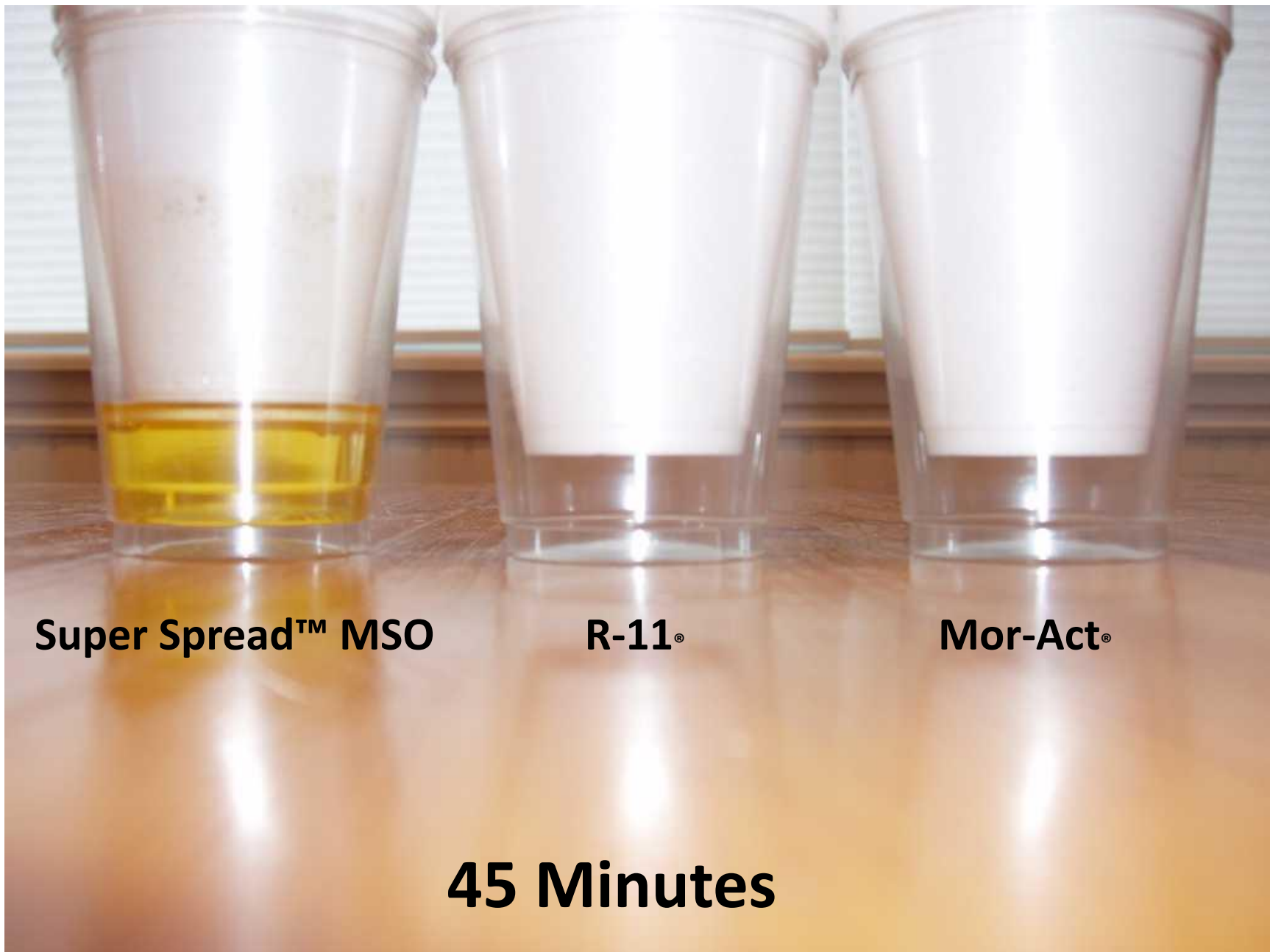


Super Spread™ MSO

R-11®

Mor-Act®

0 Minutes



Super Spread™ MSO

R-11®

Mor-Act®

45 Minutes

Trump's Foreign Policy....



The Importance of Water Quality!!

Why Is Water Important?

Water is the carrier for **98%** of all pesticides sprayed.

