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EXTENSION

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Surfactants to Aid in Cranberry Pest Management: Why, What, When and How Much

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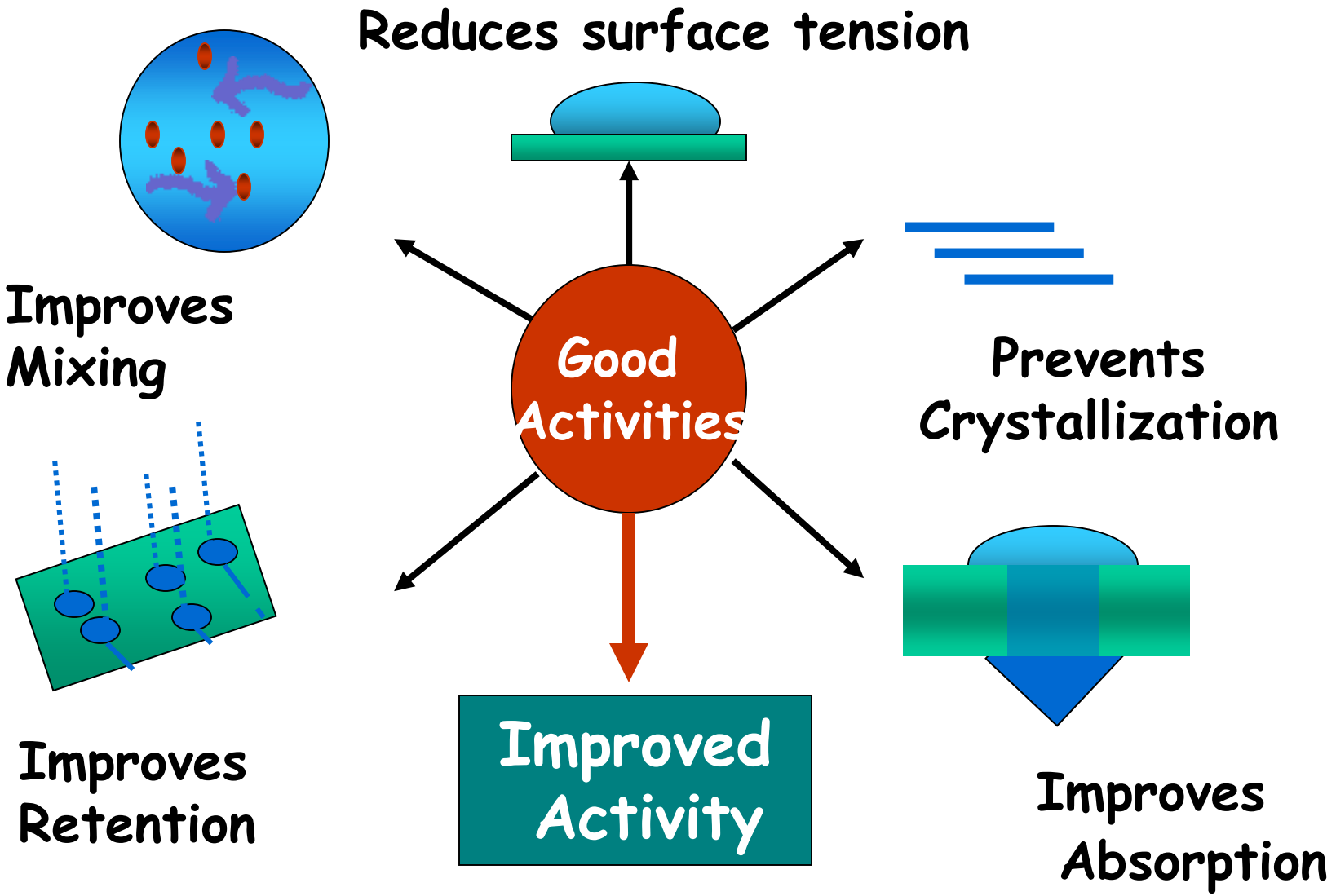
Basic types

- Activators / spray modifiers
  - Surfactants
    - NIS (Agral 90)
    - Hybrids (Sylgard 90)
    - Anionic
  - Oils (Merge)
- Utility modifiers
  - Compatibility (Unite)
  - Drift control
  - Anti-foaming (Flat-out)
  - Buffering (Aqua-Stable)
  - Acidulents (Li700)

