



# Tell the Story!

Wild World of Weeds Workshop

**WINFIELD**  
**UNITED**

January 18, 2022

**Figure out the story.**

**Then just tell the  
story.**

**Dr. John Nalewaja**

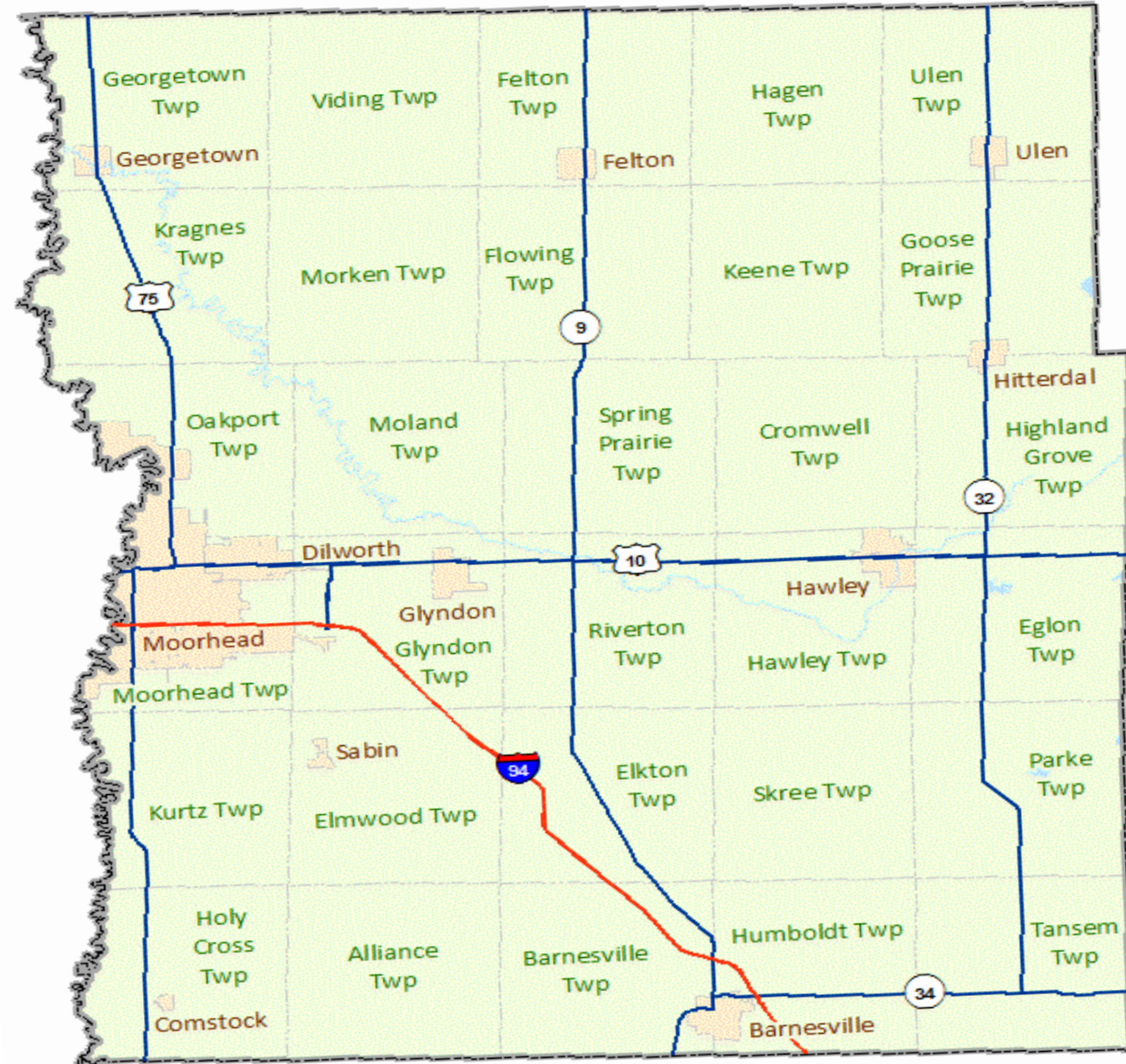
**Thanks Family**  
**NDSU & NDSU Weed Science**  
**NDSU Extension Service**  
**Industry**  
**Societies**