Once you put pesticides into bad water the damage is done and **can't** be reversed.

When Do You Treat?

- If you are conditioning your water for;
 - pH adjustment
 - up
 - down
 - water hardness

YOU MUST.....

**Treat the water before adding any
pesticide to the spray water !!!!**

What Are The Problems?

pH Sensitivity

Certain spray materials break down if spray water is either too **BASIC** (high pH) or **ACIDIC** (low pH).

Solubility of Pesticides

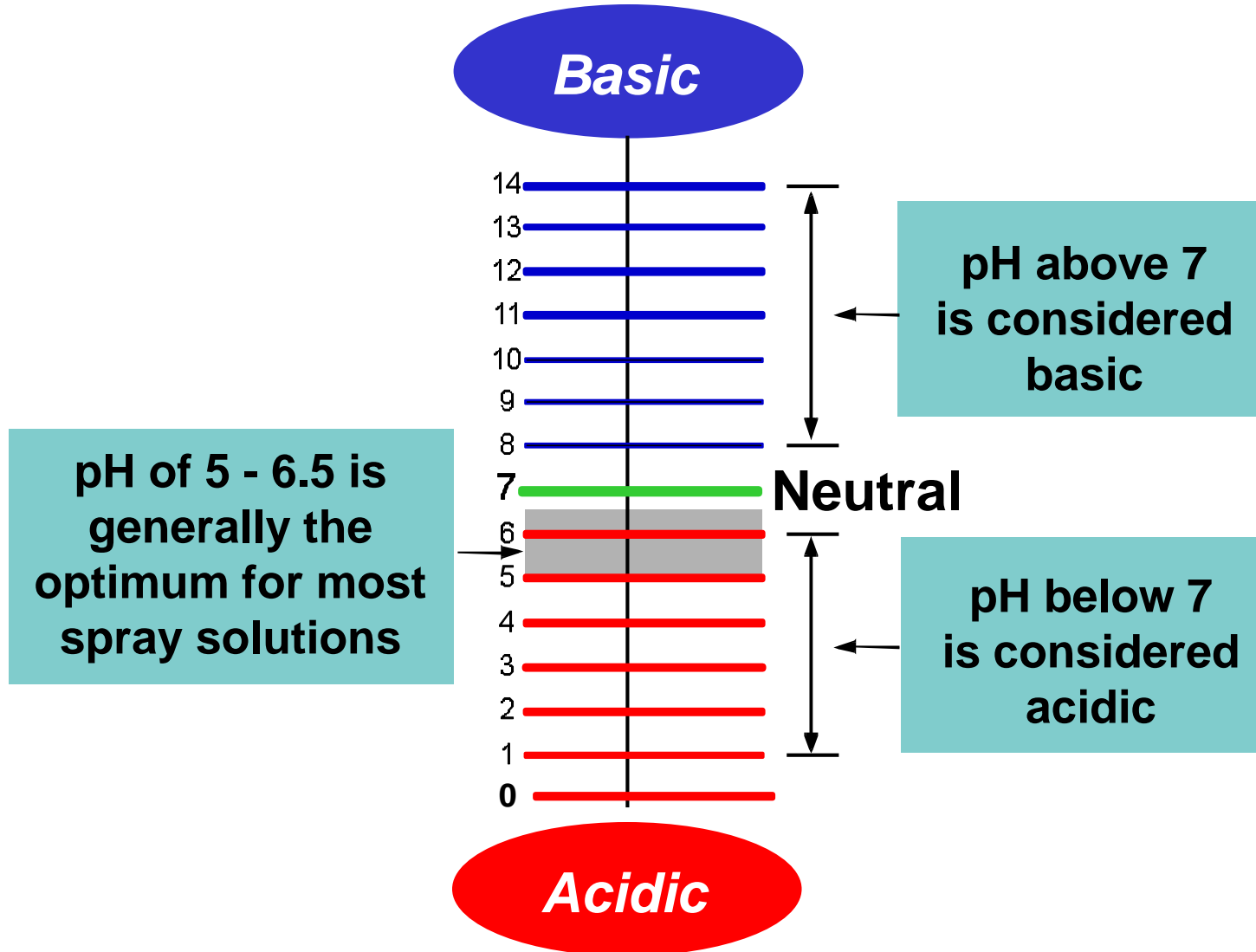
- Some pesticides increase in solubility as the spray water pH increases.

