

**CO-OP AGRO** IT'S HERE.



# Spray Water Quality



**GROW**



**FUEL**



**EQUIP**



**BUILD**



**FEED**

# Herbicide Formulations

Herbicide formulations contain

## 1. Active ingredient

- This is the component responsible for having the toxic effect on the targeted plant

## 2. Inert ingredients

- Solvents can be water, petroleum distillates
- Carriers can be water or clay
- Adjuvants are substances in a herbicide formulation to improve herbicidal activity or application characteristics. These include: surfactants, stickers, drift retardants, pH adjusters, anti foaming agents.
- Surfactants when added to a herbicide, reduce its surface tension, thereby increasing its spreading and wetting properties. Makes water wetter.

# Herbicide Formulations

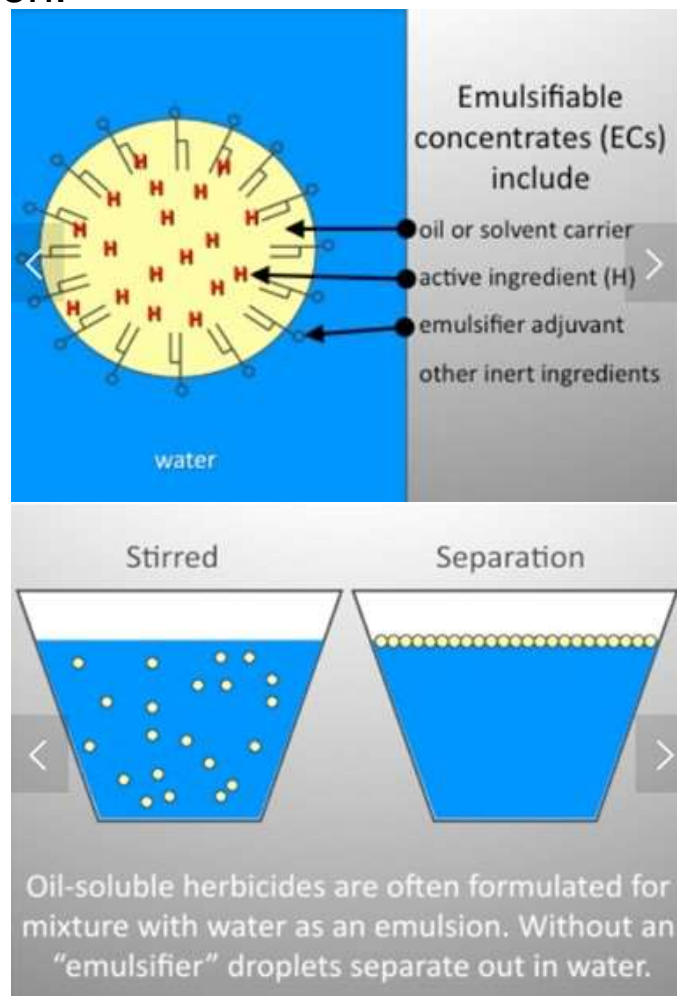
**Emulsifiable Concentrate (EC, MEC):** A solvent based (oil) system that contains active ingredients dissolved in a solvent and emulsifiers. It is designed to form an oil-in-water emulsion upon dilution.

Advantages:

- Relatively easy to handle, transport, and store
- Not abrasive, do not plug screens or nozzles
- Little visible residue on treated surfaces

Disadvantages:

- Agitation required – Can settle out if left in tank
- May be more phytotoxic to non-target plants
- More easily absorbed through skin of humans or animals
- Solvents may cause sprayer parts to deteriorate.
- May be corrosive



# Herbicide Formulations

## Solutions, Soluble liquids and Soluble Powders (S,SL, SP):

These formulations dissolve and go into solution. Think of adding table salt to water and stirring. The active ingredient (salt) dissolves to become part of the solution and doesn't separate out.

### Advantages:

- Mix readily with water
- No agitation required for water soluble herbicides when mixed with water
- Non volatile, non abrasive
- Do not plug screens or nozzles

### Disadvantages:

- Inhalation hazard when pouring soluble powders
- Some products may react with unlined steel spray tanks
- Eye irritation with some salts
- **Hard water or water containing high salts may have reduced efficacy with these formulations.**

# Herbicide Formulations

**Wettable Powder (WP), Water Dispersible Granules (WDG), Dry Flowables (DF) Liquid Flowables and Suspensions (SN), Suspension Concentrates (SC) Suspoemulsion (SE)**

These formulations contain tiny particles of active ingredient suspended in liquid and milled to reduce average particle size. Suspension agents are added to prevent solids from settling. Wetting agents are also added because most active ingredients are hydrophobic.