Activities of a Good Adjuvant



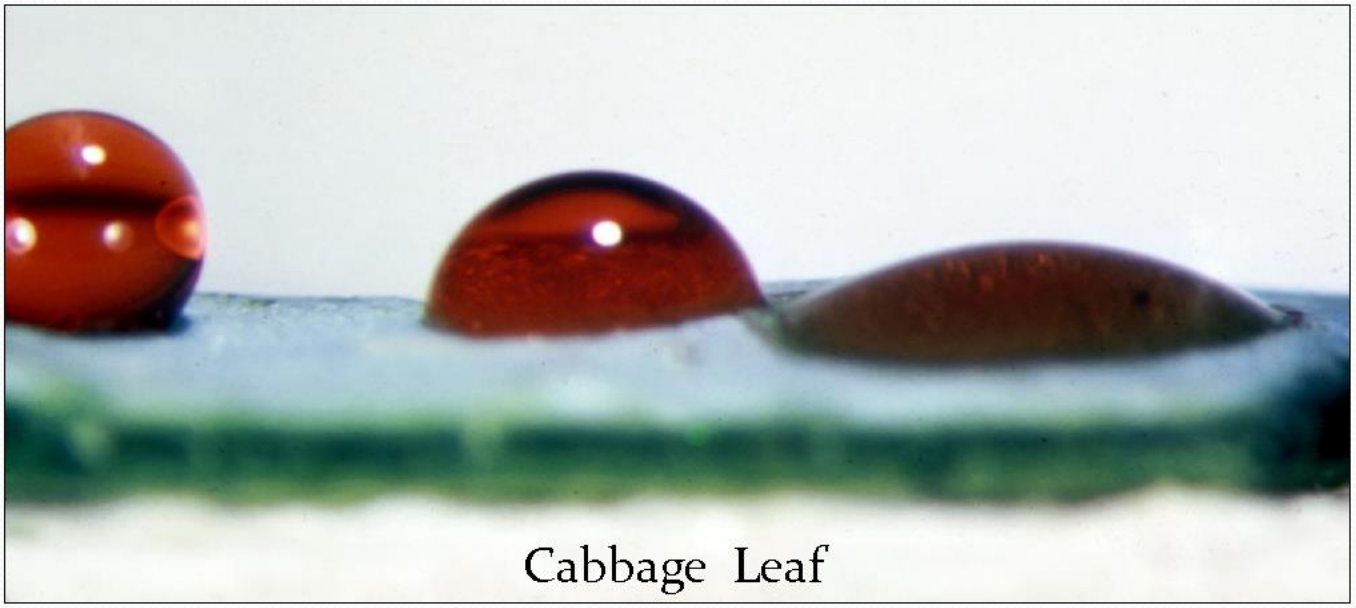
Slide courtesy of S. Nissen

SURFACTANTS
Effect on Surface Tension

- Surfactants reduce tension to help droplet spread out over the leaf; penetrating hairy surfaces and establishing broader contact.

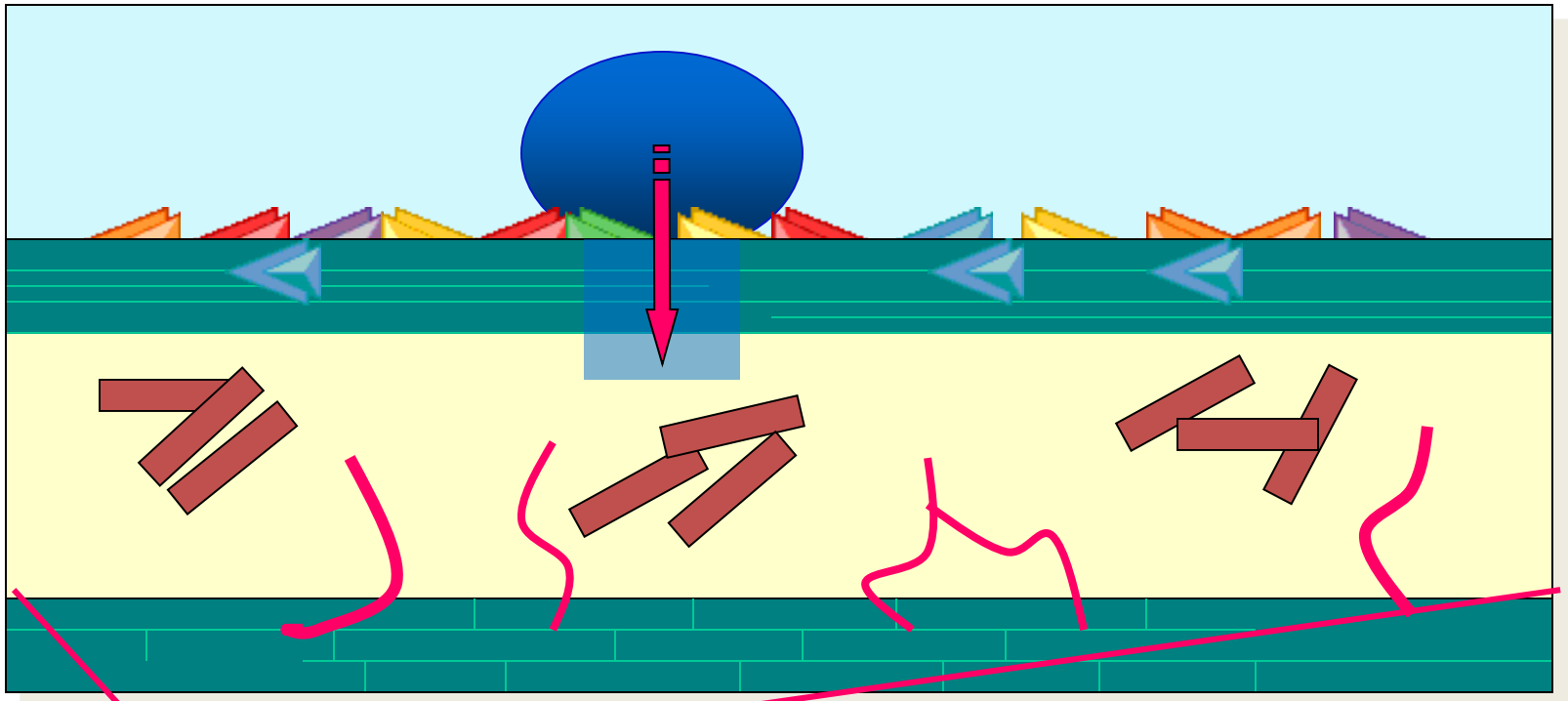
Slide courtesy of J Vollmer

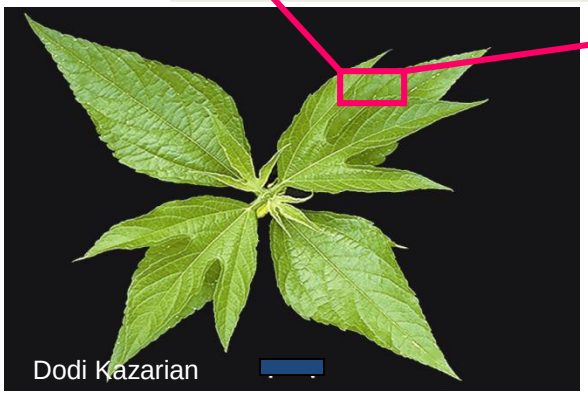
Left to Right: 0, 0.01, 0.1% Non-Ionic Surfactant