**When I was young:  
Curious, Busy, Daydreamer,  
Wanders Off.  
Observant, Imaginative.  
Not Real Obedient.**

# Clay County Minnesota

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## Felton Township

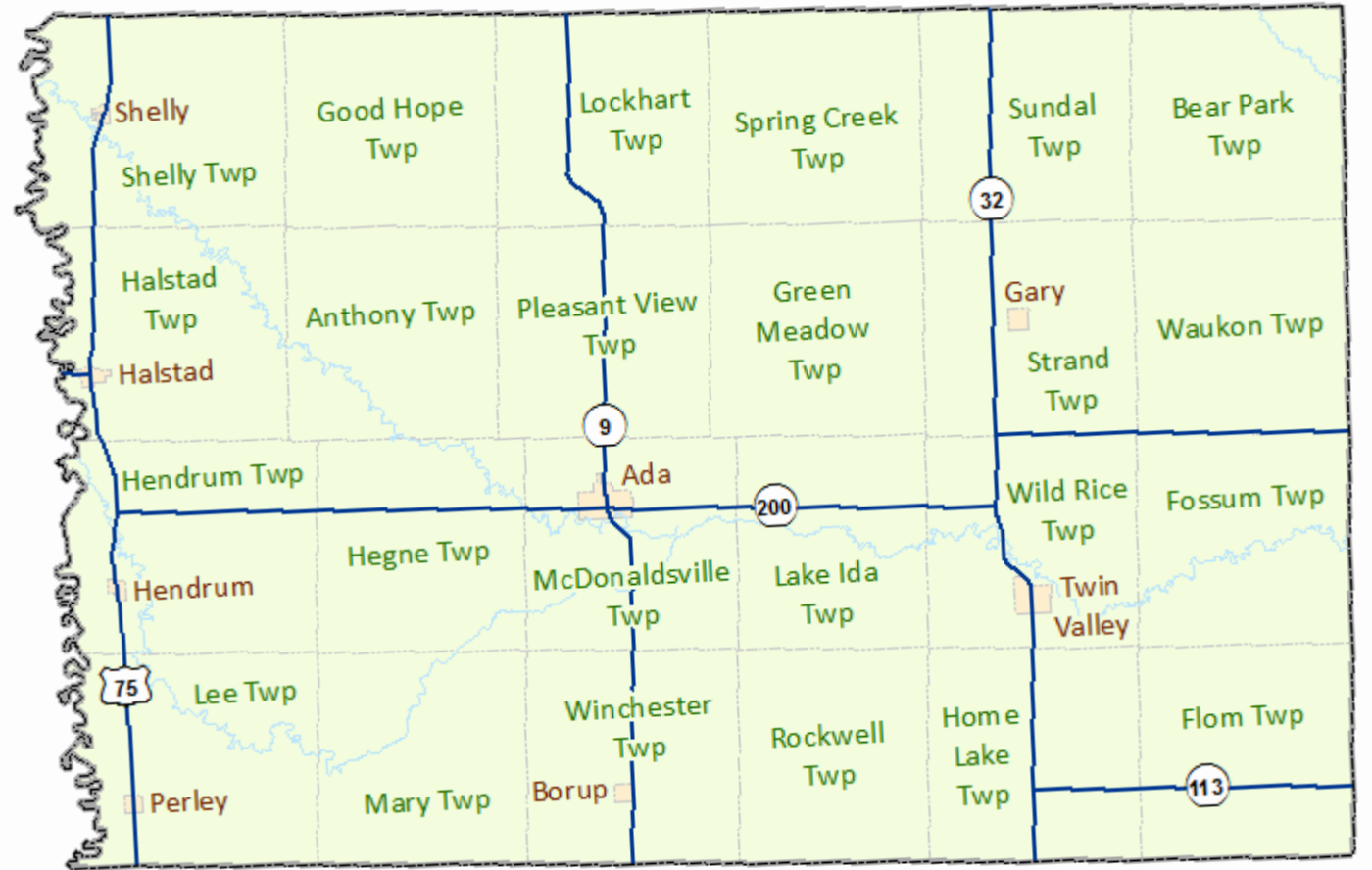


# Norman County Minnesota

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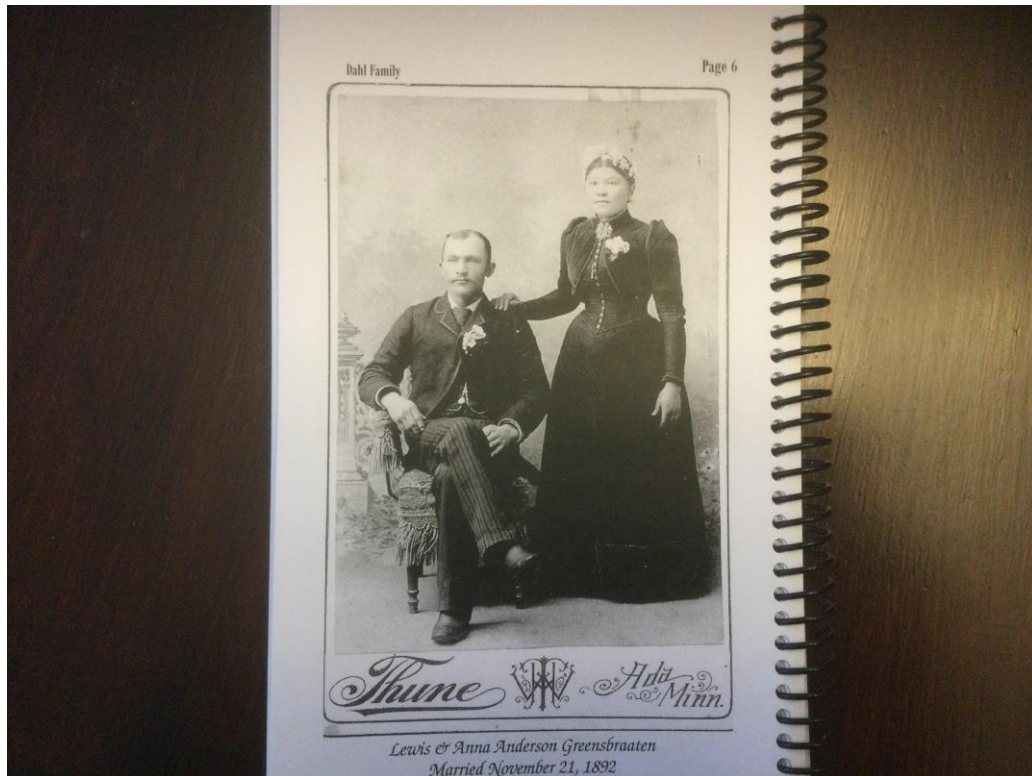
Rockwell  
Township

Anthony, Halstad,  
Shelly Townships



# Lewis and Anna Dahl

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**Potatoes**  
**Wheat, Barley, Oats**  
**Silage Corn**  
**Dry Beans, Sunflower**  
**Alfalfa, Sweetclover**  
**Livestock**



**When you start spinning up  
yellow clay, JUST STOP!  
You are stuck!  
Raymond Dahl  
Tractor Stuck!**

# **Weed Control**

**Plowing, Cultivation, Summer  
Fallow 1969.**

**Cultivation, Hilling Potatoes  
1971.**

**Spraying Herbicides on Wheat,  
Small Grains 1973.**

**Crop Rotation, Delayed Planting,  
Summer Fallow.**

Thanks to Tom  
Peters!

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Thanks to  
Dave Nicolai!

GENERAL SESSION:

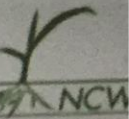
LIVE

## NCWSS past, present, and future: An industry perspective

Thomas J. Peters

Extension Sugarbeet Agronomist and  
Weed Control Specialist

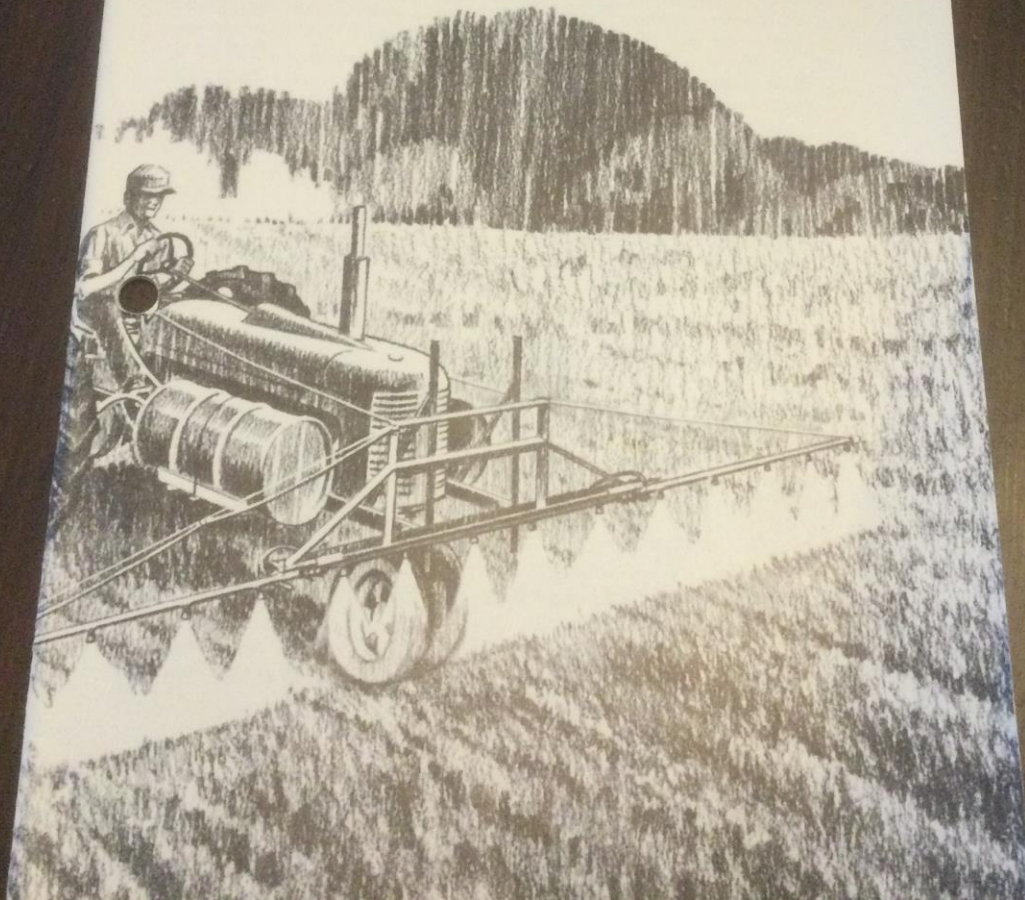
North Dakota State Univ. and the Univ. of  
Minnesota