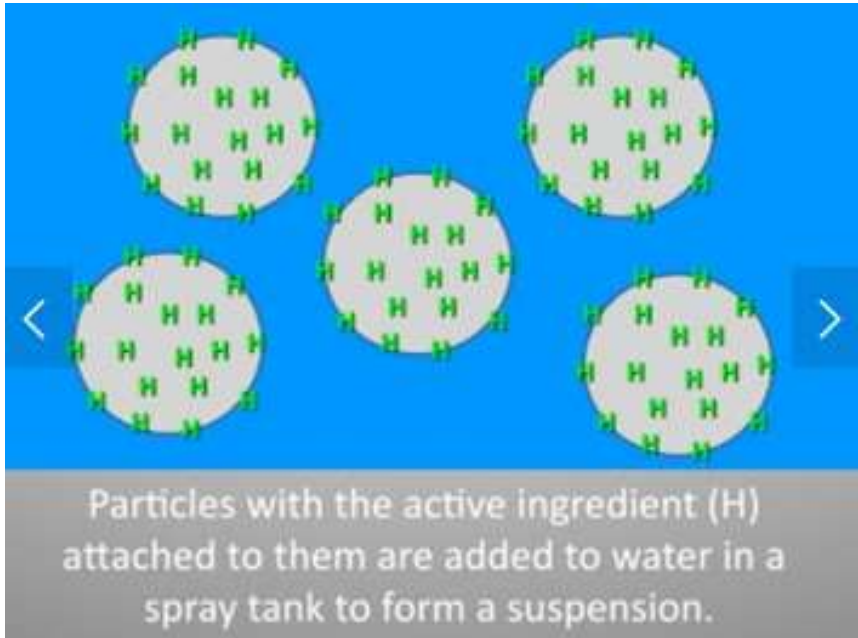
Advantages:

- Ease of transport and handling
- Reduced applicator exposure when mixing and loading
- Seldom clog nozzles

Disadvantages:

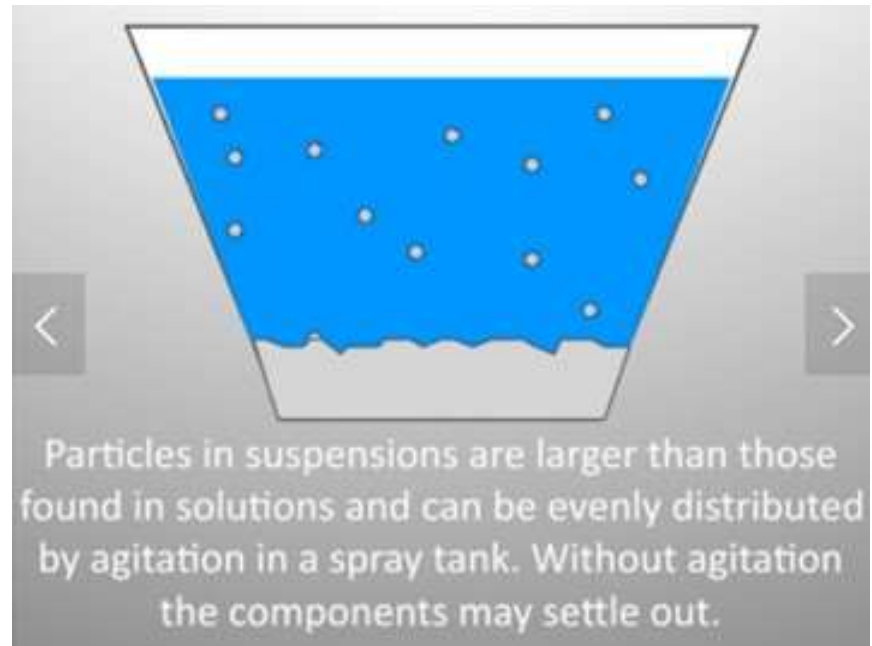
- May require agitation
- May be abrasive to sprayers, may leave a visible residue
- WP may be difficult to mix in very hard or alkaline water
- WP may clog nozzles and screens

# Herbicide Formulations



Without agitation the particles will eventually settle to the bottom of the tank creating a sludge which will clog filters, nozzles and pumps.

Wettable powders are a cheap formulation to manufacture. The (ai) is attached to particles which do not dissolve when added to water. They are suspended in solution with agitation.





# Why is water quality important when spraying??





**1 square foot**

**10 gpa = < 0.8 g/ft<sup>2</sup>**

**5 gpa = < 0.4 g/ft<sup>2</sup>**

**How about 5gpa with more pressure?**





## Well Water Sample

Conductivity: 3.78 dS/m

Hardness: 2100 ppm

pH: 7.38

TDS: 1890 ppm

0.84 g in 1 measuring cup of water.