Courtesy: Bukovac - Michigan State University

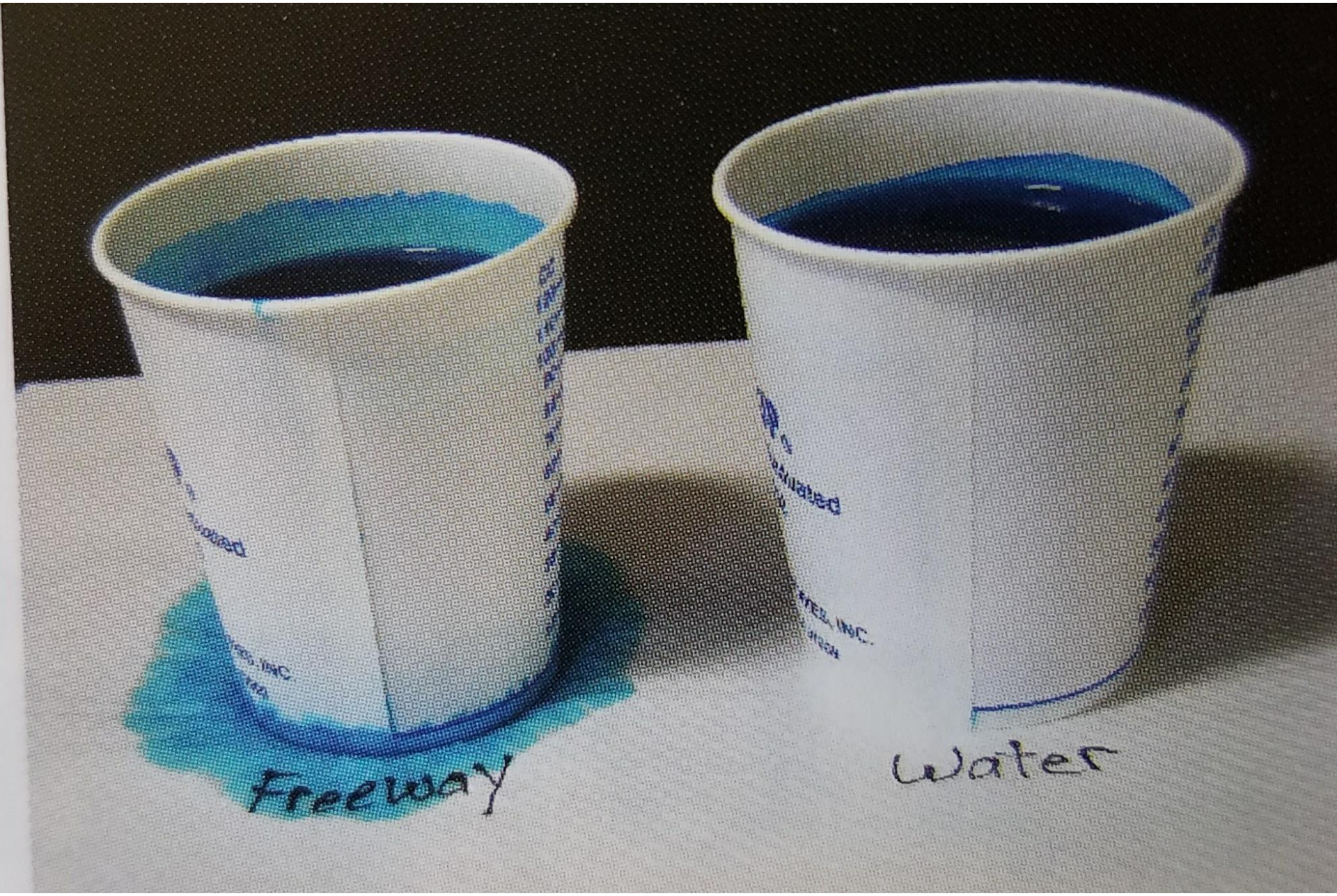
Improves Absorption (rearranges cuticle structure or provides entrance via stomates).





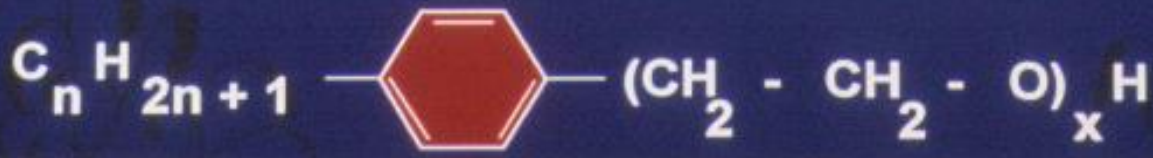
Cuticle is the most important barrier to absorption.

