



# Water Quality and Herbicides

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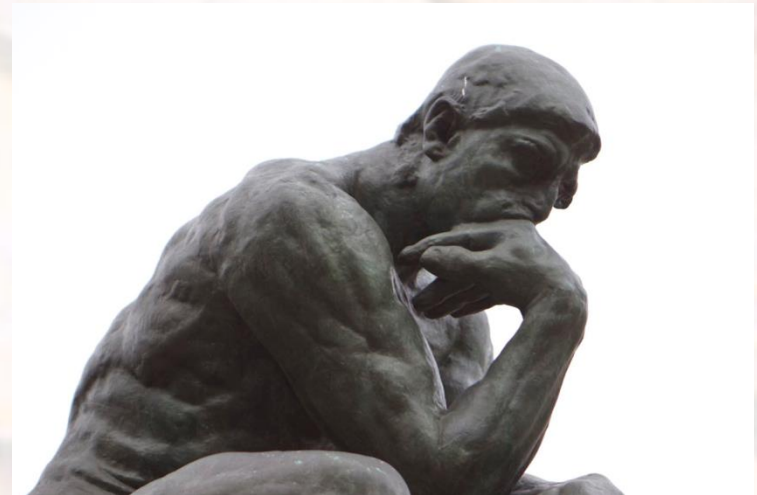


UNIVERSITY OF  
**GEORGIA**

College of Agricultural &  
Environmental Sciences

# A common question?

- Should I use AMS with that?





# Important Water Qualities



- turbidity
- pH
- hardness



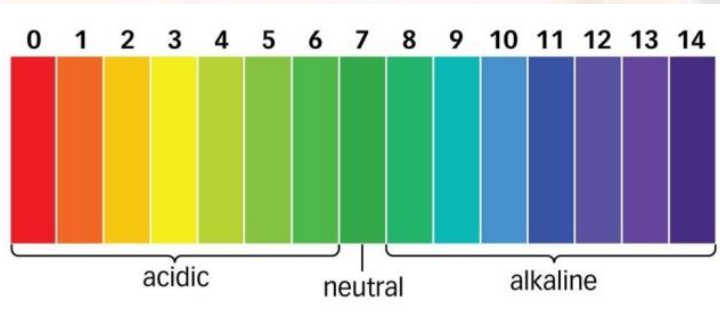
# Turbidity

- Suspended solids, soil, and OM
- Can affect herbicides with high  $K_{oc}$  values
  - *Paraquat*
  - *Glyphosate*
- Don't use muddy water!



Herbicide	$K_{oc}$ (mL/g)
paraquat	1,000,000
glyphosate	24,000
s-metolachlor	200
atrazine glufosinate	100
dicamba	2

# Water pH



- Measurement of acidity/alkalinity
  - $<7.0 = \textit{acidic}$
  - $>7.0 = \textit{alkaline}$
  - $7.0 = \textit{neutral}$
- 4.0 to 7.0 is fine
- Alkaline hydrolysis above 7



# Alkaline Hydrolysis

- Valor (flumioxazin)
- Soil-Water Half-Life
  - *pH 5.0 = 3.4 to 5.1 days*
  - *pH 7.0 = 21.4 to 24.6 hours*
  - *pH 9.0 = 12.6 to 22.0 minutes*



# Water Hardness

- Measure of cations (+) in solution
- Ca, Mg, Fe, K, Na
- Can influence the performance of weak acids
  - *glyphosate*
  - *glufosinate*

USGS Category	CaCO <sub>3</sub> (ppm)
Soft	0-60
Moderately Hard	61-120
Hard	121-180
Very Hard	> 180

WHO Category	Total Hardness (ppm)
Soft	0-114
Moderately Hard	114-342
Hard	342-800
Very Hard	> 800

# Ammonium Sulfate and Hard Water



- $(\text{NH}_4)_2\text{SO}_3$
- Overcomes antagonistic effects of cations
- How?
  - *Lowers pH*
  - *$\text{NH}_4^+$  binds with herbicide*
  - *$\text{SO}_4^-$  binds with cations*
  - *8.5-17 lbs/100 gals (dry)*
  - *2.5-5.0 gals/100 gals (liquid)*