More than 16 kg of salt in a 1200 US gallon spray tank!



Pioneer Cooperative Association Ltd.  
 S.SERV RD HWY#1, W.  
 SWIFT CURRENT, SK S9H 0G1  
 Ph: (306) 778-8800 Fax: (306) 773-7313

# Invoice

Ref No: 10124667  
 Date: Jun 11, 2019  
 Page: 1 of 1

Sold To:

Ship To:

3062984445  
 Sales Rep: Ken Wall  
 GST#: 897791075

Item #	Description	Ref No	Quantity	Unit	Taxes	Unit Price	Amount
3006384	ASSURE II CASE	10Wo10322	80	CASE	N		
935726	PURBUII 3.3 L	10Wo11340	6	JUG	N		
7700180	FLUSH 10L	10Wo11340	10	EACH	N		
3101011	PERIMETER II 3.4 L	10Wo11340	12	JUG	N		
3157062	CARRIER 8 L		36	JUG	N		
3083490	OCTTAIN XL 9 L	10Wo11340	214	JUG	N		
3078995	TRAXOS 10 L	10Wo11340	70	JUG	N		
3110871	SIMPLICITY GO-DRI 2.24 KG	10Wo11340	16	JUG	N		
3089307	AGRAL 90 10 L		12.8	JUG	N		
3068731	LIQUID ACHIEVE 8 L		36	JUG	N		

# \$104,063.50

Invoice is Due on or Before: Jul 31, 2019

**Total**

**\$104,063.50**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Created On: Jun 11, 2019 11:43 AM

# Factors affecting water quality

1. Total Dissolved Solids
2. Hardness
3. Bicarbonates
4. pH
5. Suspended solids and organic matter
6. Iron
7. Water Temperature

# 1. Total Dissolved Solids (TDS)

- The amount of dissolved salt in the water
- Electrical Conductivity (EC)
- Units = mS/cm (milisiemens/centimeter) = dS/m (decisiemens/meter)
- Did You Know? Conductivity x 650 = TDS.
- **What is a good EC? < 0.5 dS/m**
- Unfortunately very few groundwaters on the Canadian Prairies meet this criteria.
- For herbicide water quality, the type of minerals dissolved in the water is the most important consideration.



# Major mineral constituents in Prairie water

Cations (positively charged)	Anions (negatively charged)
Calcium	Sulfate
Magnesium	Chloride
sodium	Bicarbonate

Report Number: C18173-60002  
 Account Number: 95000

# A & L Canada Laboratories Inc.

2136 Jetstream Road, London, Ontario, N5V 3P5  
 Telephone: (519) 457-2575 Fax: (519) 457-2664



C18173-60002



TO: TAKAILA KENDALL  
 501 CENTRE STREET  
 PONTEIX, SK S0N1Z0

FOR: KEVIN ROSS

KTRS FARMS LTD.

Phone: 519-457-2575

PAGE: 2

PROJECT NO:  
 PO NO:  
 LAB NUMBER: 1736003  
 SAMPLE ID: DUGOUT IN 31-9-9 W3

## CERTIFICATE OF ANALYSIS

SAMPLE MATRIX: WATER  
 DATE SAMPLED: NONE GIVEN  
 DATE RECEIVED: 2018-06-22  
 DATE REPORTED: 2018-06-25  
 DATE PRINTED: 2018-06-27

PARAMETER	RESULT	UNIT	DETECTION LIMIT	Irrigation INTERPRETATION (POTENTIAL PROBLEMS)		
				NONE	INCREASING	SEVERE
Potassium	20.55	ug/ml	0.10	----	----	----
Sodium	56.49	ug/ml	0.10	< 70	70 - 180	> 180
Sulphur (as SO4)	279.030	ug/ml	0.10	----	----	----
Zinc	BDL	ug/ml	0.02	< 2.0	> 2.0	----
Conductivity (@ 25 deg C)	0.73	ms/cm	0.02	< 0.75	0.75 - 3.0	> 3.0
pH	7.5		0.1	5.5 - 7.5	< 5.5 or > 7.5	< 4.5 or > 8.5
pHc	7.638		0.01			
Total Dissolved Solids	475.9	ug/ml	10.0	< 480	480 - 1920	> 1920
SAR	1.565	---	0.01	< 3.0	3.0 - 6.0	> 6.0
Saturation Index	-0.11		0.01			
Sulphur	93.01	ug/ml	0.10	----	----	----

Method ID: Greenhouse / Irrigation  
 BDL Result: Below Detection Limits (None Detected)  
 The results of this report are for agricultural use only.  
 They are not to be used for determining drinking suitability

