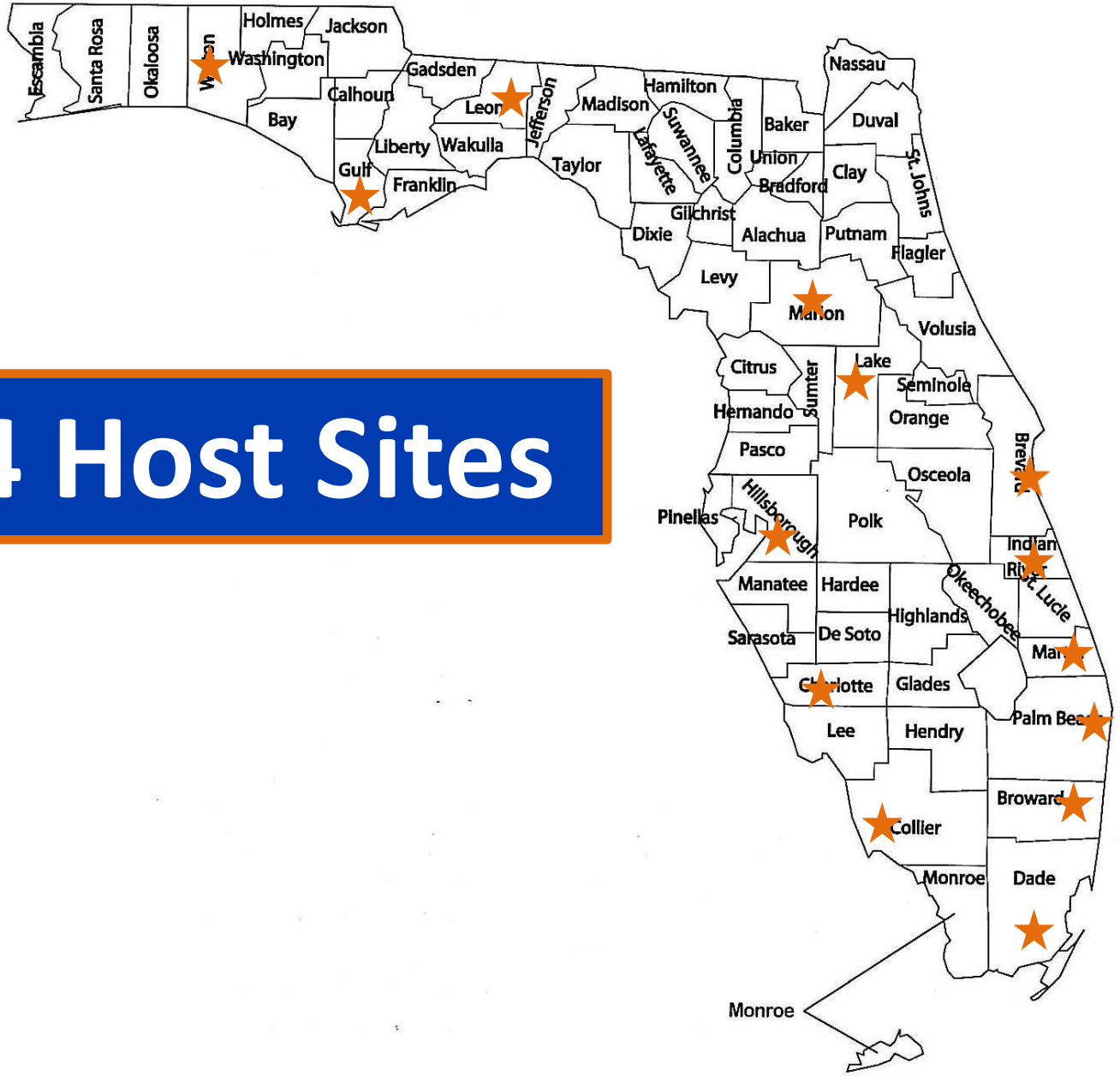
The Great CEU Roundup

UF IFAS
UNIVERSITY of FLORIDA

FLORIDA TURFGRASS ASSOCIATION

June 26, 2019

14 Host Sites



Time (EDT)	Topics
9:00 – 9:50	Introduction; Tank mixing to sidestep disasters
10:00 – 10:50	Updates on insect management in the landscape
11:00 – 11:50	Organic amendments, biostimulants, root-enhancers, etc. as tools for nematode management
11:50 – 1:00	BREAK
1:00 – 1:50	Crested floatingheart and related species in Florida
2:00 – 2:50	Pesticide spill management and cleanup
3:00 – 3:50	Native wetland plants in Florida
3:50 – 4:00	Distribution of evaluations/CEU attendance forms