SEE AGENDA

Farmers' Bulletin No. 2183 • U.S. DEPARTMENT OF AGRICULTURE

●  
USING  
PHENOXY HERBICIDES  
EFFECTIVELY



# Farmers' Bulletin No. 2183 - USDA

- Issued May 1962
- Slightly Revised June 1967

# Spraying 1970's

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# Spraying 1970 - 1980's

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**Wonderful Career**  
**1980 Start of Weed Science for me.**  
**100+ Products**  
**Applied on**  
**Billions of Acres**  
**Products Sold in 7 Countries**  
**On 4 Continents**  
**Leadership and Achievements**

# WinField United Innovation Center

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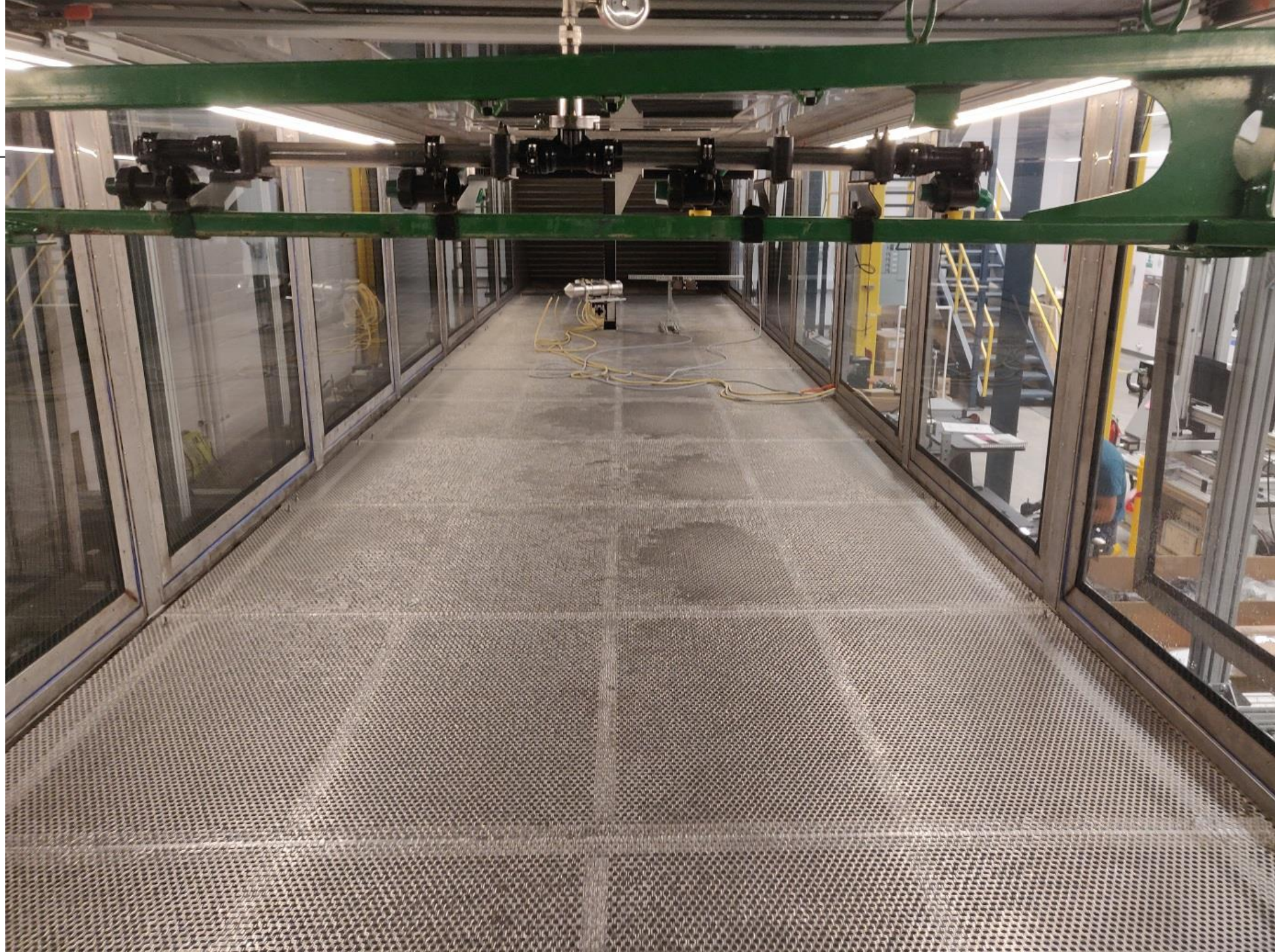


# WinField United Innovation Center











**WINFIELD<sup>®</sup>**  
**UNITED**



**PAY ATTENTION!**

Thanks to  
Bruce Dahl and  
NDSU Ag. Economists

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Pay attention.

Do not let this  
happen again.



# ***Holodomor Memorial Day***

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Famine Genocide in Ukraine (1932-1933)