Results Authorized By:

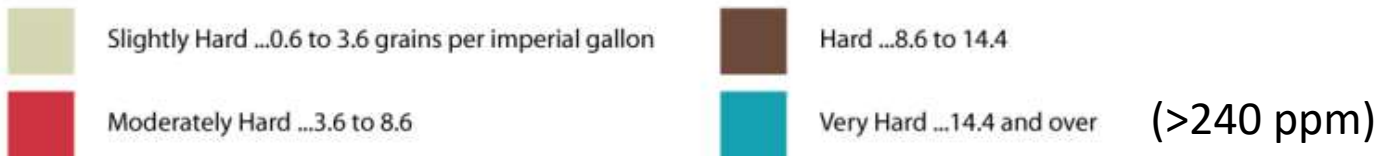
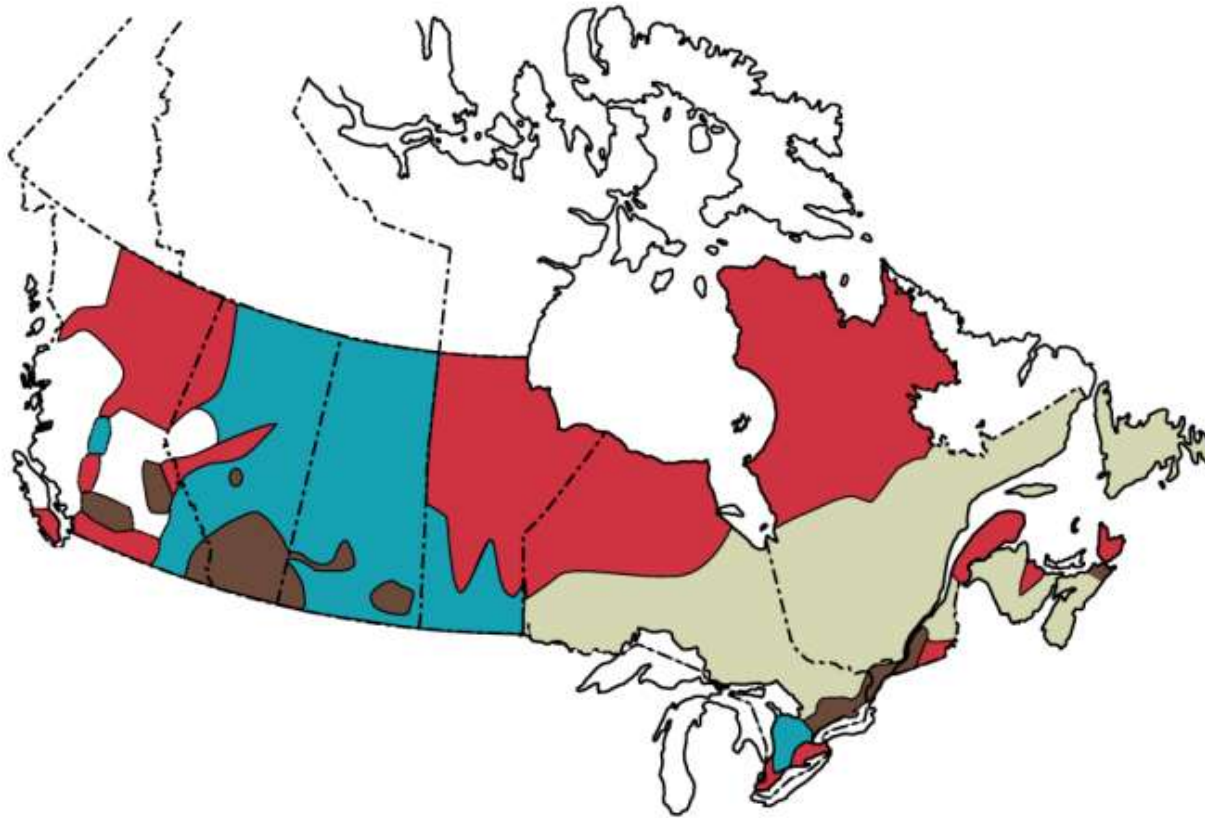
Sanja Hadzic, Environmental  
 Supervisor

\* - accredited test

The results of this report relate to the sample submitted and analyzed.

A&L Canada Laboratories Inc. is accredited by the Standards Council of Canada for specific tests as listed on www.scc.ca and by the Canadian Association for Laboratory Accreditation as listed on www.cala.ca

## 2. Hardness



## 2. Hardness

- Hard water produces scale in appliances and does not produce suds
- Water hardness is the measure of the total concentration of hard water ions. These include Fe, Zn, **Mg, Ca**, Na, and K.
- Hardness is typically determined by the amount of calcium and magnesium present as calcium carbonate equivalent.
- Expressed in ppm, mg/L or grains per US gallon.