# Water Conditioners



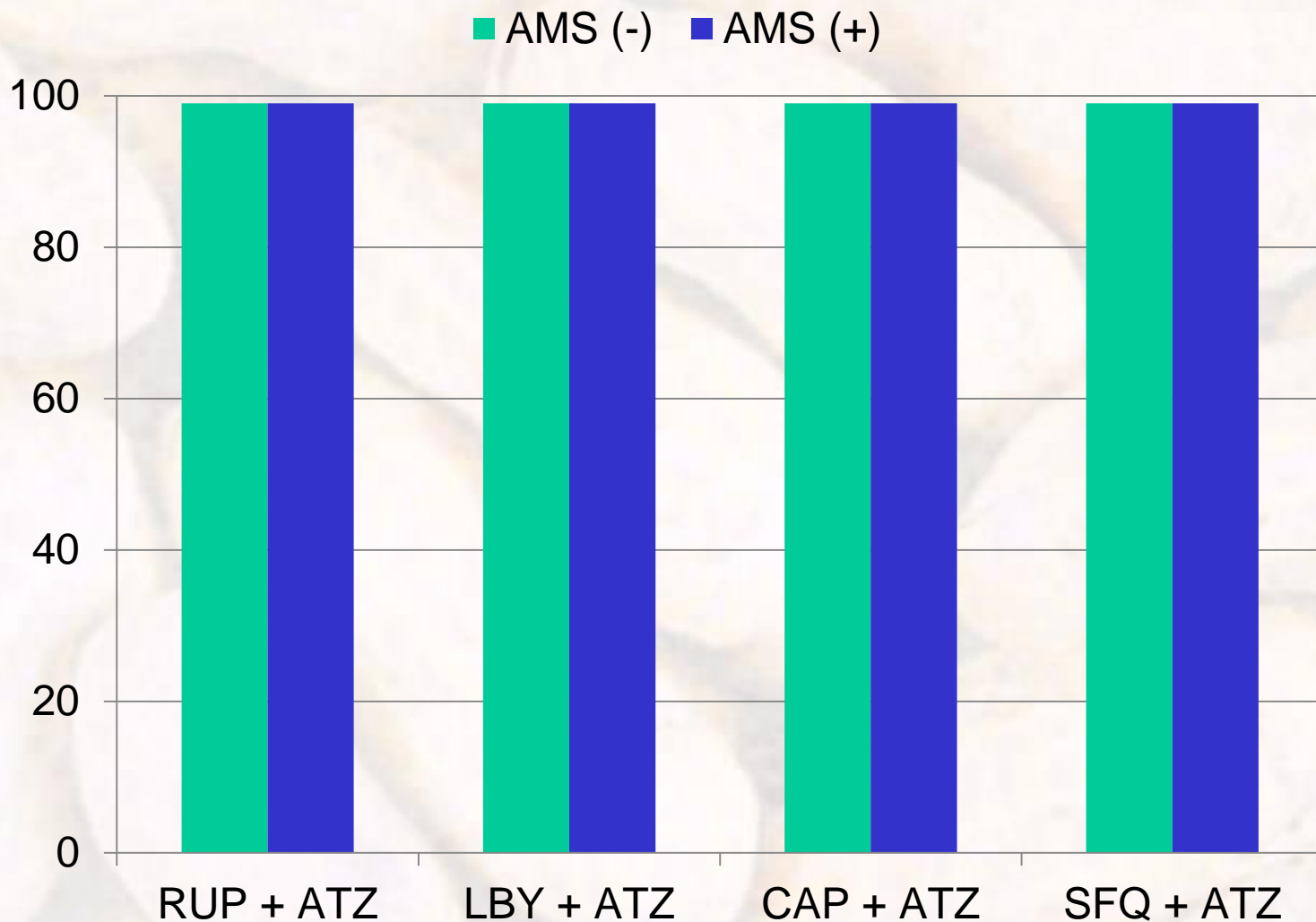
- CPS
- Non-AMS water conditioner
- 0.25% to 0.50% v/v
- ~\$34/gal
- \$0.85-\$1.70/A – 10 GPA

# QUEST<sup>®</sup>

- Helena
- Non-AMS water conditioner
- 0.25%-0.50% v/v
- ~\$24/gal
- \$0.60-\$1.20/A – 10 GPA