Approved Applicator Categories

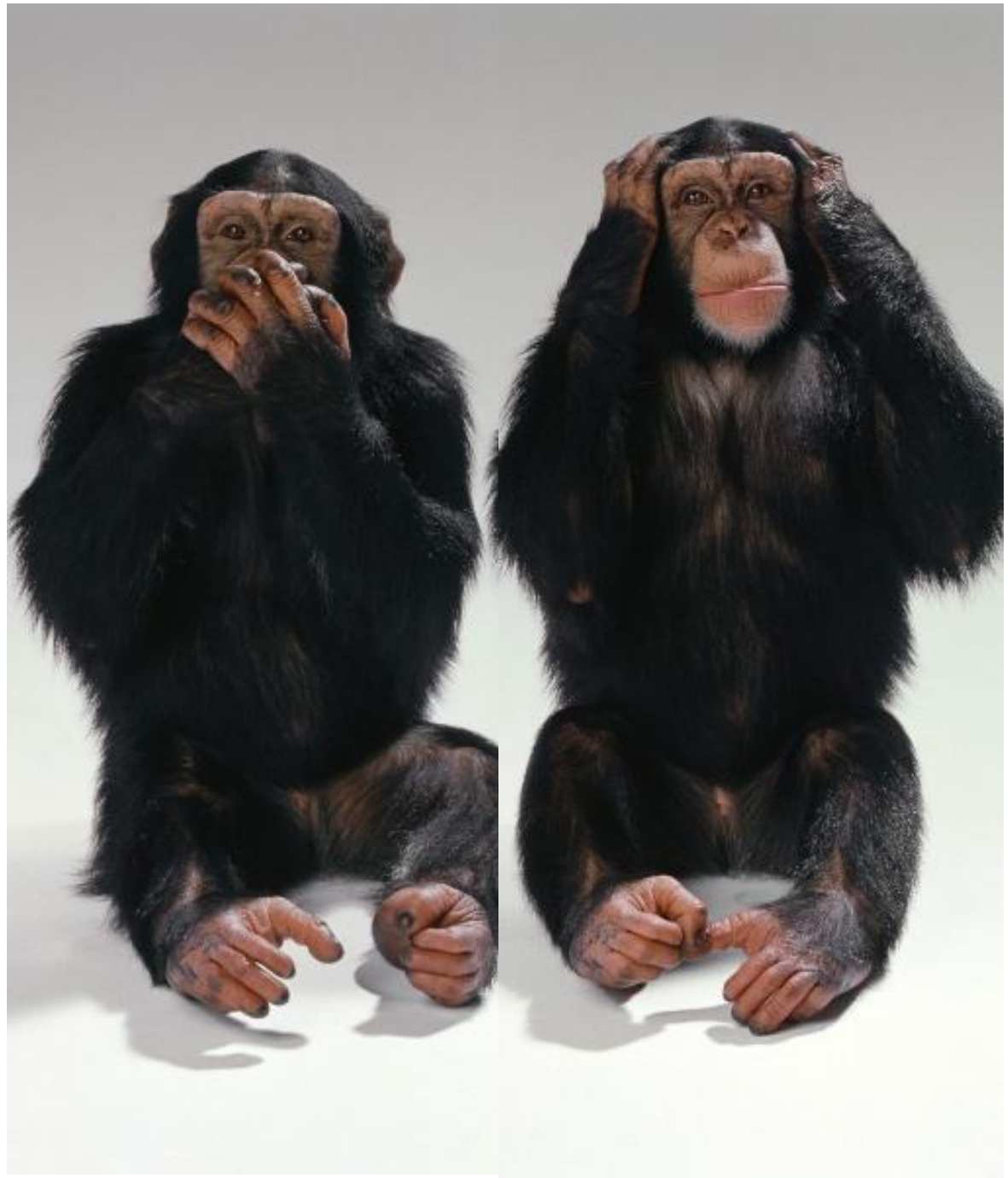
Category	Available CEUs
Limited Lawn & Ornamental	2
Limited Commercial Landscape Maintenance	2
Commercial Lawn & Ornamental	2
Private Applicator Ag Pest Control	2
Aquatic Pest Control	2
Demonstration & Research	4
Ornamental & Turf Pest Control	2
487 Core	2
482 Core	2
Total Available	**6**

Approved Association Categories

Association	CEUs/Points
FNGLA	4
GCSAA	0.45

Site Co-providers:

- Circulate CCA/FNGLA/GCSAA CEU sign-in forms
- Remind attendees seeking only pesticide CEU credit to refrain from signing association forms
- Distribute and have attendees complete evaluations
- Distribute Pesticide Applicator CEU attendance forms at conclusion of day following the completion of the evaluations



If there are questions for speakers, please hold and email to weeddr@ufl.edu

IT questions: Glen Graham (352) 392-3893

Tank Mixing to Sidestep Disasters

Fred Fishel
UF/IFAS Agronomy/Pesticide Information Office

Outline

- Types of incompatibility
- Factors leading to incompatibility
- Mixing order using water as a carrier
- Precautions using liquid fertilizer as a carrier
- Jar testing and associated tools

Tank Mixing Advantages

- **Efficiency and convenience**
  - Enhances timeliness
  - Broader spectrum control
  - Can mix with fertilizer
  - Saves time and cost
  - Reduces soil compaction
  - Lowers chance of resistance

Background

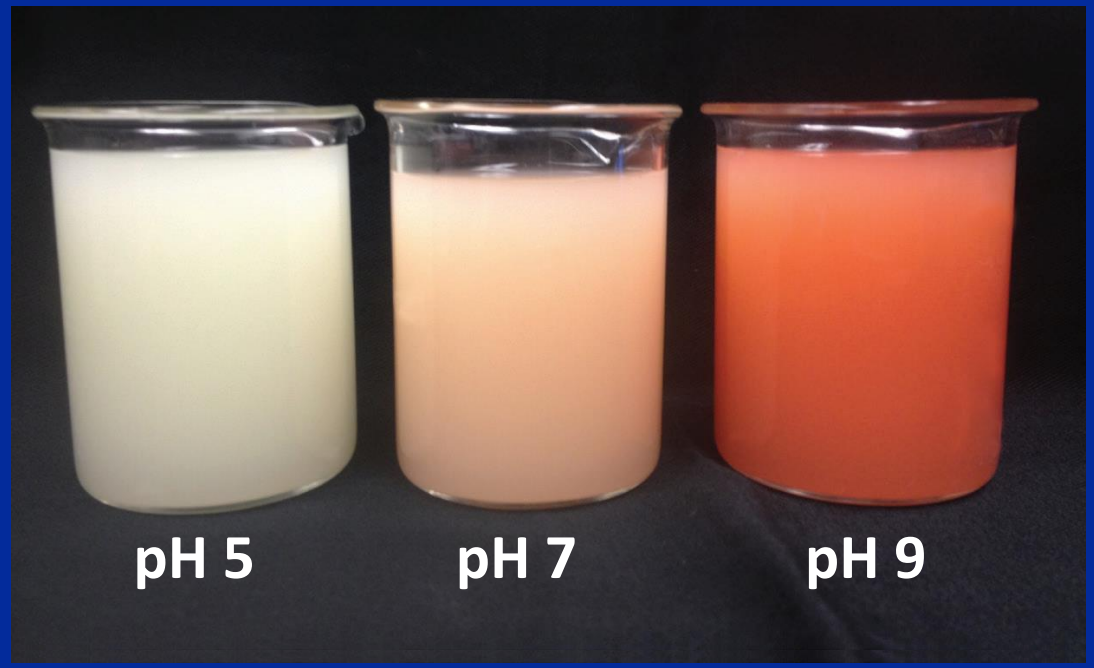
- Developing a new active ingredient can take 10 years at a cost of $300 million
- EPA requires nearly 140 tests for a product to reach the market
- AI's physical properties heavily influence the final commercial product formulation
- It's impossible for a registrant to test every possible tank mix combination