# Hardness affects the efficacy of herbicides when:

## 1st

## 2nd

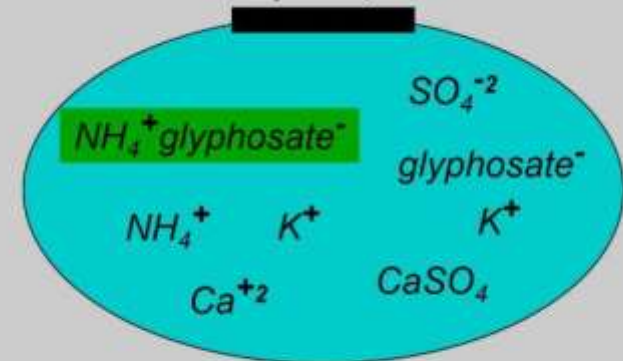
The negatively charged pesticide molecules attach to the positively charged cations, such as Mg and Ca. The binding of pesticides with these cations creates molecules that:

- Cannot enter the target pest
- Enter the pest (ie. leaf) at a much slower rate
- Precipitate out of the pesticide solution



1<sup>st</sup>  $(\text{NH}_4)_2\text{SO}_4$

2<sup>nd</sup> glyphosate (potassium salt)




*Ammonium glyphosate is readily absorbed into plant tissue.*

Products most affected by hard water are **weak-acid herbicides** such as Glyphosate, Glufosinate Ammonium and 2,4-D.

## Weak Acid Herbicides

**Weak acid is a chemical compound that does not ionize or dissociate readily in an acidic Solution. Below is a partial list of some key weak-acid herbicides currently used in Canada.**

2,4-D Amine	Dicamba	Imazamox	Picloram
Amitrole	Endothal	Imazapyr	Quizalofop
Atrazine	Fluazifop	Imazethapyr	Sethoxydim
Bentazone	Glufosinate Ammonium	MCPA Amine	Tralkoxydim
Clethodim	Glyphosate Isopropylamine	Metsulfuron-Methyl	
Clopyralid	Glyphosate Potassium	Paraquat	



Water hardness is 664 ppm expressed as CaCO<sub>3</sub>, glyphosate applied at 0.5 Litre per acre at 10 gallons per acre (GPA) total volume.

Would need about 23.6% more herbicide (i.e. an additional 120 mL/ac) would have to be used.\* (Based on a 360 gai formulation.) to compensate for the hardness.

For a 540 formulation you would require about 15.6% more.

# To Mitigate the Effects of Hard Water


1. Use **maximum recommended rates** of herbicide for the application
2. **Spray the solution immediately** after mixing
3. To limit the amount of binding with herbicides (specifically glyphosate) use the **lowest recommended rate** of water (ie. 5 gpa)
4. Use a different product formulation if possible. In the case of **2,4-D**, **use ester instead of amine**. Use of a non-ionic surfactant 0.1% v/v will also help



# To Mitigate the Effects of Hard Water

## Continued

5. Mix ammonium sulphate (AMS 21-0-0-24) with the water prior to the addition of herbicide .
  - If the water hardness is > 350 mg/L (20 grains), add 1% v/v AMS
  - If the water hardness is > 515 mg/L (30 grains), add 2% v/v AMS
  - If the water hardness is > 700 mg/L (40 grains), find another water source.
6. The lower rate of AMS should be used in-crop when daytime temperatures are warm to reduce the potential for leaf burn on the crop.
7. The sprayer should be thoroughly rinsed with clean water after use to reduce corrosion



**Bayer CS suggests that total water hardness should be below 350 ppm (20 grains) for the low rate (1/2 L/acre equivalent) of glyphosate, and below 700 ppm for the higher rates.**

### 3. Bicarbonates

When water contains high levels of bicarbonates, but low levels of other ions like chloride or sulphate, it can inhibit the effectiveness of herbicides, most notably **Achieve, Dims in group 1** as well as **2,4-D amine, especially when low rates are used**

Bicarbonates contain the anion  $\text{HCO}_3^-$  (negative charge) that is always associated with positively charged cations such as sodium and calcium. This contributes to the alkalinity of a water sample.

Bicarbonate antagonism can be greatly reduced by adding 1% v/v of AMS or 0.5L/100L of liquid 28-0-0

If possible avoid using water with more **than 500 ppm bicarbonate** when applying Achieve, Clethodim (Centurion, Patron, Select, etc.) or Poast.