Slide courtesy of S. Nissen


Freeway
Water

SPRAY ADJUVANTS
NON -IONIC SURFACTANTS

- Do not ionize in water
- Do not form precipitates in hard or soft water
- Low phytotoxicity
- Low mammalian toxicity
- Form stable emulsions
- More soluble in cold than hot water

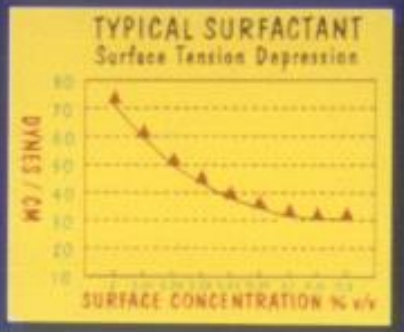


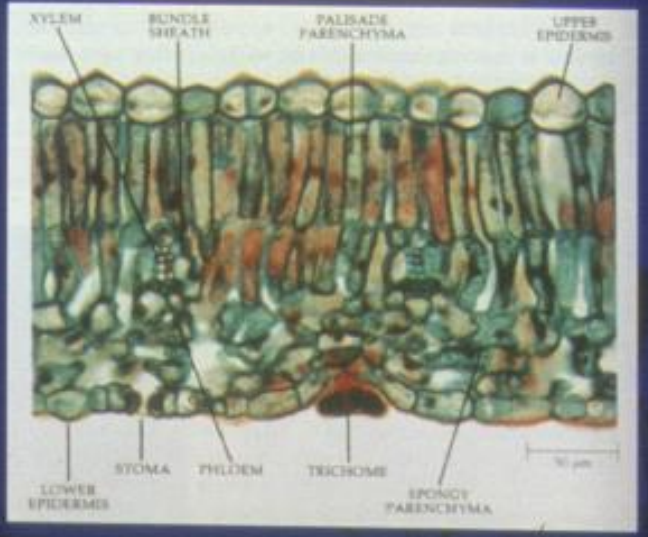
SURFACTANTS - OIL PRODUCTS
EMULSIFIED PETROLEUM BASED OILS

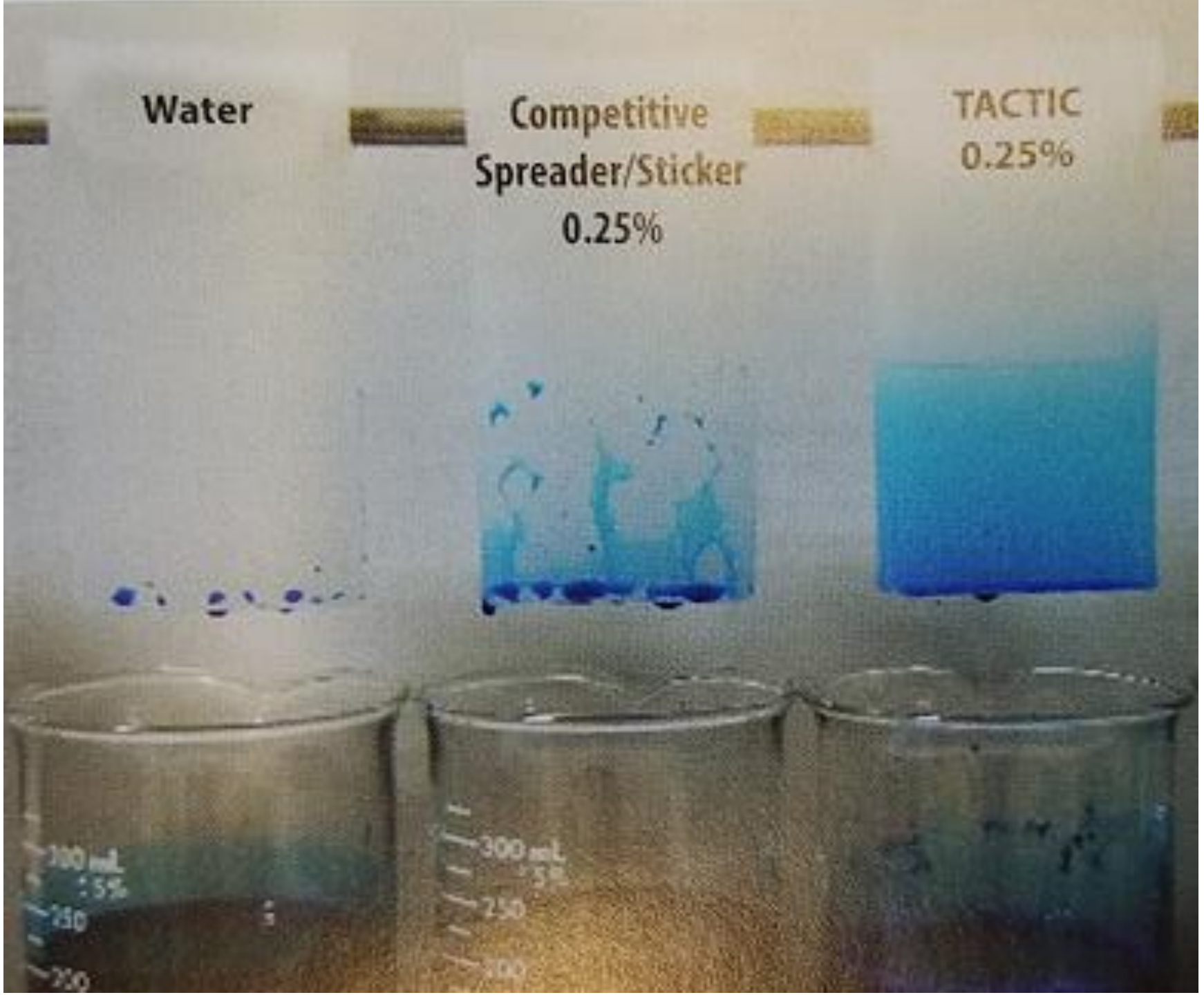
- Emulsifiable petroleum based oil surfactants
- Referred to as crop oil concentrates
- Ratio is 15-20% surfactant emulsifier and 85-80% petroleum based oils.
- Aid in deposition and upake under moisture, temperature stress
- Can be phytotoxic