Impact of Water on Protection Products

- pH - the rate products dissolve depends on water acidity or alkalinity
- Minerals – some products bind to minerals in hard water
- Temperature – products require more time to dissolve in cold water
- Each formulated product has a set of complex chemical structures
  - Each tank-mix partner added increases the potential for incompatibilities

Incompatibility

- It’s impossible for a registrant to test every possible tank mix combination



Indication of chemical compatibility problem

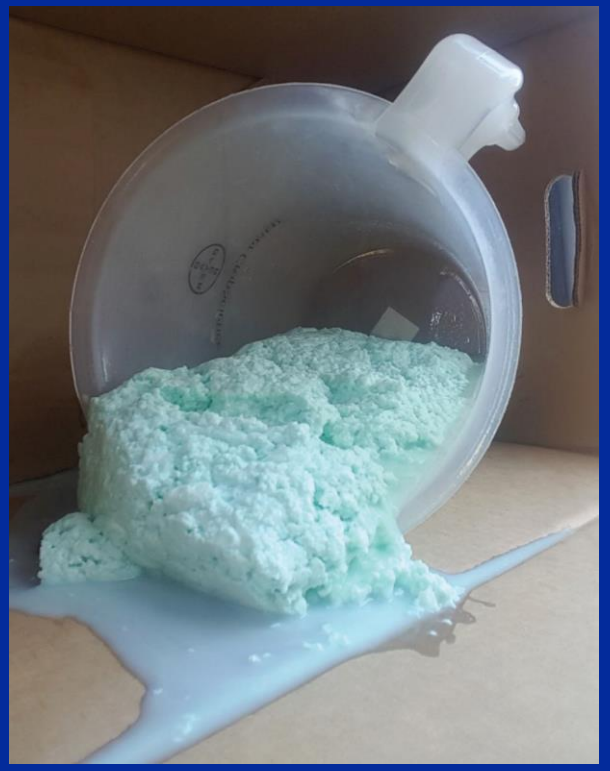
Incompatibility

- If you don’t mix products correctly, you will encounter incompatibilities

Incompatibility

- Two types of incompatibility:
  - Physical – products do not mix well
  - Chemical – mix effectively, but contain ingredients that make them chemically incompatible

Incompatibility



Physical – curdle into gels and pastes

Chemical – glyphosate with hard water (right)

Physical Incompatibility

- Product will not suspend
- Product clumps
- Product doesn’t completely dissolve
- Oil residues appear in tank
- Product separates into layers
- Solution foams excessively

It costs you time and effort to clean the mess!

Chemical Incompatibility

- Solution may appear to be fine, but may:
  - cause phytotoxicity
  - reduce biological activity

Both effects are known as antagonism

Not always obvious, but costly!

Formulation Ingredients

- Dispersants
- Oils
- Wetting agents
- Antifreeze
- Built-in adjuvants
- Carriers
- Suspension aids
- Solvents
- Emulsifiers
- Anti-drift agents
- Thickeners
- pH buffers
- Defoamers
- Stabilizers
- Disintegrants

Factors Leading to Incompatibility

- Label ignored
- Not jar-tested
- New mixtures of multiple products
- Mixing products out of proper sequence
- Insufficient water
- Not waiting until products dissolved
- Too much or too little agitation