When more than 500 ppm of bicarbonates, use the maximum recommended rate of the herbicide @ optimum growth stage for the weeds.



**Definite guidelines are hard to find because the antagonistic effect of the bicarbonate ion depends on the presence of other ions such as Na & Ca.**

Where water containing more than 500 ppm of bicarbonate is known to occur, the following should be considered:

- Use an alternate water source if available
- Use an LV Ester formulation
- **Use MCPA ester rather than amine if MCPA is recommended.**
- Use the maximum rate of 2,4-D amine
- Use a non-ionic surfactant at 0.1% v/v (1L per 1000L) of spray solution if the amine formulation is used. Nitrogen fertilizers and acidifiers have not been effective in correcting the problem with 2,4-D amine.






# 4. pH

Is a complex parameter because it is related to pesticide solubility, hard water antagonism, and pesticide degradation.

If the pH of water used in the spray tank is between 6 and 8 it is suitable for spraying.



Group	Common name	Trade name	preference
2	Florasulam Pyroxulam	Frontline Simplicity	Higher pH
2	Imi's	Odyssey Ares	Lower pH
Insecticide (some)			Lower pH



**Alkaline hydrolysis:** a process that breaks the bonds holding pesticides together, can reduce the life of a pesticide in solution and is significantly affected by water pH. Products most affected are insecticides

**Solution:** Use a pH reduction agent, such as LI 700<sup>®</sup> or Surfactant NI, that will reduce the pH of the spray solution to around 5 which, in most cases, will take care of any disassociation issues.

Do not reduce the pH of the spray solution when using sulphonylurea (SU) chemistries. SU technology is more soluble at higher pH.

Lowering the pH too much can allow the product to precipitate out of solution and compromise efficacy.

# 5. Suspended Solids and Organic Matter

Dirt and color in the water. Known to deactivate the following herbicides:

- Diquat (Reglone, Bolster)
- Paraquat (Gramoxone)
- Glyphosate brands



Having clean mixing water is very important when these products are used. (Aluminum Sulphate)



## 6. Iron

Iron and manganese can also occur in groundwater in many areas across the prairies.

Is easily detected because it produces rust (iron) or black coloured stains (manganese)

Water containing iron or manganese reduces the activity of products that contain glyphosate.

When iron or manganese dissolved in ground water is exposed to the air, it can quickly oxidize producing a precipitate which can plug screens and nozzles.

For these reasons, water containing iron or manganese should not be used as spray water

# 7. Water Temperature

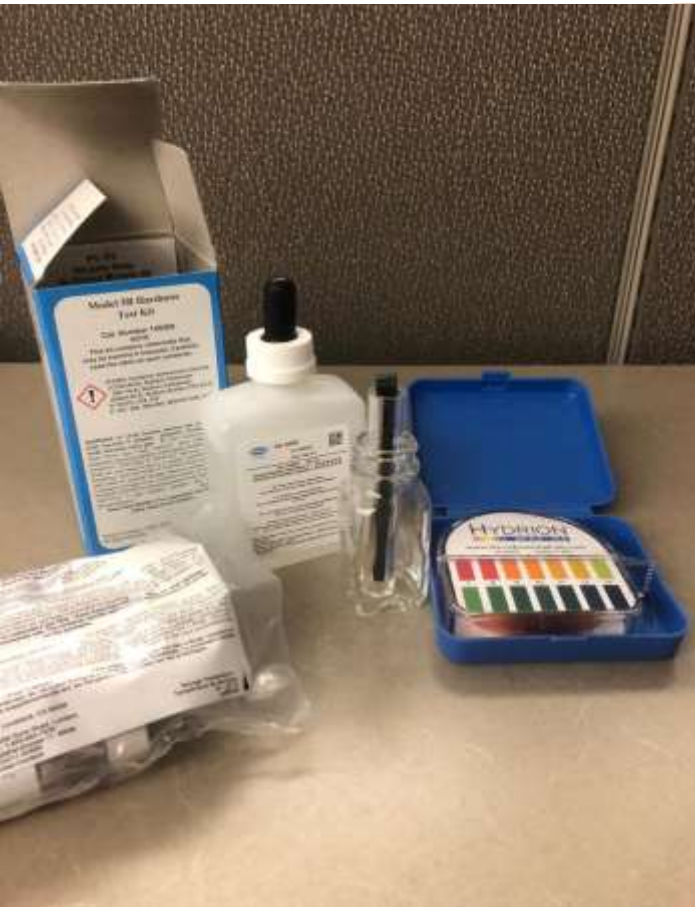
Water temperature can affect some herbicides and herbicide formulations.

If water temperature is cold spend more time mixing and ensure mixing directions are followed.