Mineral Antagonism

- Water Hardness (dissolved minerals) directly interfere with a broad range of spray materials.
 - **Calcium**
 - **Magnesium**
 - **Iron**
 - **Sodium**

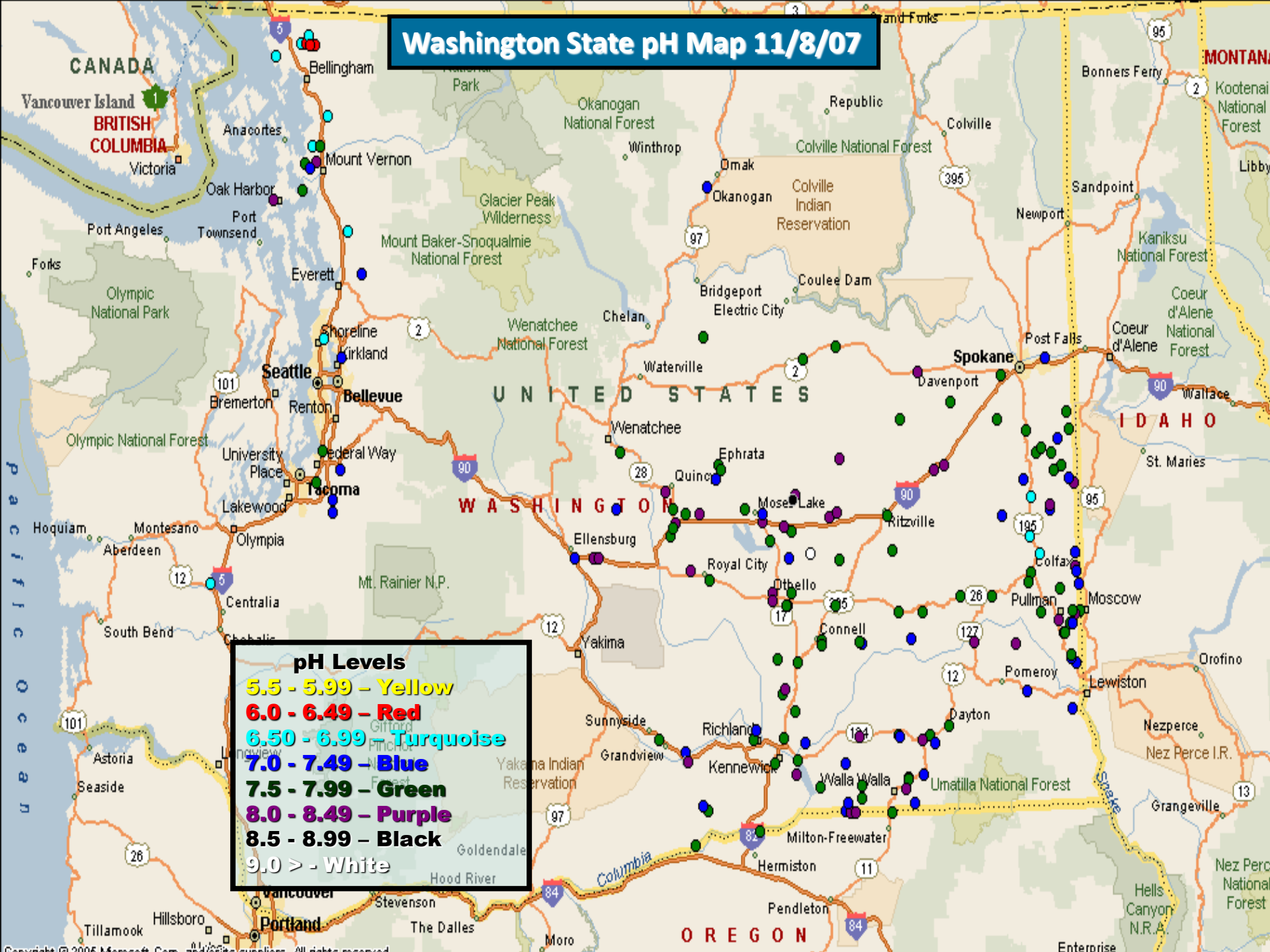
pH Sensitivity

pH Chart



What Is Your Spray Water pH?