1. Check Containers First

- Some formulations have AIs that separate into layers

2. Follow Label Instructions

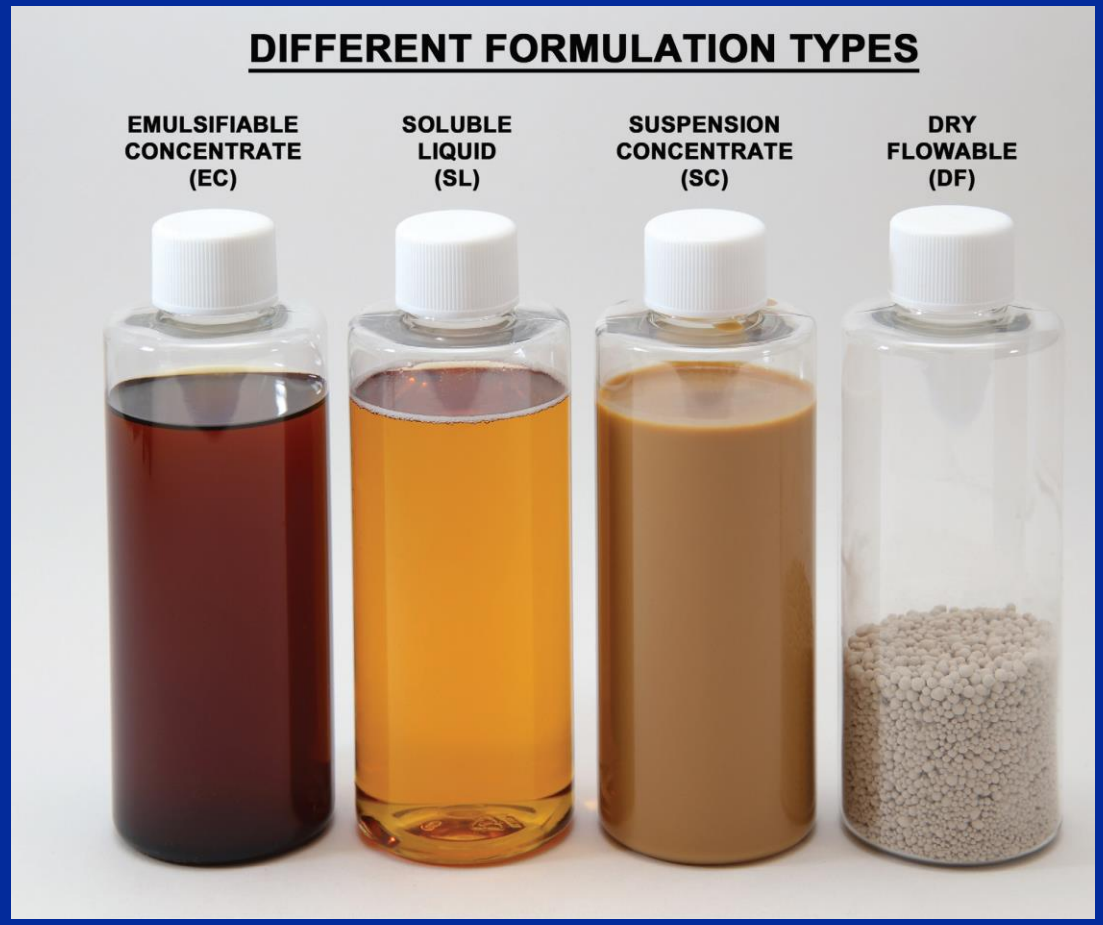
- **Manufacturers develop mixing instructions based on:**
  - **Laboratory and field tests of potential tank mixtures**
  - **Comments from customers and researchers**

2. Follow Label Instructions

- Labels specify:
  - Products that have been tested for compatibility
  - The order in which you should add products
  - The recommended carrier volume
  - Whether you need a tank-mix adjuvant
  - General recommendations for tank-mix agitation
  - Product sensitivities to extreme temperatures
  - Warnings about carrier pH and/or mineral content
  - Products that should not be tank mixed