**BAD THINGS  
HAPPEN WHEN YOU  
ARE DISTRACTED!**

**Good People  
Overcome Bad  
Systems!  
Work-Around!**

**Most People Want to  
Do the Right Thing!**

**People are usually a genius at something!**

**Be Kind!**

**They are also complete mess-ups at most other things!**

**SERENDIPITY!**

**You don't learn  
anything the second  
time you are kicked  
by a mule.**

**Grandpa Henry Dahl**

# Thank you very much!

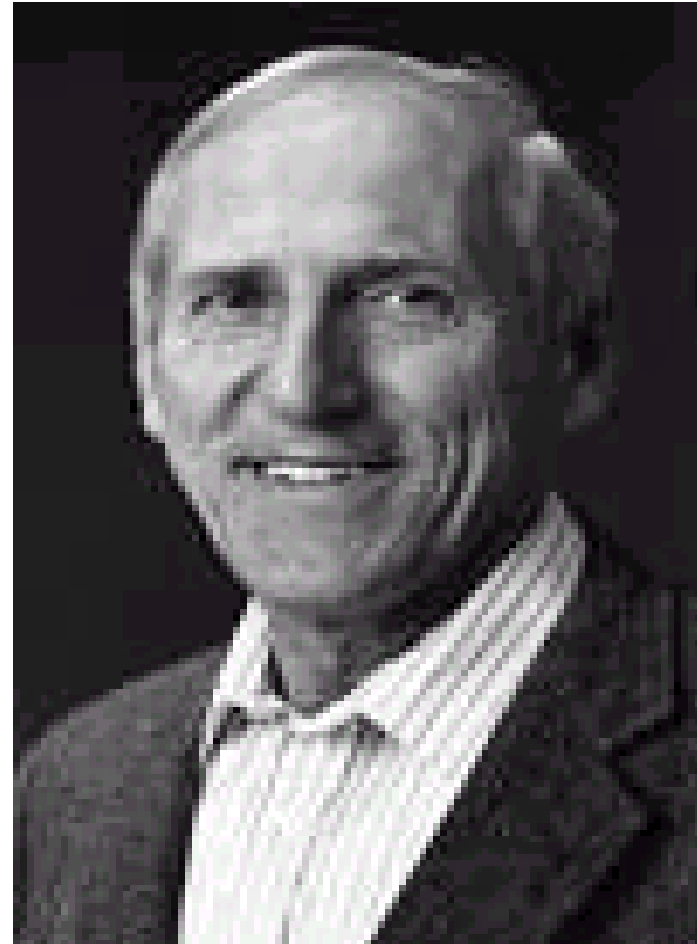
- Alan Dexter
- Cal Messersmith,



# Dr. John Nalewaja

---

Thanks for your  
Leadership, Wisdom,  
Achievements and  
Friendship!





# Joe Gednalske

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Thanks for your Leadership,  
Achievements and Friendship!

Don't get so busy you don't have  
time to think!

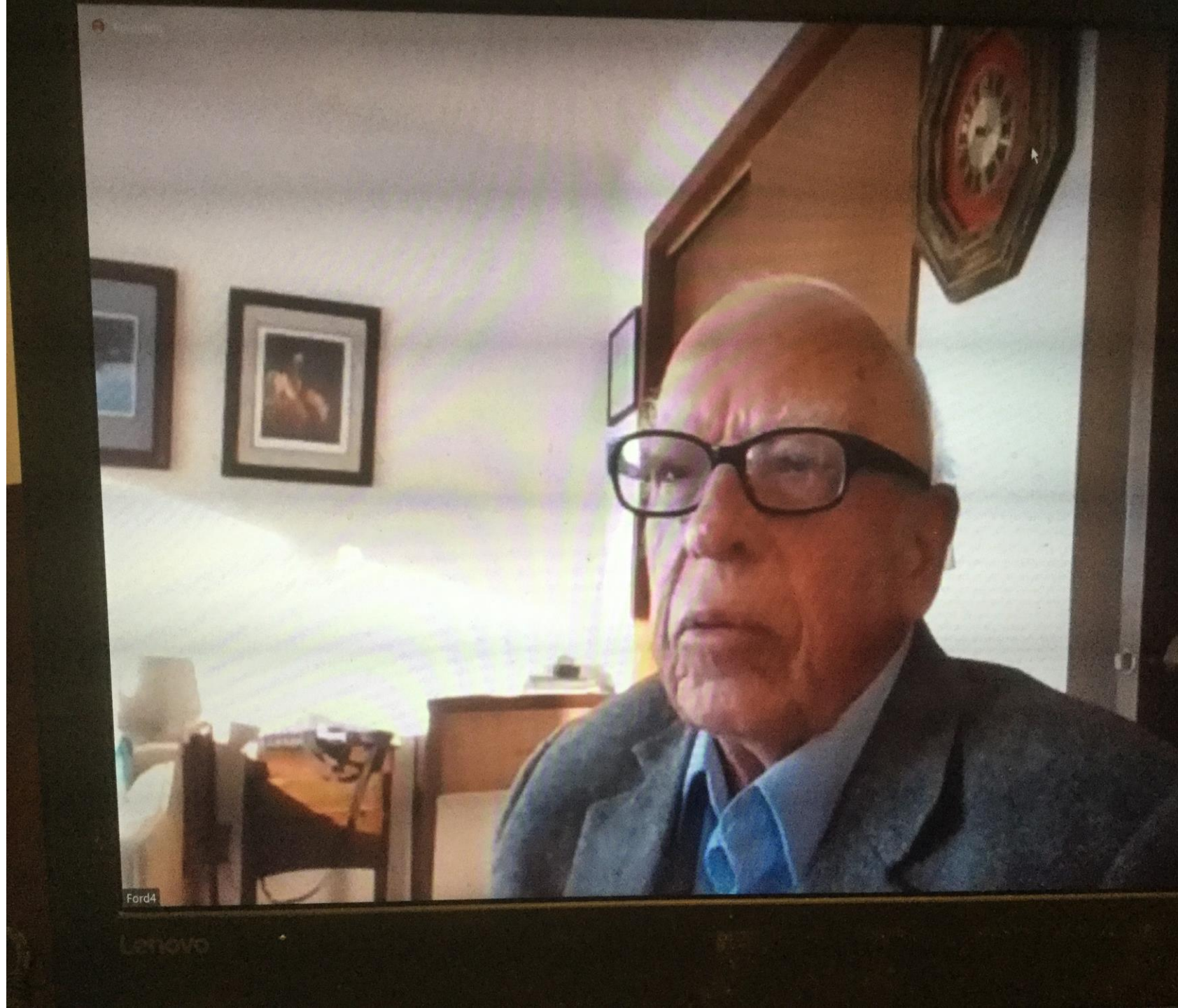
Don't learn something that isn't  
so!



Thank you  
very much!

---

Donald Penner,  
Michigan State  
University



# Dr. Richard Zollinger

---

Thanks for your Leadership,  
Achievements and  
Friendship!