# Conclusions:

Test your water, know what's in it!!




**A grower tested their well and found poor water.**

**Now what?**

**The first step should always be to try and locate a better water source.**

**If an alternative source isn't available,  
Follow these guidelines.**

<b>If you are using:</b>	<b>Avoid water that has:</b>
Glyphosate	<ul style="list-style-type: none"><li>• High levels of iron</li><li>• Hardness</li><li>• Over 300 ppm CaCO<sub>3</sub> equivalent for low rates of glyphosate</li><li>• Over 700 ppm CaCO<sub>3</sub> for higher rates</li><li>• Suspended solids or organic matter</li></ul>
Dim herbicides (Tralkoxydim, sethoxydim, clethodim)	<ul style="list-style-type: none"><li>• Bicarbonate levels over 500 mg/L</li></ul>
Assert	<ul style="list-style-type: none"><li>• High pH and alkalinity (use pH adjuster)</li></ul>
2,4-D amine	<ul style="list-style-type: none"><li>• Bicarbonate levels over 500 mg/L</li><li>• Hard water</li></ul>
Diquat and paraquat	<ul style="list-style-type: none"><li>• Suspended silt and organic matter</li></ul>



**Caution is advised when adding foliar fertilizer specialty products. Adding a blend of fertilizer salts, combined with associated changes in pH can result in unpredictable interactions with pesticides and water.**

**Ask for compatibility data and always do a jar test!!**

# Kochia & RT – Herbicide Management:

- Consider Staging- Kochia should be <5 cm for best control  
RT should be in the early seedling stage
- Coverage is crucial – use lots of water
- Environmental conditions – avoid spraying after cool nights  
Apply when weeds are actively growing.
- Increase applications along roadsides





# Water Quality for Livestock

## Total Dissolved Solids:

<3000 ppm	Acceptable
<b>3000-5000 ppm</b>	<b>Generally acceptable – Test your water</b> Livestock performance may be reduced
5000-7000 ppm	Poor – especially young and lactating cattle Test for sulfates
7000-10000 ppm	Unsuitable
>10000 ppm	Unsuitable

## Sulphates:


<500 ppm	Good
<b>500-1000 ppm</b>	<b>Acceptable, laxative, consider chelated minerals</b>
1000-1500 ppm	Performance reduced, high probability of trace mineral deficiency
1500-2000 ppm	Poor, polio, mineral deficiencies (chelated minerals)
>2000 ppm	Unsuitable



# Water Quality

- Cattle will drink 0.5-1.5% of their body weight in gallons per day
- Prairie waters can be high in sulfates which can “tie up” minerals such as copper
- High sodium content in water can reduce intake of mineral





Total dietary Sulfur should not exceed 0.4% of diet  
Make sure you know what's in your water!  
Especially if watering from a dugout.

- \* some dugouts may be fed by water high in salts
- \* as well as spring runoff
- \* **May change drastically with summer evaporation rates.**



If you have poor quality water.....

- Switch to a better quality water or use better quality water to dilute minerals in the poor water.
- Depending on the minerals in the water make use of poorer quality water at certain times of the year, with classes of animals that are less affected.
- Make use of the Farm and Ranch Water Infrastructure Program to help with pasture pipelines, new water infrastructure (wells or dugouts), or expanding an existing dugout of known good water quality.
- Test your water!

# Conclusions:

## A word about sloughs and dugouts

- Water from these sources can be highly variable, between locations and also throughout the growing season
- If the water is surrounded by white during the summer months and not much is growing around it, probably best to not use it.
- Is it spring fed or rain/runoff dependent
- Best to check quality before each spray operation



**Conclusions:  
Stay out of sloughs!**

A first-person perspective from the driver's seat of a red tractor. The tractor is moving through a field of tall, golden-brown grain. In the distance, a slough or small pond is visible, surrounded by more grain. The sky is clear and blue. The tractor's red hood and a black cap are visible in the foreground. A black vertical post is on the left side of the frame.

**And finally.....  
If you wouldn't mix your spray water in  
your drink, don't use it in your sprayer!**

**CO-OP AGRO** IT'S HERE.



# Questions??

[Ken.wall@fcl.crs](mailto:Ken.wall@fcl.crs)

**306-750-7711**



**GROW**



**FUEL**



**EQUIP**



**BUILD**



**FEED**



## Questions about Co-op Surfactant NI:

1. How does it compare to other non-ionic surfactants in terms of effect on spray droplet chemistry, physics?

Spray droplet fines are reduced mainly due to the soy lecithin in the formulation. I don't believe it is in the same class as Interlock for reducing fines though. I would need to confirm if the same data has been generated for Surfactant NI, but the presence of lecithin in adjuvants reduces droplet fines under 150 um when using both older XR nozzles and newer air induction nozzles. The presence of lecithin is also purported to decrease droplets over 500 um and makes spray quality more consistent.