3. Mix in the Proper Order

- **Solubilized active ingredients**



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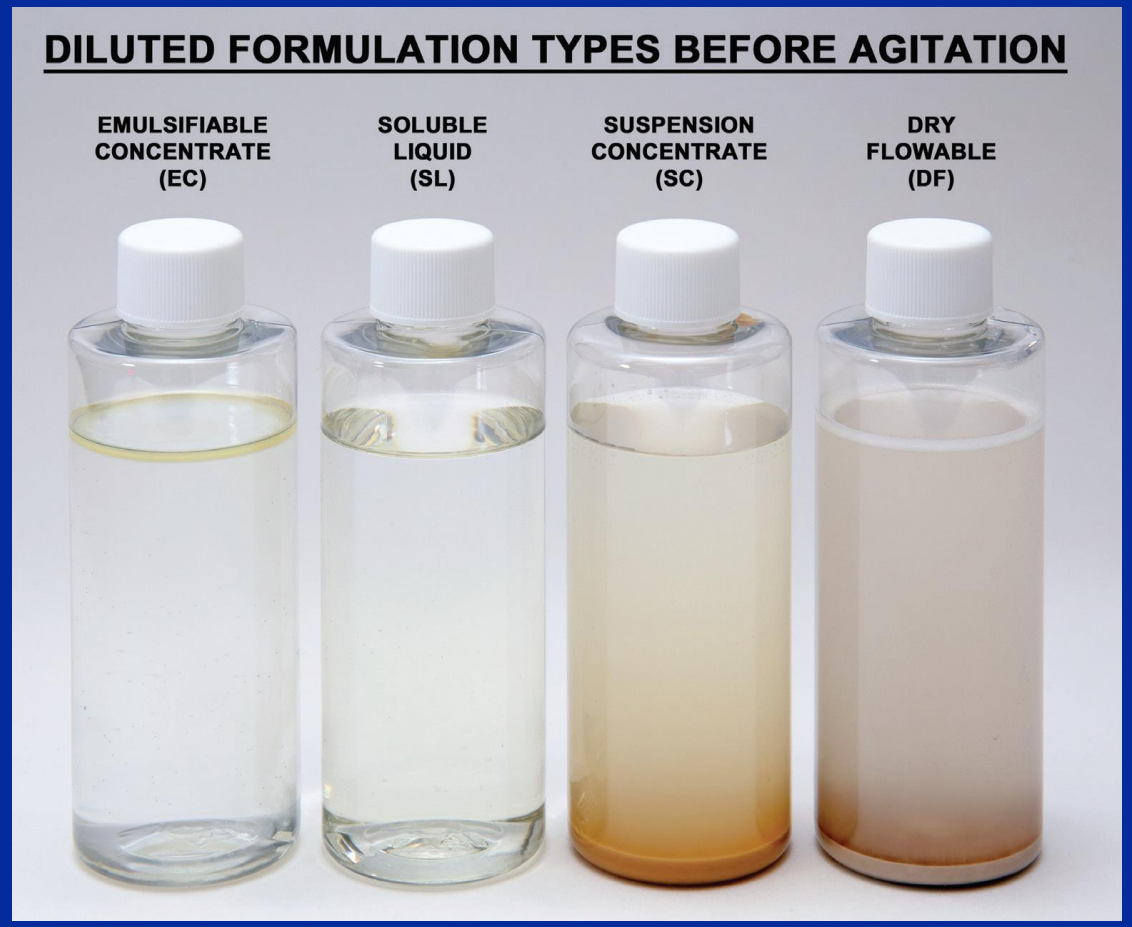
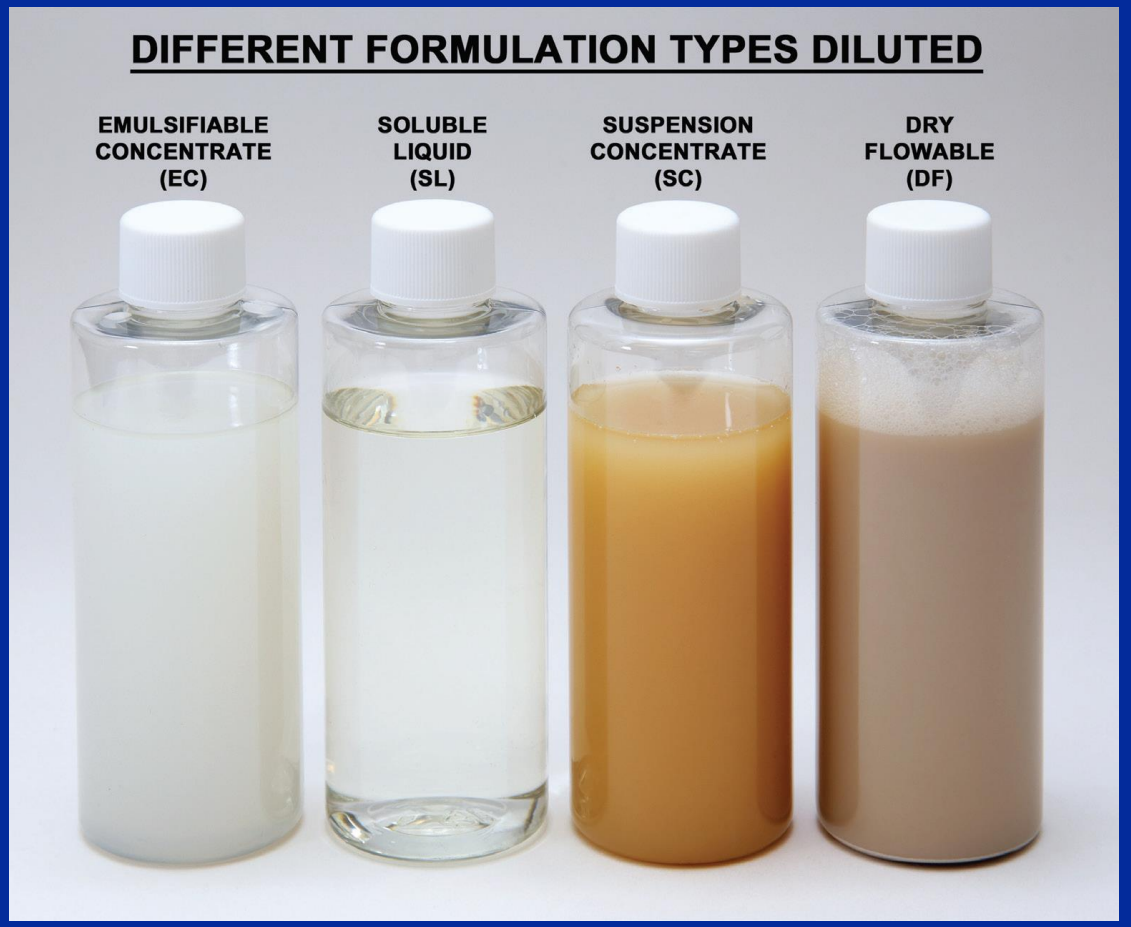
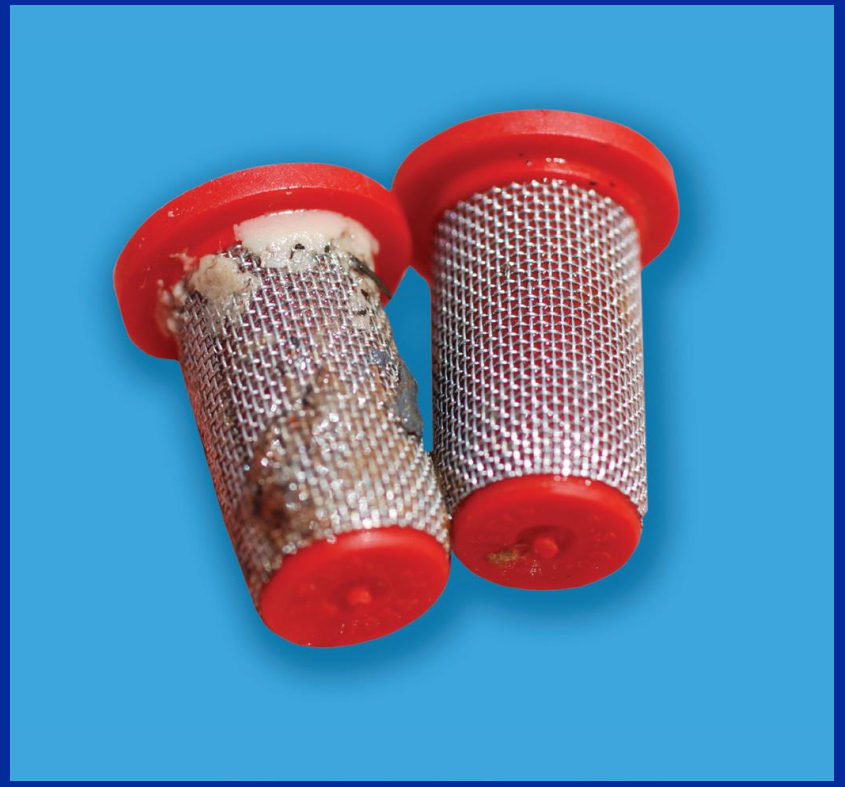