Washington State pH Map 11/8/07



pH Sensitivity

- ❑ Generally, the ideal pH for water used in applying spray materials is slightly acidic (**pH 5 to 6.5**) but some exceptions exist. Read Labels.
- ❑ Sulfonylureas such as **Ally®**, **Escort®**, **Amber®**, **Harmony®Extra**, **Express®** and **Accent®** begin to degrade when left in spray solution that is below pH 7.
- ❑ Some herbicides, insecticides and fungicides, such as **Topsin®**, **Captan™** & **Imidan®** break down in basic (pH above 7) **ALKALINE HYDROLYSIS.**

Imidan[®]

Agricultural Insecticide

Effects of pH on Imidan Half Life

<u><i>pH</i></u>	<u><i>Half Life</i></u>
5.0	178 hours
5.5	92 hours
6.0	36 hours
6.5	14 hours
7.0	10 hours
7.5	2 hours
8.2	33 minutes

Effect of pH on Residual Efficacy of Imidan J. Attaway, CA. 1996.
Effects of Field-Aged Residues on Efficacy J. Brunner, WSU. 1996.

Solubility vs Spray Water pH

- As the spray water pH increases some products increase in solubility.
- As solubility increases, it increases the bioavailability of active ingredient for better and more consistent efficacy.

Spray Solution pH vs Solubility

	pH 5.0	pH 7.0	pH 9.0
Maverick	18 ppm	1,627 ppm	482 ppm
Amber	32 ppm	815 ppm	13,500 ppm
Peak	30 ppm	3,580 ppm	n/a
Glean	587 ppm	31,800 ppm	n/a
Finesse (Glean + Ally)	587 ppm 548 ppm	31,800 ppm 2,790 ppm	n/a 213,000 ppm
Ally	548 ppm	2,790 ppm	213,000 ppm
Express	48 ppm	2,040 ppm	18,300 ppm
Harmony Extra (Harmony GT + Express)	223 ppm 48 ppm	2,240 ppm 2,040 ppm	8,830 ppm 18,300 ppm
Harmony GT	223 ppm	2,240 ppm	8,830 ppm