2. How does it compare to LI700 in terms of water conditioning, hardness, pH

Co-Op Surfactant NI is a direct competitor to LI 700 so it has all the same uses and mixtures. It is a multi-functional adjuvant that acts as a surfactant and wetter, a pH adjuster (acidifier) and also reduces spray droplet fines as explained above. Many pesticide actives require an acidic pH (clethodim, sulfonyleureas and others prefer a neutral or basic pH) otherwise they degrade. Neither Surfactant NI nor LI 700 are hard water conditioners. Solutions of AMS are required for hardwater conditioning.

## Environmental Services Analysis Report - Final

**Invoice Number:** 1147578  
**Sample Location:** RM Marquis #191  
**Collected by:** Jim LaLonde

**Collected Date:** 18-Oct-2021 12:00 AM  
**Received:** 20-Oct-2021 9:31 AM  
**Reported:** 25-Oct-2021 3:32 PM  
**Water Source:** Well

**Submitted By:**  
LALONDE, JIM  
BOX 68  
MARQUIS, SK  
S0H 2X0

**Invoice:**  
LALONDE, JIM  
BOX 68  
MARQUIS, SK  
S0H 2X0

Analysis	Result	Unit	Sask Guideline	Test Comment	Fee
General Chemistry/Water Quality Panel					104.00
Conductivity	1171	µS/cm	< 2300		
pH	8.7	pH Units	7.0 - 10.5		
Total Alkalinity	491	mg/L CaCO3	< 500		
Phenol Alkalinity	26.6	mg/L CaCO3	No Guideline		
Bicarbonate	534	mg/L	No Guideline		
Carbonate	32	mg/L	No Guideline		
Hydroxide	0	mg/L	No Guideline		
Chloride Dissolved	31.1	mg/L	< 250		
Fluoride Dissolved	0.38	mg/L	< 1.5		
Nitrate Dissolved	<0.2	mg/L	< 45		
Sulfate Dissolved	152.5	mg/L	< 500		
Total Hardness (Calculated)	522	mg/L CaCO3	< 800		
Total Dissolved Solids	1027	mg/L	< 1500		
Iron	1.4	mg/L	< 0.3		
Manganese	0.36	mg/L	< 0.05		
Calcium	64	mg/L	No Guideline		
Magnesium	88	mg/L	< 200		
Potassium	64	mg/L	No Guideline		
Sodium	61	mg/L	< 300		

ACCOUNT NUMBER  
00581

2136 Jetstream Road, London, ON, N5V 3P5 Tel: (519) 457-2575 Fax: (519) 457-2664

TO:WETASKIWIN CO-OP  
3702 - 47TH ST  
WETASKIWIN, AB T9A 2J1

FOR:WELLSPRING SEED

Phone:780-352-3359  
Fax:780-352-8296**CERTIFICATE OF ANALYSIS**

PAGE: 1 / 1

PROJECT NO:  
PO#:  
LAB NUMBER:1096006  
SAMPLE ID:DUGOUTSAMPLE MATRIX:WATER  
DATE SAMPLED:NONE GIVEN  
DATE RECEIVED:2021-04-19  
DATE REPORTED:2021-04-20  
DATE PRINTED:2021-04-20

PARAMETER	RESULT	UNIT	DETECTION LIMIT	METHOD REFERENCE
Total Alkalinity	184.5	ug/ml	10.0	Titration
Bicarbonate	184.5	ug/ml	10.0	Titration
Carbonate	BDL	ug/ml	10.00	Titration
Calcium	57.51	ug/ml	0.10	ICP
Copper	BDL	ug/ml	0.02	ICP
Magnesium	25.26	ug/ml	0.10	ICP
Manganese	0.05	ug/ml	0.02	ICP
Phosphorus	0.47	ug/ml	0.10	ICP
Potassium	38.19	ug/ml	0.10	ICP
Sodium	26.55	ug/ml	0.10	ICP
Sulphur (as SO <sub>4</sub> )	81.510	ug/ml	0.10	ICP
Zinc	0.05	ug/ml	0.02	ICP
Conductivity (@ 25 deg C)	0.59	ms/cm	0.02	Conductivity Meter
pH	7.9		0.1	pH Meter
Total Dissolved Solids	370.119	ug/ml	10.0	TDS Meter
Hardness	247.341	ug/ml	1.00	ICP/Calculation
Nitrate - N	BDL	ug/ml	1.0	Automated Colourimetric
Chloride	16.9	ug/ml	1.0	ISE*