3. Mix in the Proper Order

- Solid active ingredients
  - Water dispersible granule (WDG)
  - Wettable powder (WP)
  - Are not very soluble
  - Rely on agitation

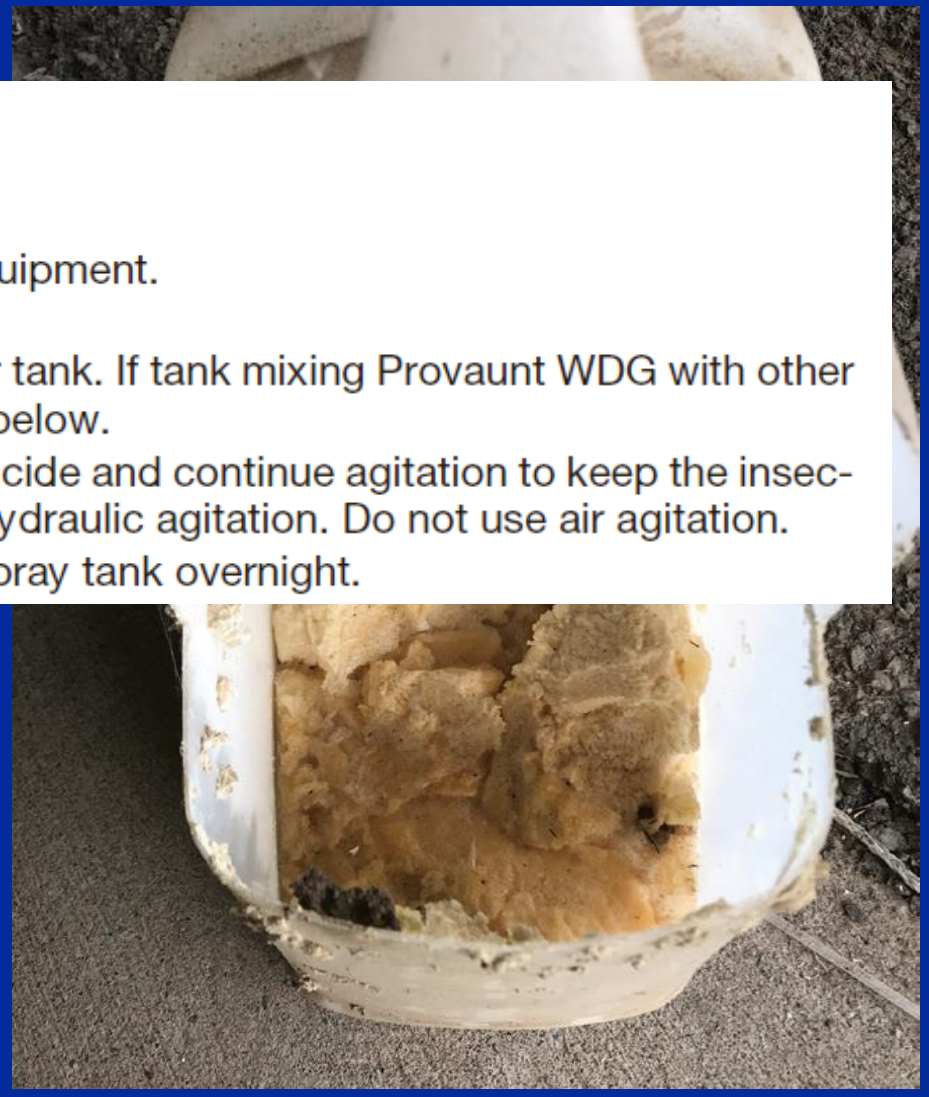


4. Use the Right Water Volume

4.3 Mixing Directions

4.3.1 PROVAUNT WDG ALONE

1. Use clean, well maintained application equipment.
2. Fill sprayer tank 1/4 to 1/2 full of water.
3. Add Provaunt WDG directly to the sprayer tank. If tank mixing Provaunt WDG with other products, see the Tank-Mixtures section below.
4. Mix thoroughly to fully disperse the insecticide and continue agitation to keep the insecticide in suspension. Use mechanical or hydraulic agitation. Do not use air agitation.
5. The mixture should not be stored in the spray tank overnight.