Spray Solution pH vs Solubility

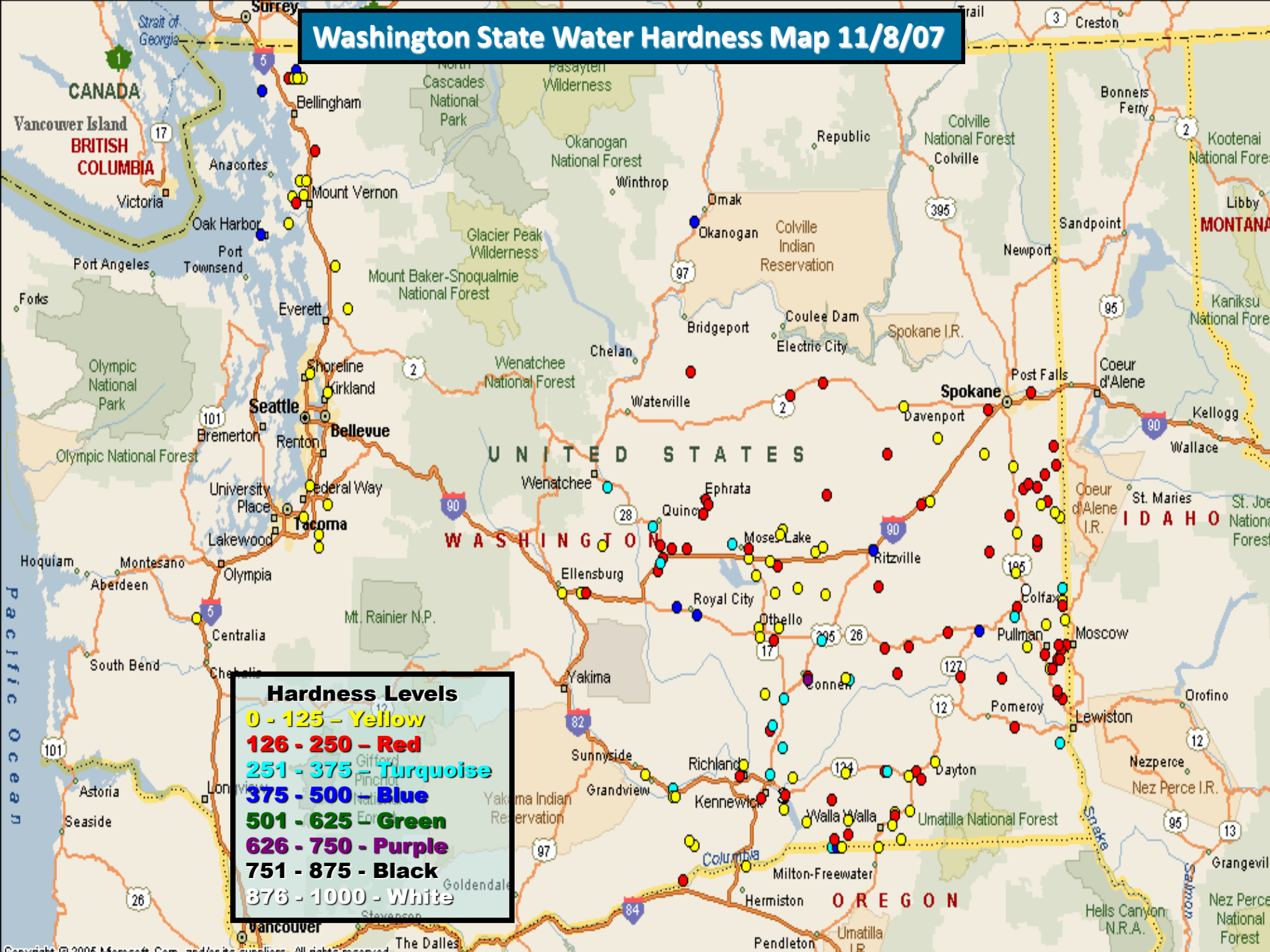
	pH 5.0	pH 7.0	pH 9.0
Olympus	2,900 ppm (pH 4.0)	42,000 ppm	42,000 ppm
Osprey	7 ppm	483 ppm	15,390 ppm
Everest	3,000 ppm	44,000 ppm	44,000 ppm
Rave	32 ppm	5,815 ppm	13,500 ppm
Ally Extra	548 ppm	2,790 ppm	213,000 ppm
Achieve	6 ppm	7 ppm	9,800 ppm
UpBeet	3 ppm	110 ppm	11,000 ppm
Poast	257 ppm	4,390 ppm	n/a
Beacon	3 ppm	243 ppm	5,280 ppm

Spray Solution pH vs Solubility

	pH 5.0	pH 7.0	pH 9.0
Oust	10 ppm	300 ppm	n/a
Telar	587 ppm	31,800 ppm	n/a
Escort	548 ppm	2,790 ppm	213,000 ppm
Landmark (Oust + Telar)	10 ppm 587 ppm	300 ppm 31,800 ppm	n/a n/a
Weststar	10 ppm	300 ppm	n/a
Oust Extra (Oust + Escort)	10 ppm 548 ppm	300 ppm 2,790 ppm	n/a 213,000 ppm

What Is Your Spray Water Hardness?

Washington State Water Hardness Map 11/8/07



Mineral Antagonism

- ❑ Water hardness (dissolved minerals) directly interfere with a broad range of spray materials.

Mineral Antagonism

Calcium [Ca⁺⁺]

Magnesium [Mg⁺⁺]

Iron [Fe⁺⁺]

Sodium [Na⁺]