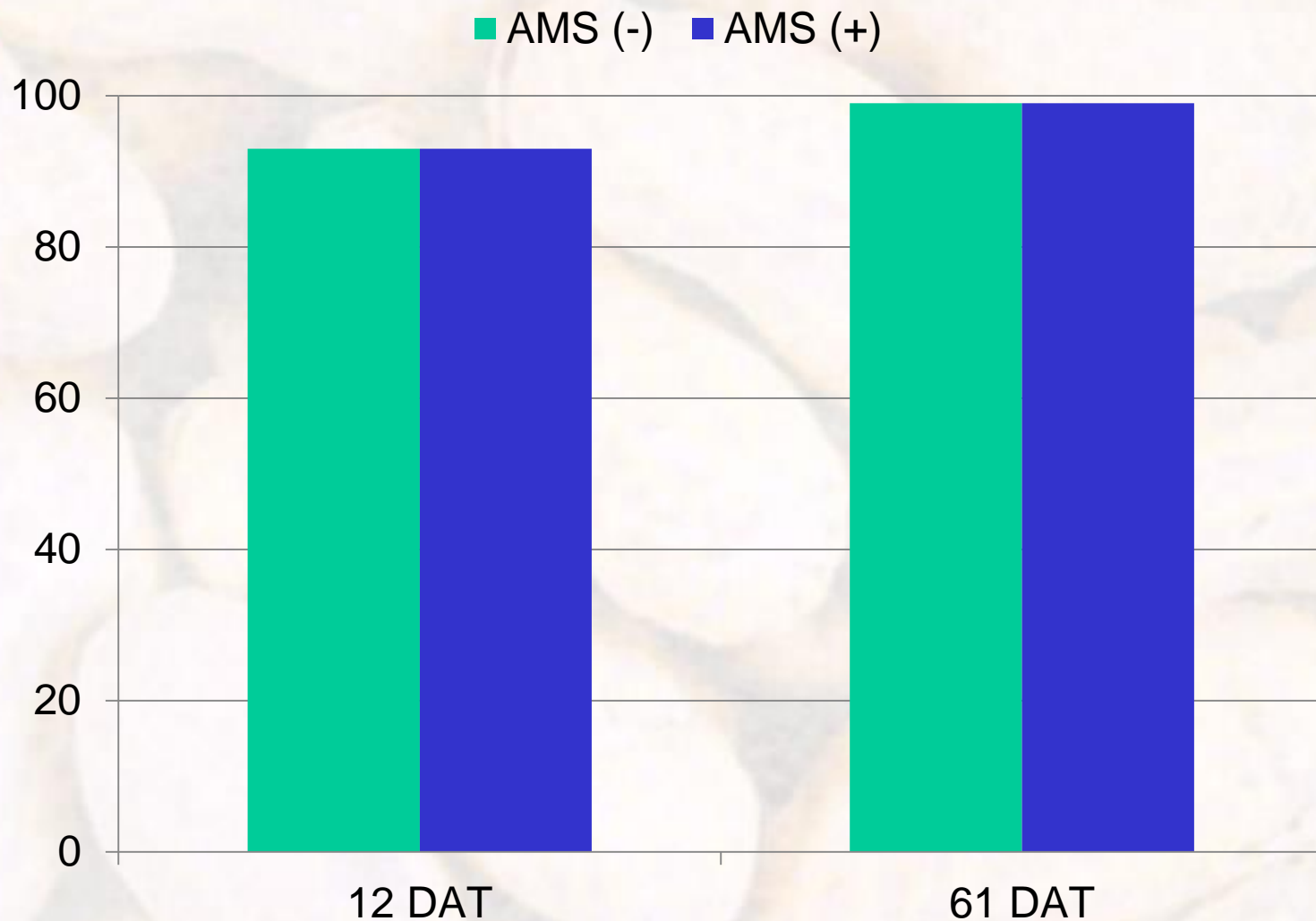
# In the absence of hard water, is AMS really needed?



RUP = Roundup  
ATZ = Atrazine  
LBY = Liberty  
CAP = Capreno  
SFQ = Steadfast Q



# In the absence of hard water, is AMS really needed?



Cadre 70DG 1.44 oz/A  
COC @ 1% v/v  
CASOB  
PE-08-04  
AMS 100 DF @ 3 lb/A

# Sample Water Quality Report

02/06/2017 12:00 AM

Farm/Client	Sample Description
BARRINGTON DAIRY	CARLOS WELL

	Results
pH	4.28
Nitrate as Nitrogen, ppm	22.8
Nitrate as NO <sub>3</sub> , ppm	100.3
Total Coliform, colonies per 100 ml	
E.Coli, Colonies per 100 ml	
Hardness, ppm CaCO <sub>3</sub>	88
Total Dissolved Solids (TDS), ppm	172
Chloride, ppm	26
Sulfates, ppm	30.6
Calcium (Ca), ppm	11.5
Phosphorus (P), ppm	<0.10
Magnesium (Mg), ppm	10.8
Potassium (K), ppm	3.11
Sodium (Na), ppm	8.34
Iron (Fe), ppm	<0.05
Manganese (Mn), ppm	0.07
Zinc (Zn), ppm	<0.01
Copper (Cu), ppm	<0.01
Sulfate - Sulfur, ppm	
Alkalinity	
Molybdenum (Mo), ppm	

- pH = 4.28
- Hardness = 88 ppm CaCO<sub>3</sub>
  - Moderately hard (USGS)
- Using NDSU-AMS equation
  - 0.3 lbs AMS/100 gals

**Table 1. Water pH and major cation concentrations of South Georgia Wells from July 1, 2014 to May 2, 2017<sup>a</sup>.**

Value	pH	Cation Concentration (ppm)					AMS/100 gals (lbs) <sup>b</sup>
		Ca	Fe	K	Mg	Na	
Median	7.7	30.17	<0.1	1.52	4.66	5.89	0.37
Minimum	4.5	1.9	<0.1	<0.5	0.22	<0.5	0.03
Maximum	8.59	126.23	14.45	97.1	35.10	97.22	2.92

<sup>a</sup>Dr. Jay T. Lessl, Program Coordinator, UGA Soil, Plant & Water Laboratory, 1146 water well samples.