5. Be Patient When Adding Products

- Always agitate before adding another product
- It takes time for some products to disperse

6. Agitate Properly

- WDG, WP, EC and others will settle out
- Too much agitation may result in:
  - Foaming (add anti-foaming agent early in the process)
  - Cottage cheese curds
  - Diminished effectiveness of anti-drift agents
- Use moderate agitation
  - You can observe the top layer of th
  - If it looks like boiling water, there i agitation

Slight Changes, New Problems

- Products are getting more complex, not less
- Too many combinations for manufacturers to test
- You should anticipate incompatibility problems
- Manufacturers reformulate products periodically

Water as a Carrier

- Water dissolves and disperses most products effectively
- Add 25-50% of required volume to tank
- Be aware of water pH and hardness

Know Your Water

Set: E45005 Report Date: 08/24/2017

Lab No	Sample Identification	Parts per million ppm or mg/L								pH	Electrical Conductivity in mmho/om or dS/m	Total carbonates in meq/liter
		Calcium Ca	Magnesium Mg	Hardness mg/L	Iron Fe	Manganese Mn	Sodium Na	Chloride Cl	Suspended Solids			
E113982	Tap 1	28.85	22.21	163.17	0.00	0.00	11.62	27.46	0.00	8.50	0.36	0.84

Know Your Water

Just give your water the finger!

General Recommendations for Mixing Order (Water as a Carrier)

1. Read all product labels
    a. Know what kind of formulation the product is – you may need to contact the manufacturer
    b. Check about optimal pH and the influence of hard water – you may need to add appropriate adjuvants

General Recommendations for Mixing Order (Water as a Carrier)

2. Shake all liquid product containers

General Recommendations for Mixing Order (Water as a Carrier)

3. Fill the tank with 50% of the required water volume
4. Start agitation and continue through the mixing process
5. Add products based on formulation type in the proper order

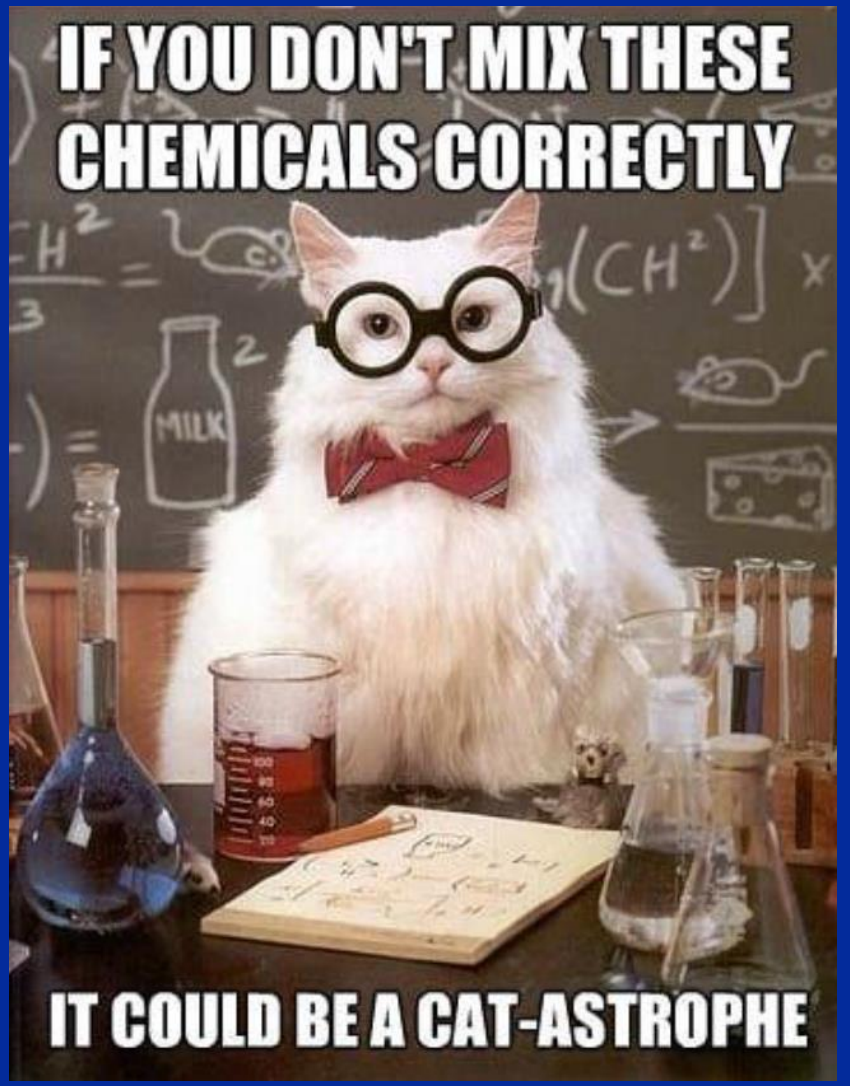
General Recommendations for Mixing Order (Water as a Carrier)

5. Add products in this order:
   a) Water soluble packets (dissolve prior to agitation)
   b) Dry formulations (DF, WDG, WG, WP, SG) – wait 3-5 min
   c) Dry or liquid ammonium sulfate
   d) Dry or solid anti-drift agents
   e) Compatibility agents and anti-foamers
   f) Dispersed liquid formulations (SC, F, FL, ME)
   g) Liquid drift retardants
   h) Remaining liquid formulations (EC, S, SL)
   i) Adjuvants (COC, MSO, NIS, water-conditioning agents)
   j) Micronutrients and liquid fertilizers

General Recommendations for Mixing Order (Water as a Carrier)

6. Add remaining water
7. Measure solution's pH (add pH adjuster if necessary)

General Recommendations for Mixing Order (Water as a Carrier)



Fertilizer as a Carrier

- Fertilizers are high in salt – dissolves less product than water
- Add 50-75% of r
- Mix dry product
  preslurry
- Salts in fertilizer
  in products caus
- Conduct a jar tes

Jar Test to Avoid the Mess

- Conduct jar test prior to mixing in the tank
- Simulates what occurs in the tank
- Follow label directions for conducting jar tests
  - Different products may require different water volumes