Mineral Antagonism

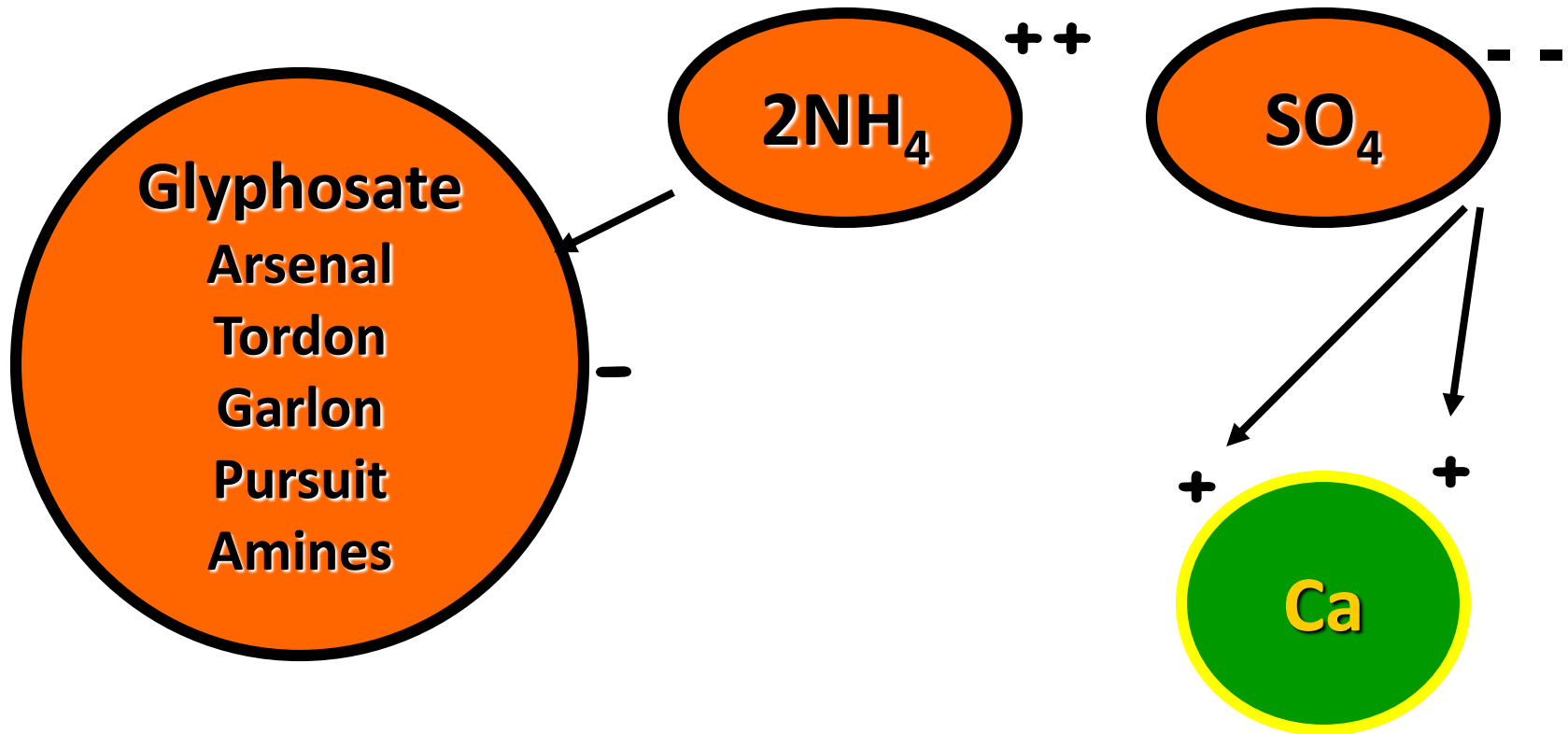
❑ **Dissolved minerals** specifically interfere with the performance of some herbicides such as;

Glyphosate, Achieve[®], Poast[®], Pursuit[®], Raptor[®], Beyond[®], Select[®], Dicamba, Liberty[®], Rely[®], 2,4-D Amine and MCPA Amine.

2,4-D is completely deactivated at 500 ppm water hardness.

Glyphosate less effective noticeably as low as 150 ppm hardness.

Addition of Ammonium Sulfate...Why?



The Sulfate ion “blocks” the mineral cation.

The Ammonium ions attach and “escort” the glyphosate into the plant.