SPRAY ADJUVANTS
ORGANOSILICONE SURFACTANTS

- **Ultralow surface tension**
  - low 20's dynes/cm
- **Extreme spreading of droplets**
  - up to 20 x's greater spreading than conventional surfactants
  - maximum wetting on nearly all plant surfaces
  - stomatal entry






Water
Competitive
Spreader/Sticker
0.25%
TACTIC
0.25%

There are >3000 surfactants

Common BC cranberry surfactants

Product	Type	Compostion
Agral 90	NIS	Nonylphenoxy polyethyoxyethanol 90%
Li700	NIS & pH adjuster/acidifier.	Phosphatidylcholine, methylacetic acid and alkyl polyoxyethylene ether 80%
Sylgard 309	Hybrid blend/ NIS	Siloxylated polyether 76% + surfactant mixture 24%
Merge	COC	50% surfactant blend plus 50% solvent (petroleum hydrocarbons)
Assist	COC	83% paraffin base mineral oil plus 17% surfactant blend

http://www.omafra.gov.on.ca/english/crops/pub75/pub75ch5.pdf

Common BC cranberry surfactants

Product	Purpose
Agral 90	wetting and spreading agent that improves coverage of spray mixes.
Li700	neutralizes or slightly acidifies the spray solution, breakdown hydrolysis of pH-sensitive products, wetting and spreading agent, penetrating agent. Add LI700 before adding the pesticide.
Sylgard 309	Silcone NIS surfactant for wetting and spreading – improves penetration, especially in broadleaf weed species.
Merge	Wetting and spreading agent, Improves penetration of herbicide through the leaf cuticle layer, protectant against photodegradation of POAST ULTRA by UV light.
Assist	Wetting and spreading agent, Improves penetration of herbicide through the leaf cuticle layer, reduces the evaporation of spray droplets

Common BC cranberry surfactants

Product	Use with	Rate
Agral 90	glyphosate	0.25 to 2.5 % v/v
LI00	glyphosate	0.25 to 1% v/v
Sylgard 309	Poast Ultra, glyphosate	0.1 to 0.25 % v/v
Merge	Poast Ultra, Centurion, Select	1 % v/v
Assist	Poast Ultra, Centurion, Select	1 % v/v

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Common BC cranberry surfactants

Product	Concerns
Agral 90	Do not exceed the labelled rates of AGRAL 90 as too much wetting agent can lead to loss of spray due to excessive run-off.
Li700	Add LI700 before adding the pesticide, limited shelf stability if frozen or old (separates)
Sylgard 309	Add to the spray tank after the herbicide has been thoroughly mixed, excess rate results in runoff
Merge	Crop oils can be hot on new cranberry growth, reduce rate or avoid at certain times
Assist	Can by phytotoxicity on new cranberry growth. Eastern Canada only?

Common BC cranberry surfactants

Product	Other uses
Agral 90, Li700, Slygard 309	Broadcast applied insecticides, like Intrepid, as per label instructions.
Agral 90, Li700, Slygard 309	Substitute for COC with grass herbicides if conditions are suitable for phytotoxicity
Sylgard 309	Improved efficacy of wiping mix with glyphosate for horsetail

Efficacy of glyphosate as a function of weed and surfactant

Surfactant	Beggar tick (aster)	Perennial bunch grass
NIS	+	+
OS	++	-
MSO	++	++

Efficacy of orthene on thrips control as a function of surfactant

Surfactant	control
NIS	+
COC	+
MSO	+
OS	+
No surfactant	+

Efficacy of insecticide on thrips control in onions as a function of surfactant & fungicide

Surfactant	control
No Surfactant	+
NIS	++
COC	++
OS	++
Bravo	-
NIS+ Bravo	-
NIS+ Quadris	++

Common cranberry surfactants questions

- Is it worth using with ‘Sticking agent’ with Chemigation?
  - No data to support, follow label, could cause a MRL issue.

Callisto

- NIS @ 0.25%
- COC @ 1% (may cause injury to CB if sunny and new growth)

	Broadcast	Chemigation
NIS	~1 qt/ac	~~2.5 gallons~~
COC	~1 gal/ac	~~10 gallons~~

Common cranberry surfactants questions

- Any other good uses for a surfactant?
  - LiI700 in chemigation tank to help with injection uniformity with non water soluble product.

Common cranberry surfactants questions

- Do I need a surfactant with Roundup?
  - No, it already has one in it.
  - If your off-brand glyphosate product doesn't have a surfactant – use one.
  - Adding an organo-silicon surfactant @ 1% v/v will improving wiping results on some tough weeds.

Common cranberry surfactants questions

- When do I need to use water conditioner or acidulant?
  - Glyphosate is inactivated by hard water or sediment. Test and treat your spray tank water if needed.
  - Some ALS herbicides are inactivated at high pH.
  - Some insecticide are inactivated at high pH (Sevin XLR doesn't work if pH>8).