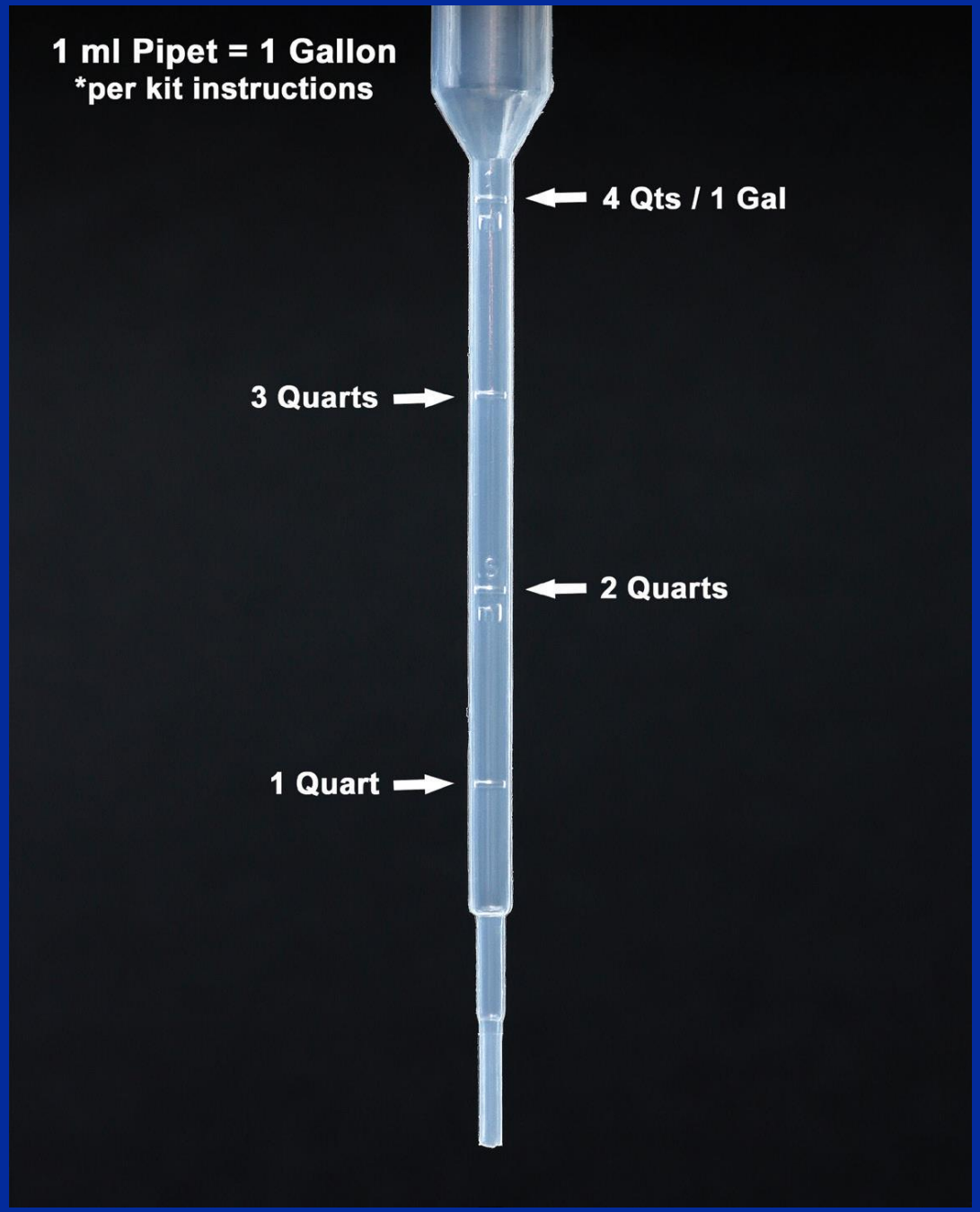
Jar Test to Avoid the Mess

- Not using enough water (left)
- Using more water (center)
- More water + compatibility agent (right)

Jar Test to Avoid the Mess

Jar Test to Avoid the Mess

- Test kit guidelines
  - 1 ml represents 1 gal of liquid
  - Each PVC container is marked at 100 ml
  - Each pipette holds 1 ml with ¼ ml marks, each representing 1 qt
  - Open pipette – assume each scoop = 8 lb


1 ml Pipet = 1 Gallon
*per kit instructions
4 Qts / 1 Gal
3 Quarts
2 Quarts
1 Quart

Example

- Roundup PowerMAX @ 40 oz/A
- 2,4-D LV 4 @ 1 pt/A
- Atrazine 4L @ 1.5 qt/A
- Crop oil @ 1% v/v
- Ammonium Sulfate @ 8.5 lb/100 gal

Example

Conversion factor for 100 gal of spray solution:

100 gal tank ÷ 15 gal/A = 6.67

Product	Rate	CF	Total/100 gal	Per 100 ml
Roundup	40 oz	X 6.67	266.8 oz (8.3 qt)	/4 = 2.1 ml
2,4-D LV 4	1 pt		6.67 pt (3.3 qt)	/4 = 0.8 ml
Atrazine 4L	1.5 qt		10.01 qt (10 qt)	/4 = 2.5 ml
COC	1% v/v	…	4 qt	/4 = 1.0 ml
AMS	8.5 lb/100 gal		8.5 lb	1 scoop

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Mix Tank is designed to assist agricultural applicators with the proper tank mixing sequence of crop protection products. Mix Tank also captures product use rates and application information with Mix Sheets and conveniently maintains accurate Spray Logs for easy record keeping. Download Mix Tank for free on the App Store and Google Play.

Correct Sequence

1. AMS
2. Atrazine 4L
3. 2,4-D LV 4
4. Roundup
5. COC

Acknowledgements

- Purdue Pesticide Programs

https://ppp.purdue.edu/#