# Adjuvant Resources

Compendium of Herbicide  
Adjuvants

Bryan G. Young, Purdue University

Joseph I. Matthews, Southern Illinois University

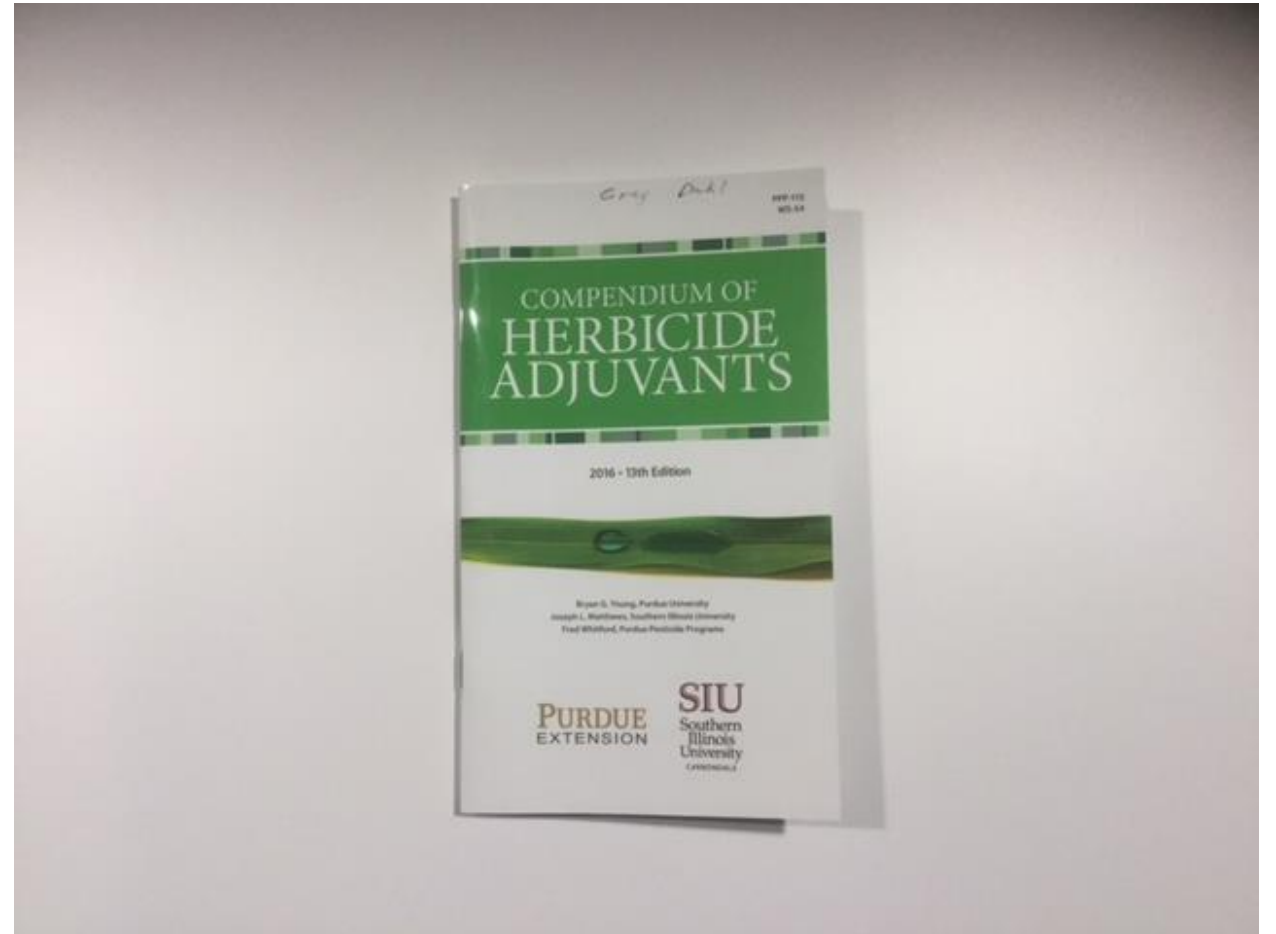
Fred Whitford, Purdue Pesticide Programs

[www.herbicide-adjuvants.com](http://www.herbicide-adjuvants.com)

779 products

38 Companies

20 classes of adjuvant products



# Dr. Rodney Lym

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Thanks for your Leadership,  
Achievements and Friendship!



# Dr. Steve Miller

---

Thanks for your Leadership,  
Achievements and Friendship!



# Vern Hofman

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Thanks for your  
service and  
Achievements!  
Thanks for all the  
fun!