Common cranberry surfactants questions

- When are cranberries most sensitive to crop oils and what should I use instead?
  - New growth, during hot sunny days with intense UV
  - Reduce rate, use an NIS instead, or delay treatment until more favorable conditions.
  - Err on the side of caution
  - Wisconsin grower only use NIS, never COC- too much risk of crop damage.

Common cranberry surfactants questions

- What label should I follow – the pesticide or surfactant label?
  - They are often the same, if not always follow the pesticide label first.
  - The surfactant label is written for a broad range of products and may not be specific enough

Common cranberry surfactants questions

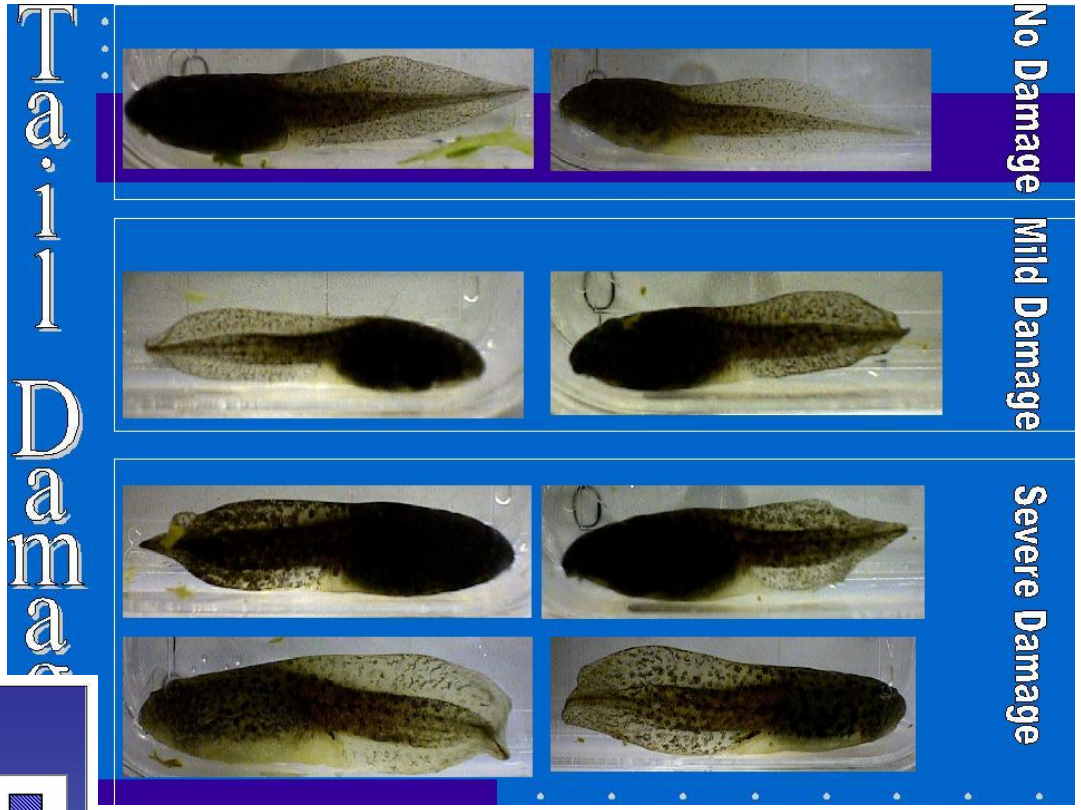
- Should I ever use an organosilicate surfactant?
  - Wisconsin growers will use a 1% v/v OS surfactant when wiping with glyphosate to control some difficult weeds species.
  - Oregon grower will use an 0.5% v/v OS with Select to help control creeping bent grass. But only as a spot treatment.

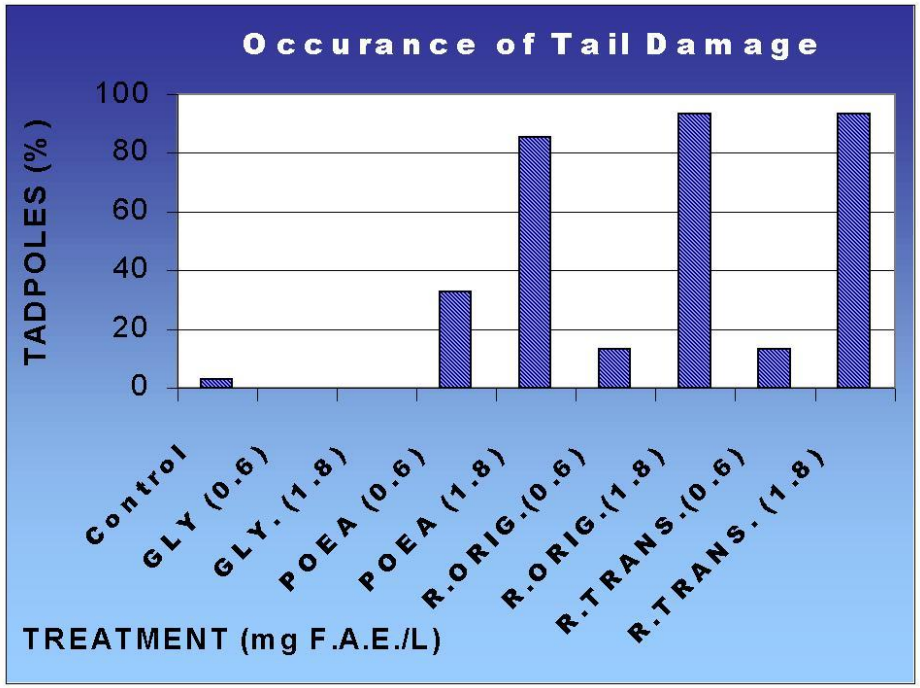
Are surfactants toxic?