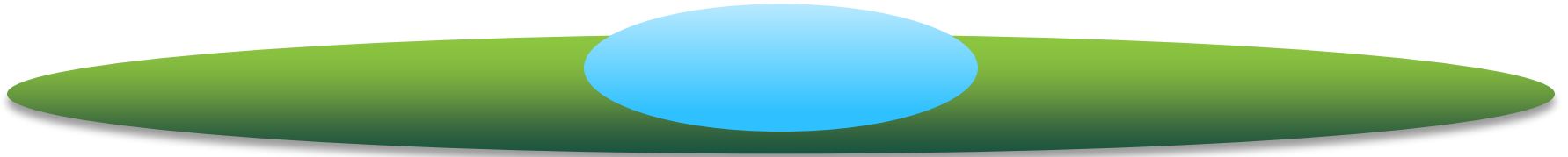
Mineral Antagonism

Time of Application | 85° F



Evaporation of Spray Droplet

Effects on Salt Concentration



Time of Application: Hardness = 100 ppm = Low
7.5 % Glyphosate antagonism

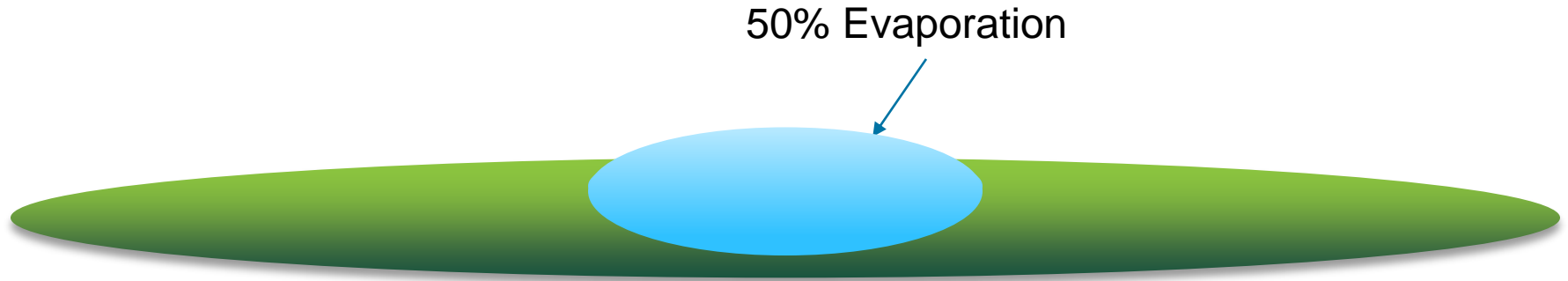
Mineral Antagonism

2.5 Minutes Post-Application



Evaporation of Spray Droplet

Effects on Salt Concentration



50% Evaporation: Hardness = 200 ppm = Low
15 % Glyphosate antagonism

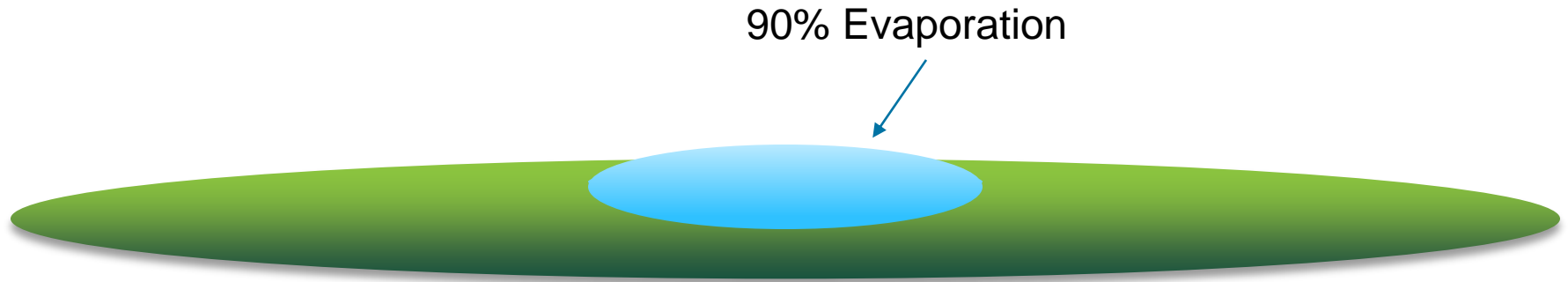
Mineral Antagonism

4 Minutes Post-Application | Note Formation of Salt Deposits

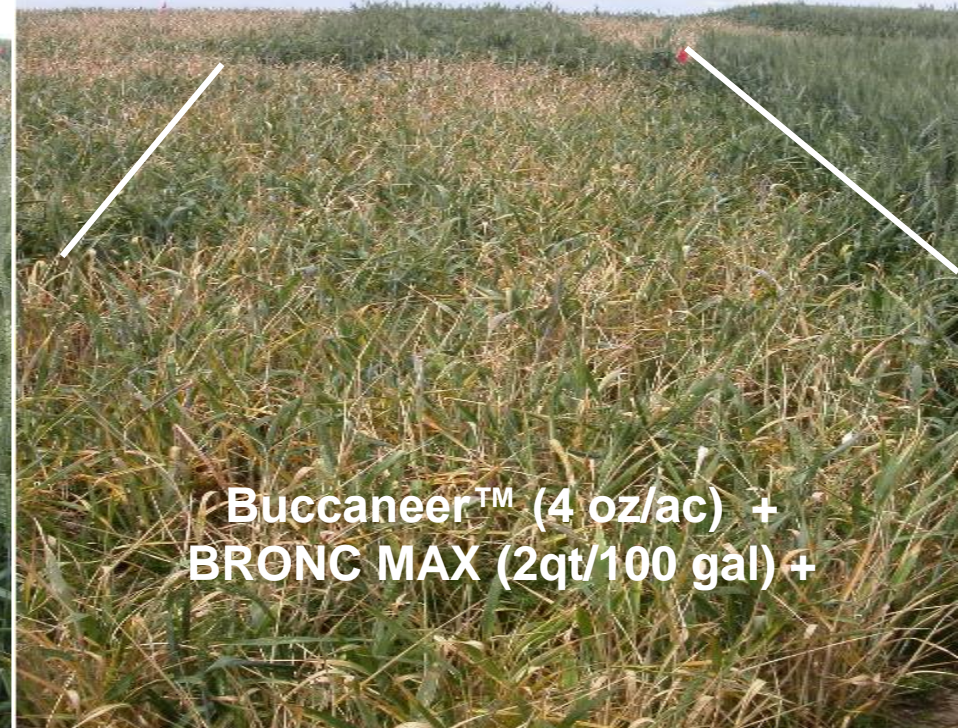


Evaporation of Spray Droplet

Effects on Salt Concentration



90% Evaporation: Hardness = 900 ppm = **Extremely High**
67.7 % Glyphosate antagonism



University of Idaho Trials 2005 - Dr. Donn Thill
Using sub-lethal rates of Buccaneer™ - Water Hardness of 1100 ppm

Ideas to Grow With®

Herbicides That May Be Susceptible To Hard Water Tie Up

- **2,4-D** (amine) – (Base Camp™ Amine 4, Weedar® 64, Broadrange™ 55)