**Plants don't Drink  
Rocks!**

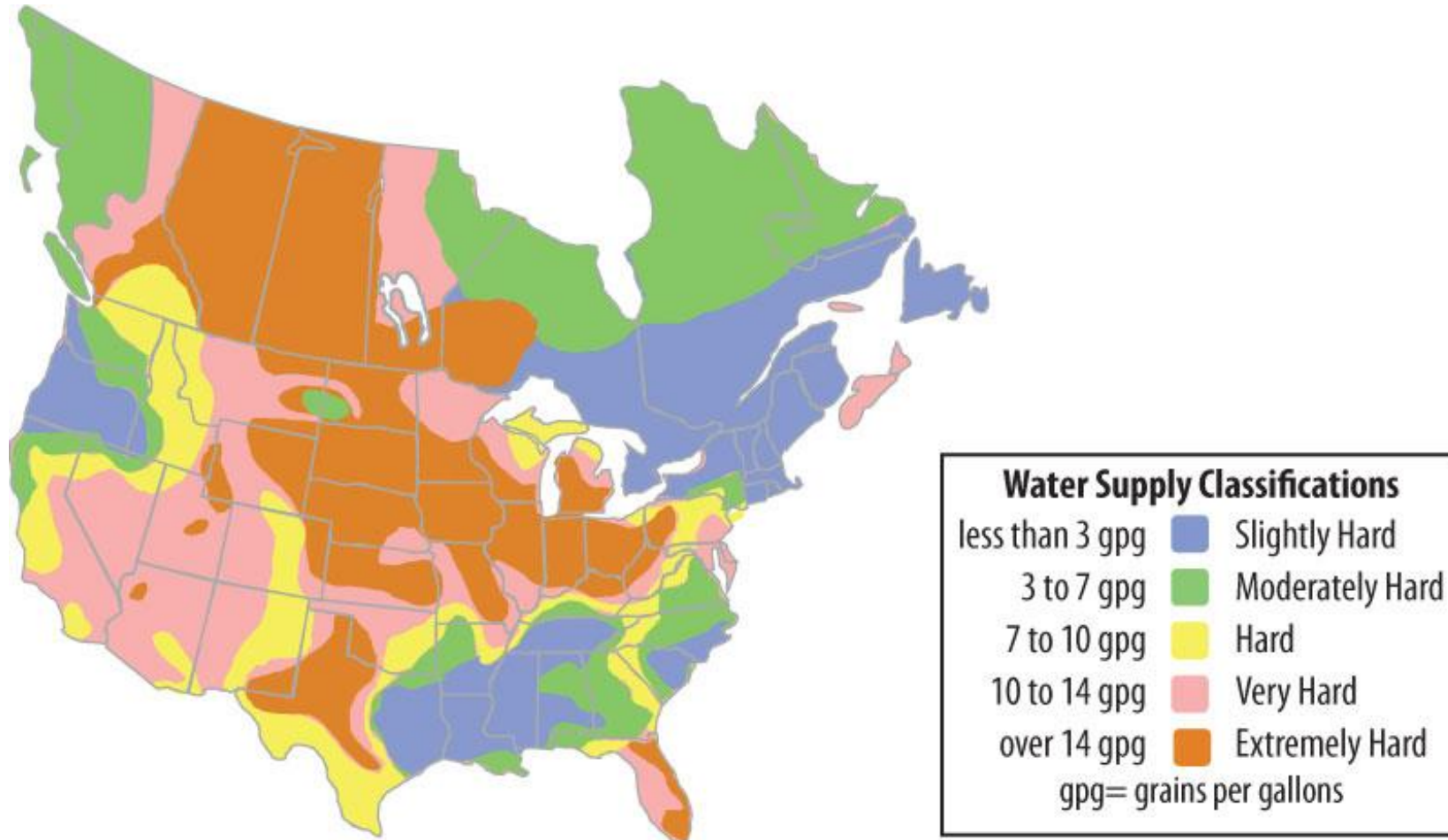


# Understand Where Water (carrier) Quality Is Important

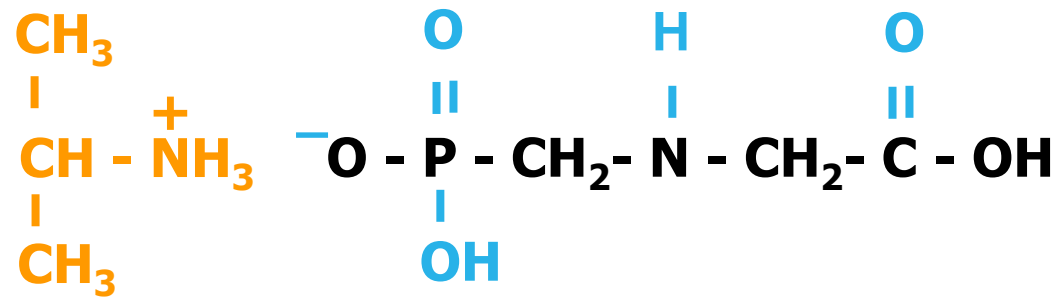
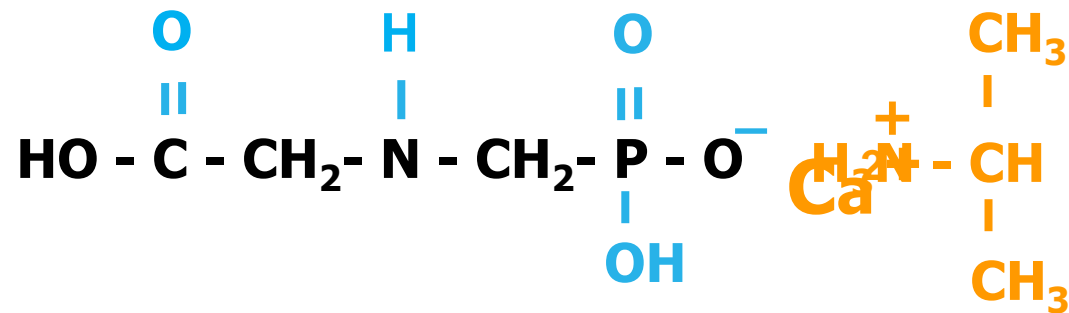
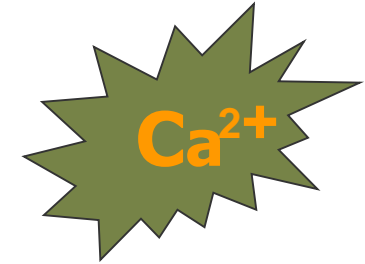
Impurities in the water carrier such as **calcium, magnesium, zinc, iron, manganese** and other can reduce the effectiveness of some herbicides.

- This is especially true with glyphosate formulations, and Liberty, and to a lesser extent with such products such as some Group 1 herbicides like Assure II, Clethodim's and others.
- The addition of ammonium sulfate or ammonium sulfate containing products to the carrier before adding the herbicides can minimize the negative effects of these impurities.