alkylphenol ethoxylate (AE) vs. nonyl phenol ethoxylate (NPE) (like Agral 90)

Property	AE	NPE
Bio-degradability	Readily	Not readily
Concern about acute toxicity to fish	No	yes
Breakdown products more toxic than parent compounds	No	yes
Predicted chronic no effect concentration	110 ug/l	0.33 ug/l
Endocrine disruptor	No	Yes

Aside from acute toxicity to fish – Surfactants may have **estrogenic effects** on fish and frogs



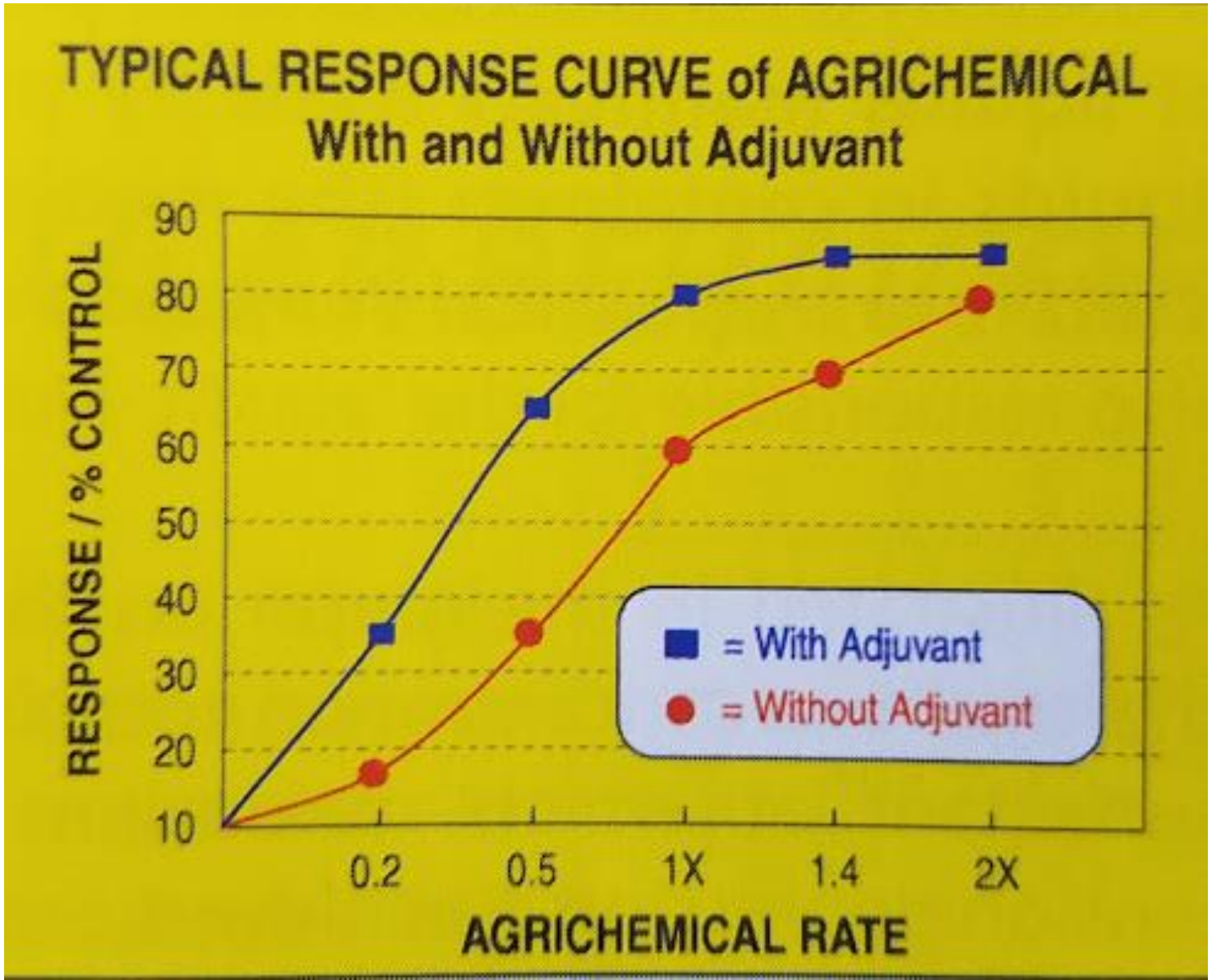


Perception is reality for assessments of many risks

Surfactants are not silver bullets. You must first have

- An adequate amount of canopy exposed and treated
- The correct herbicide rate
- Ample length of exposure prior to washoff
- Good canopy quality

You may not notice the difference with and without a surfactant at high rates



- Good coverage is more important than surfactant.
- Nozzle (Match nozzle with purpose (systemic or contact, herbicide or fungicide) and spray system)
- Pressure (if psi too low – nozzles and uniformity will be off, if too high - drift)
- Spacing (see manufacture guidelines – most aim at 50 % overlap)