- **2,4-DB** (amine)
- **MCPA** (amine) (WIL-POWER®, Vengeance® Plus)
- **Dichlorprop** (amine)
- **Mecoprop** (amine)
- **Dicamba** (Banvel®, Clarity®, Vanquish®)
- **Picloram** (Tordon®)
- **Triclopyr** (Garlon®, Crossbow™, WIL-POWER®, Vengeance® Plus, DeadLock™)
- **Clopyralid** (Stinger®, Curtail®, Curtail® M, Transline®, Lontrel®, Confront®, Redeem®, WideMatch™)
- **Aminopyralid** (Milestone™, Milestone™ VM, Milestone™ VM Plus, CleanWave™, ForeFront™)
- **Quinclorac** (Q-4®, Facet®, Paramount®)
- **Sethoxydim** (Poast®)
- **Clethodim** (Select®, Select Max™, Envoy®, Volunteer™, Shadow®)
- **Tralkoxydim** (Achieve®)
- **Imazamethbenz** (Assert®)
- **Imazapyr** (Arsenal®, Chopper®, Sahara®, Stalker®, Habitat®)
- **Imazaquin** (Scepter®)
- **Imazamox** (Raptor®, Beyond®, ClearCast™, ClearMax™)
- **Imazapic** (Plateau®, Journey®)
- **Imazethapyr** (Pursuit®)
- **Glufosinate** (Liberty®, Rely®, Ignite®, Finale®)
- **Glyphosate** (Roundup®, Touchdown®, Agri Star® Landmaster® BW)

Revised 1/1/09

Ideas to Grow With®

Thank You!!