# Water Quality United States and Canada

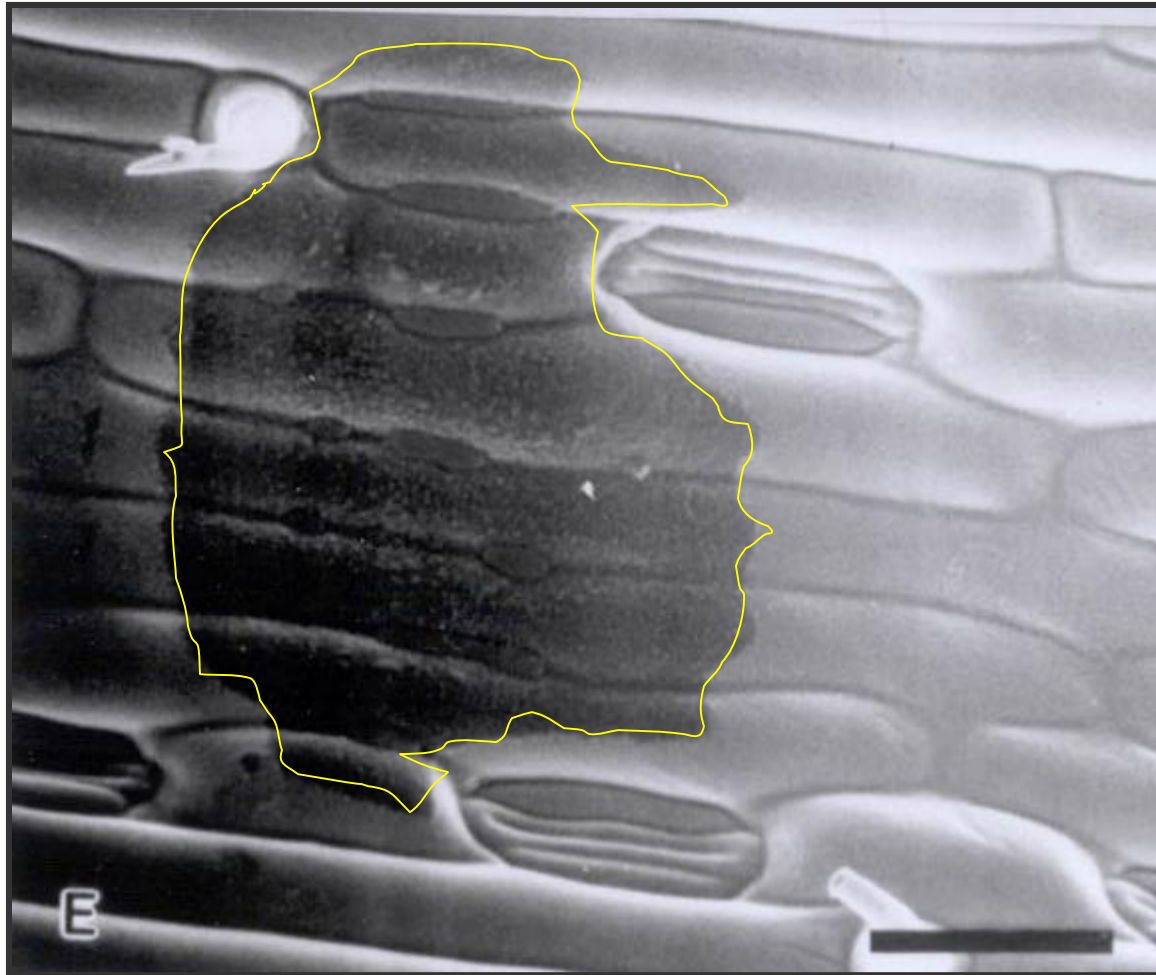


# Water Conditioning Agents



# Wheat leaf surface with residual of glyphosate

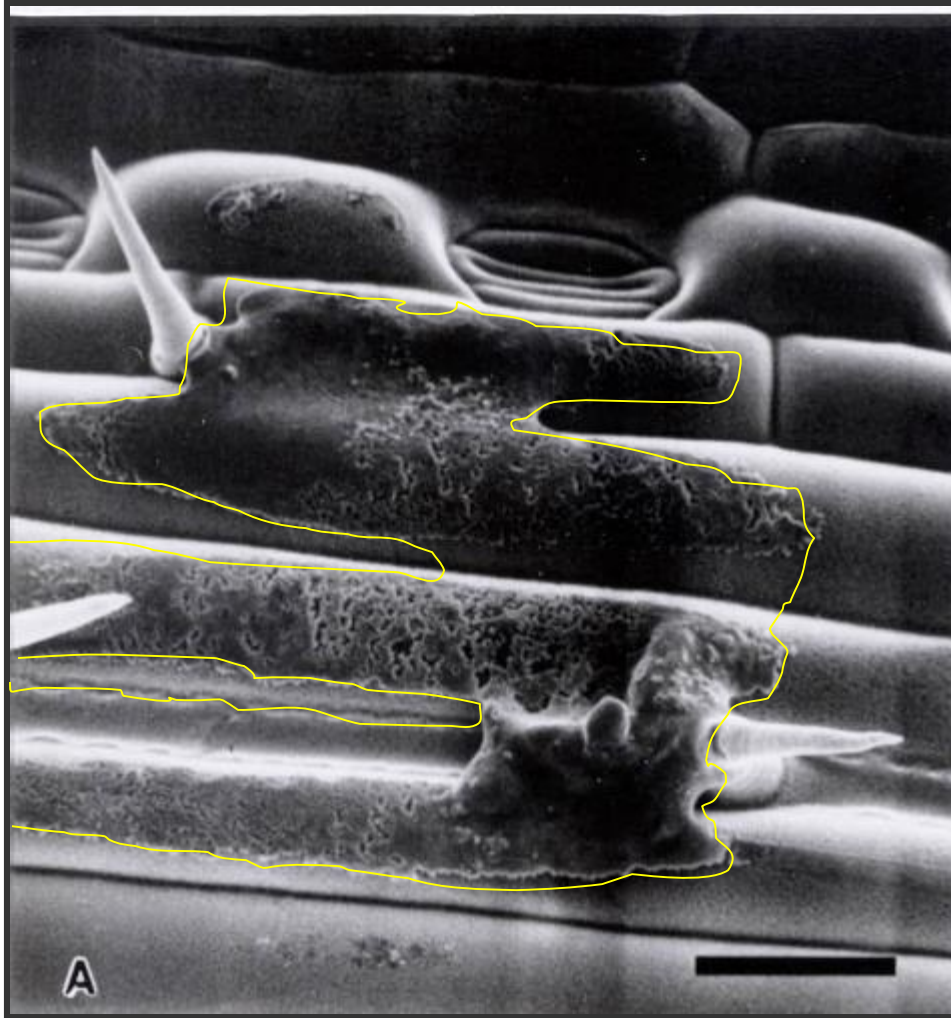
(source: Nalewaja et al., 1992)



Glyphosate +  
Tween 20

# Wheat leaf surface with residual of glyphosate

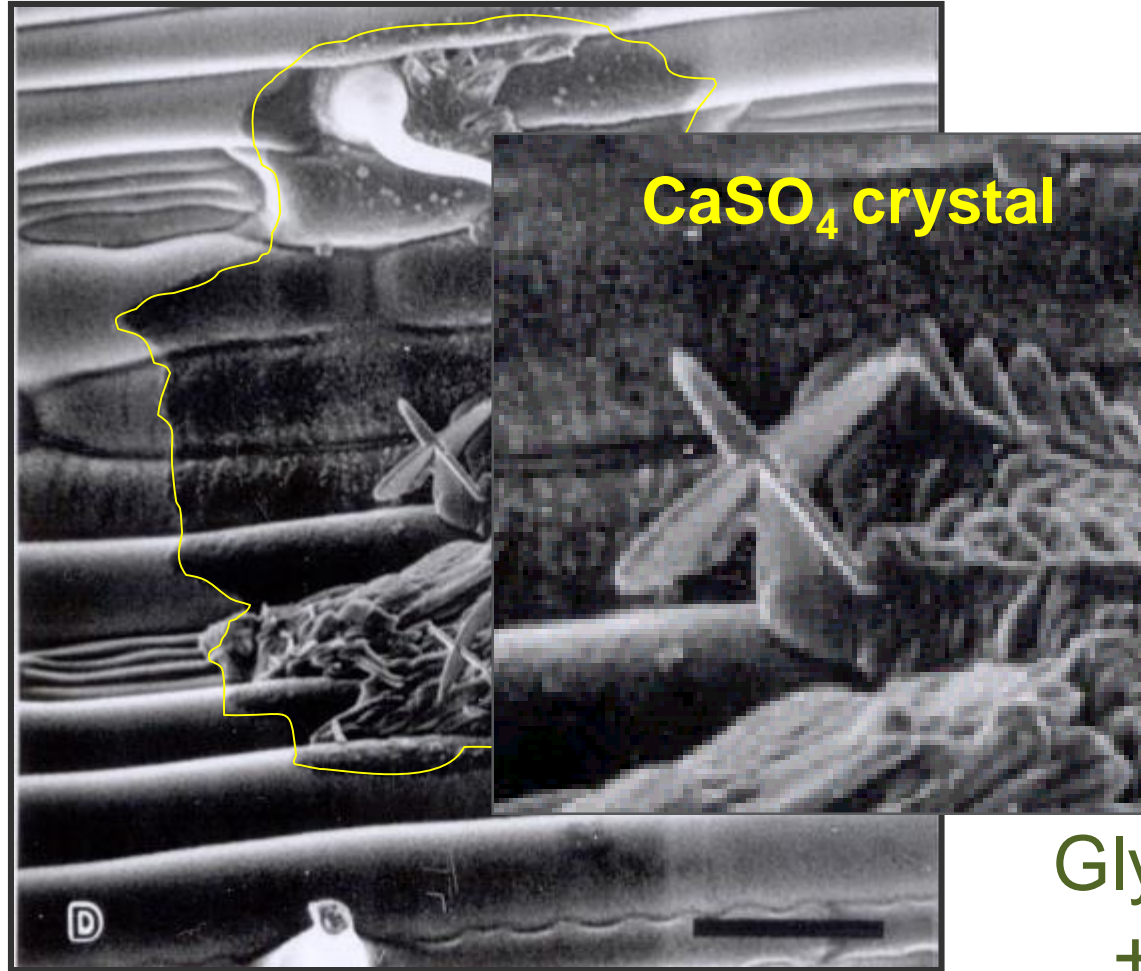
(source: Nalewaja et al., 1992)