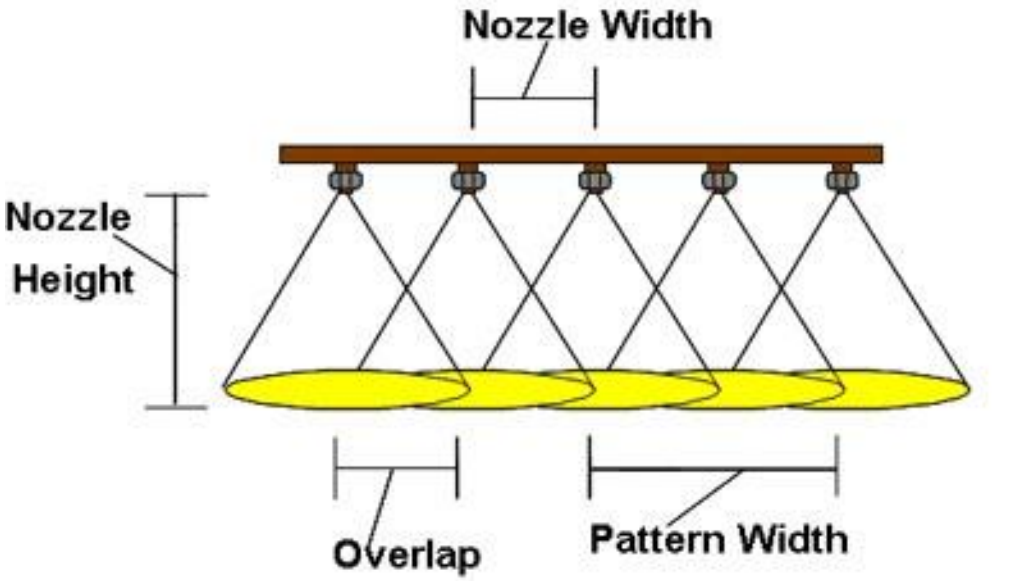
Key is to place the right size spray droplets into the canopy.

PSI and spray volume limitations.

Boomless noozles are OK for some purposes, not OK for others

	HERBICIDES			FUNGICIDES		INSECTICIDES		DRIFT MANAGE-MENT	PWM NOZZLE CONTROL
	SOIL APPLIED	POST-EMERGENCE		CONTACT	SYSTEMIC	CONTACT	SYSTEMIC		
		CONTACT	SYSTEMIC						
Turbo TeeJet® Reference page 7		VERY GOOD	VERY GOOD	VERY GOOD	VERY GOOD	VERY GOOD	VERY GOOD	VERY GOOD	EXCELLENT
Turbo TeeJet® at pressures below 30 PSI (2.0 bar) Reference page 7	GOOD	GOOD	EXCELLENT	GOOD	EXCELLENT	GOOD	EXCELLENT	VERY GOOD	EXCELLENT
Turbo TwinJet® Reference page 16	GOOD	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	EXCELLENT	VERY GOOD	EXCELLENT
Turbo TwinJet® at pressures below 30 PSI (2.0 bar) Reference page 16	VERY GOOD	VERY GOOD	EXCELLENT	VERY GOOD	EXCELLENT	VERY GOOD	EXCELLENT	EXCELLENT	EXCELLENT
Turbo TeeJet® *Induction* Reference page 11	EXCELLENT		EXCELLENT		EXCELLENT		EXCELLENT	EXCELLENT	
Air Induction Turbo TwinJet® Reference page 17	VERY GOOD	GOOD	EXCELLENT	GOOD	EXCELLENT	GOOD	EXCELLENT	EXCELLENT	
AI3070® Reference page 18		VERY GOOD	VERY GOOD	EXCELLENT	VERY GOOD	EXCELLENT	VERY GOOD	EXCELLENT	
XR, XRC TeeJet® Reference pages 12–13		EXCELLENT	GOOD	EXCELLENT	GOOD	EXCELLENT	GOOD	GOOD	EXCELLENT
XR, XRC TeeJet® at pressures below 30 PSI (2.0 bar) Reference pages 12–13	GOOD	GOOD	VERY GOOD	GOOD	VERY GOOD	GOOD	VERY GOOD	VERY GOOD	EXCELLENT
AIXR TeeJet® Reference page 8	VERY GOOD	GOOD	EXCELLENT	GOOD	EXCELLENT	GOOD	EXCELLENT	EXCELLENT	
AI, AIC TeeJet® Reference pages 9–10	VERY GOOD	GOOD	EXCELLENT	GOOD	EXCELLENT	GOOD	EXCELLENT	EXCELLENT	
TwinJet® Reference page 21		EXCELLENT		EXCELLENT		EXCELLENT			GOOD
DG TwinJet® Reference page 22	VERY GOOD	VERY GOOD	EXCELLENT	VERY GOOD	EXCELLENT	VERY GOOD	EXCELLENT	VERY GOOD	GOOD
Turbo FloodJet® Reference page 23	EXCELLENT		VERY GOOD		VERY GOOD		VERY GOOD	EXCELLENT	
TurfJet® Reference page 26	EXCELLENT		EXCELLENT		EXCELLENT		EXCELLENT	EXCELLENT	
QCTF Turbo FloodJet® Reference page 24	EXCELLENT							EXCELLENT	

Note: Consult the chemical manufacturer's product label for specific rate and application recommendations.



Overlap Nozzles 40-50 Percent

- Overlap based on nozzle angle (80 vs 110) and height above canopy

- Calibrate your system for different uses (more viscous solutions reduce output)

Conclusion

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- Follow the label recommendations for surfactant choice and rate. It is very important to assure good activity.
- For the majority of conditions – difference between surfactants or surfactant rates are very subtle.
- Avoid nonyl- phenol chemistries under sensitive ecological conditions.
- Nozzles choice, PSI, spacing, and calibration are critical

Questions?