<sup>b</sup>lbs of AMS/100 gallons of water needed to overcome potential hard water antagonism. Based upon the following equation developed at North Dakota State University:  $(0.002 \times K \text{ ppm}) + (0.005 \times Na \text{ ppm}) + (0.009 \times Ca \text{ ppm}) + (0.014 \times Mg \text{ ppm}) + (0.042 \times Fe \text{ ppm})$ .

# Check Labels

## APPLICATION DIRECTIONS FOR USE ON LIBERTYLINK FIELD CORN AND LIBERTYLINK SILAGE CORN

Apply LIBERTY 280 SL HERBICIDE only to corn labeled as LibertyLink. Uniform, thorough spray coverage is necessary to achieve consistent weed control.

### APPLICATION DIRECTIONS

<b>Application Timing</b>	<ul style="list-style-type: none"> <li>Apply to small and actively growing weeds, targeting less than 3 inch weeds in height. For additional information on weed heights refer to the Weed Control for Row Crops section.</li> <li>For Best results, warm temperatures, high humidity, and bright sunlight improve the performance of LIBERTY 280 SL HERBICIDE.</li> <li>Weed control may be reduced if application is made when heavy dew, fog, and mist/rain are present; or when weeds are under stress due to environmental conditions such as drought, cool temperatures, or extended periods of cloudiness.</li> <li>To avoid the possibility of reduced lambsquarters, Palmer amaranth and velvetleaf control, applications should be made between dawn and 2 hours before sunset.</li> </ul>
<b>Application Use Rate</b>	<ul style="list-style-type: none"> <li>Apply 22 fl oz/A.</li> <li>If required to control a second flush of weeds, or environmental condition did not allow for a timely first application and complete weed control was not achieved, a second application of 22 fl oz/A can be applied.</li> <li>The second application should be made minimum 10 days after the first application.</li> </ul>
<b>Maximum Per Year</b>	<ul style="list-style-type: none"> <li>44 fl oz /A.</li> </ul>
<b>Adjuvant</b>	<ul style="list-style-type: none"> <li>Ammonium sulfate (AMS) can be used at 1.5 lb/A to 3 lb/A. Rates are dependent on tankmix partners, environmental conditions, temperatures and potential for leaf burn.</li> <li>AMS has shown to improve weed control of difficult-to-control weeds, like velvetleaf and lambsquarters, under difficult environmental conditions (low relative humidity) or hard water.</li> <li>Anti-foam agent is recommended.</li> </ul>
<b>Surfactants/Oils</b>	<ul style="list-style-type: none"> <li>The use of additional surfactants or crop oils may increase the risk of crop response. Please refer to surfactant label for more detailed directions.</li> </ul>
<b>Application window</b>	<ul style="list-style-type: none"> <li>Emergence up to 24" tall or in the V7 stage of growth.</li> </ul>
<b>Spray Volume</b>	<ul style="list-style-type: none"> <li>15 GPA minimum.</li> <li>If dense canopy, large weeds or unfavorable growing conditions are present, increase water volume to a minimum of 20 GPA.</li> </ul>
<b>Rainfast</b>	<ul style="list-style-type: none"> <li>4 hours.</li> </ul>

### Special Adjuvant Types

- Combination adjuvant products may be used at doses that provide the required amounts of NIS, COC, and/or ammonium nitrogen fertilizer. Consult product literature for use rates and restrictions.

Consult local DuPont fact sheets, technical bulletins or supplemental labels prior to using other adjuvant systems. Products must contain only EPA-exempt ingredients.

Do not use with spray additives that alter the pH of the spray solution below 5.0 or above 9.0 as rapid product degradation can occur. Spray solutions of pH 6.0 – 8.0 allow for optimum stability of REVULIN™ Q.



# Water Testing Labs

- UGA
  - \$20/sample
- Waters Agricultural Lab
  - \$38/sample



**Questions?**  
**[eprostk@uga.edu](mailto:eprostk@uga.edu)**  
**[www.gaweed.com](http://www.gaweed.com)**