Glyphosate + Tween 20  
+ calcium chloride

# Wheat leaf surface with residual of glyphosate

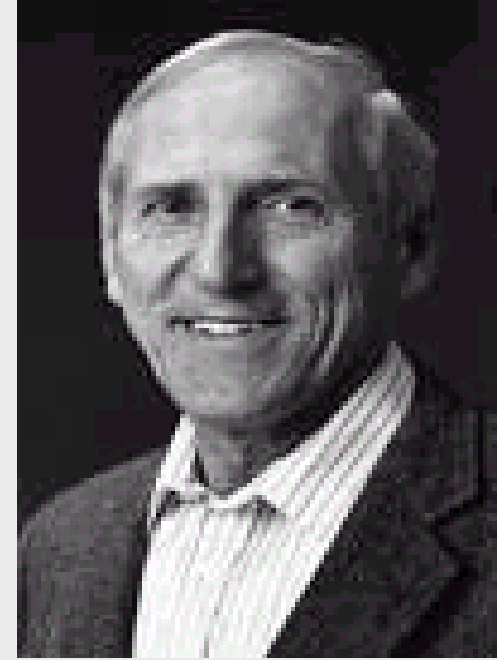
(source: Nalewaja et. al., 1992)



Glyphosate + Tween 20  
+ calcium chloride +  
ammonium sulfate

# Formula for amount of AMS: ND Weed Guide – pg 72

$$\begin{aligned} \text{AMS (lbs/100 gal water)} = & \\ & 0.002 \times \text{ppm K} + \\ & 0.005 \times \text{ppm Na} + \\ & 0.009 \times \text{ppm Ca}^{++} \\ & 0.014 \times \text{ppm Mg}^{++} \\ & 0.042 \times \text{ppm Fe}^{+++} \end{aligned}$$



K, Na, Ca, Mg, Fe values from water analysis.  
Does not account for minerals on leaf surface.

# 14 Days After Application

Liberty®



Liberty® +  
AMS (3 lb/A)



Liberty®  
Class Act®  
(2.5% v/v)



Innovation Center

©2018 WinField

WINFIELD®  
UNITED



# 24 Hours After Application

Enlist One<sup>®</sup>  
Distilled Water

Enlist One<sup>®</sup>  
Hard Water

Enlist One<sup>®</sup>  
+  
Class Act<sup>®</sup> NG<sup>®</sup>  
Hard Water



Enlist One applied at 0.5 pt/A and Class Act NG applied at 2.5% v/v with distilled water or water with a hardness of 1000 ppm CaCO<sub>3</sub> (Hard Water) at 15 GPA to 5 inch tall weeds.  
Class Act NG is a registered trademark of Winfield Solutions, LLC. Enlist One is a registered trademark of Corteva Agriscience.  
©2019 Winfield Solutions, LLC. Because of factors outside of Winfield Solutions' control, such as weather, product application, and any other factors, results to be obtained, including but not limited to yields, financial performance, or profits, cannot be predicted or guaranteed by Winfield Solutions. Actual results may vary.

# The Oil adjuvant Story

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- Fuel Oil
- Oil with 2% emulsifier 1 gal/acre
- COC with 17% emulsifier 1 to 2 qts/a
- Vegetable Oils plus NIS (2% to 20%) Safer to crop, Not as good for weed control. 1 to 2 qts/a
- Vegetable Oils were mainly Soybean Oil, Cottonseed Oil, Sunflower Oil.
- Dr. Nalewaja wanted to build a good Linseed Oil Adjuvant.
- 1982 He obtained Sunflower MSO from NDSU Ag Engineering.
- Amazing results. Best Oil adjuvant to date.
- Creates the whole MSO Adjuvant Class.

# The Oil adjuvant Story

---

- Fuel Oil
  - Oil with 2% emulsifier 1 gal/acre
  - COC with 17% emulsifier 1 to 2 qts/a
  - HSOC with >25% emulsifier 0.5X COC rate 1 pt/a
  - Need enough oil
- 
- MSO better than COC hotter.
  - HSOC with MSO as oil 0.5X MSO rate.
  - Need enough oil.
  - Several products

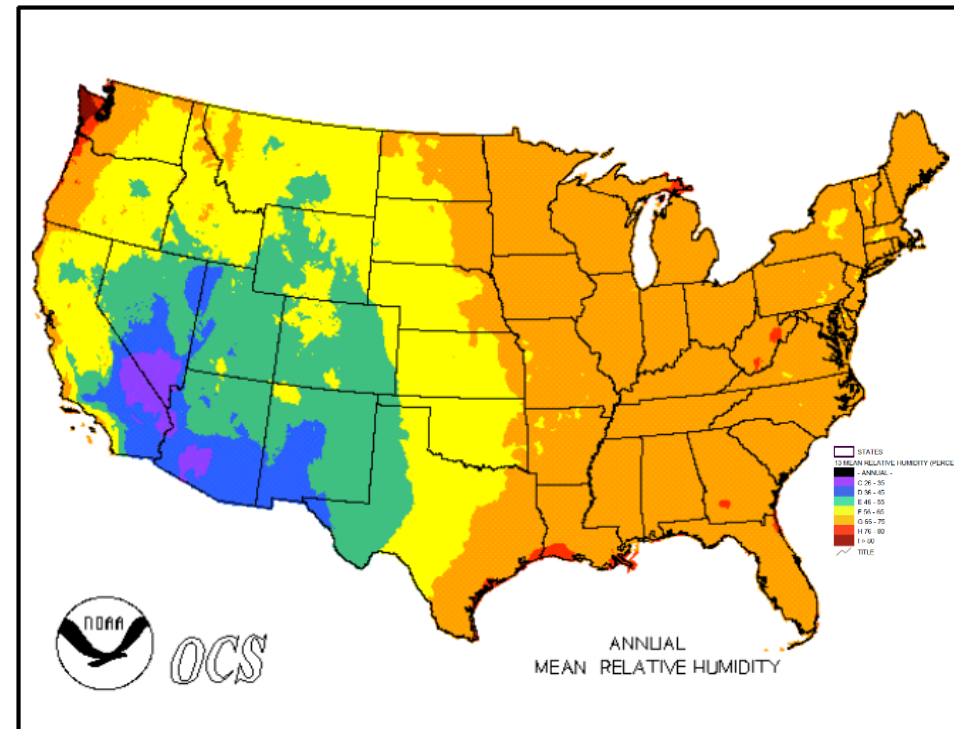
# ASTM Oil Concentrates

Crop oil concentrate (PO) = emulsifiable petroleum oil-based products containing 15-20% surfactant and remainder phytoabland oil.

High surfactant oil conc. (HSOC) = emulsifiable oil (PO or MSO) based products containing 25-50% surfactant and a minimum of 50% oil.

# Oil adjuvants and Climates

- In dry, low humidity environments, plants develop thicker cuticles to compensate for water loss (i.e. more stress)
- MSO's can cause phytotoxicity in tender lush environments.
- MSO's provide better control than petroleum oils in the drier west for weeds.
- Effects are enhanced in drier climates due to aggressive dissolving of leaf wax and cuticle compared to COC and NIS
- No to little difference between MSO and Petroleum oils farther east.



# Glyphosate Formulations Warned Against Using Oil Adjuvants

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Oil Adjuvants could be antagonistic to glyphosate.

## Glyphosate Additives and Adjuvants

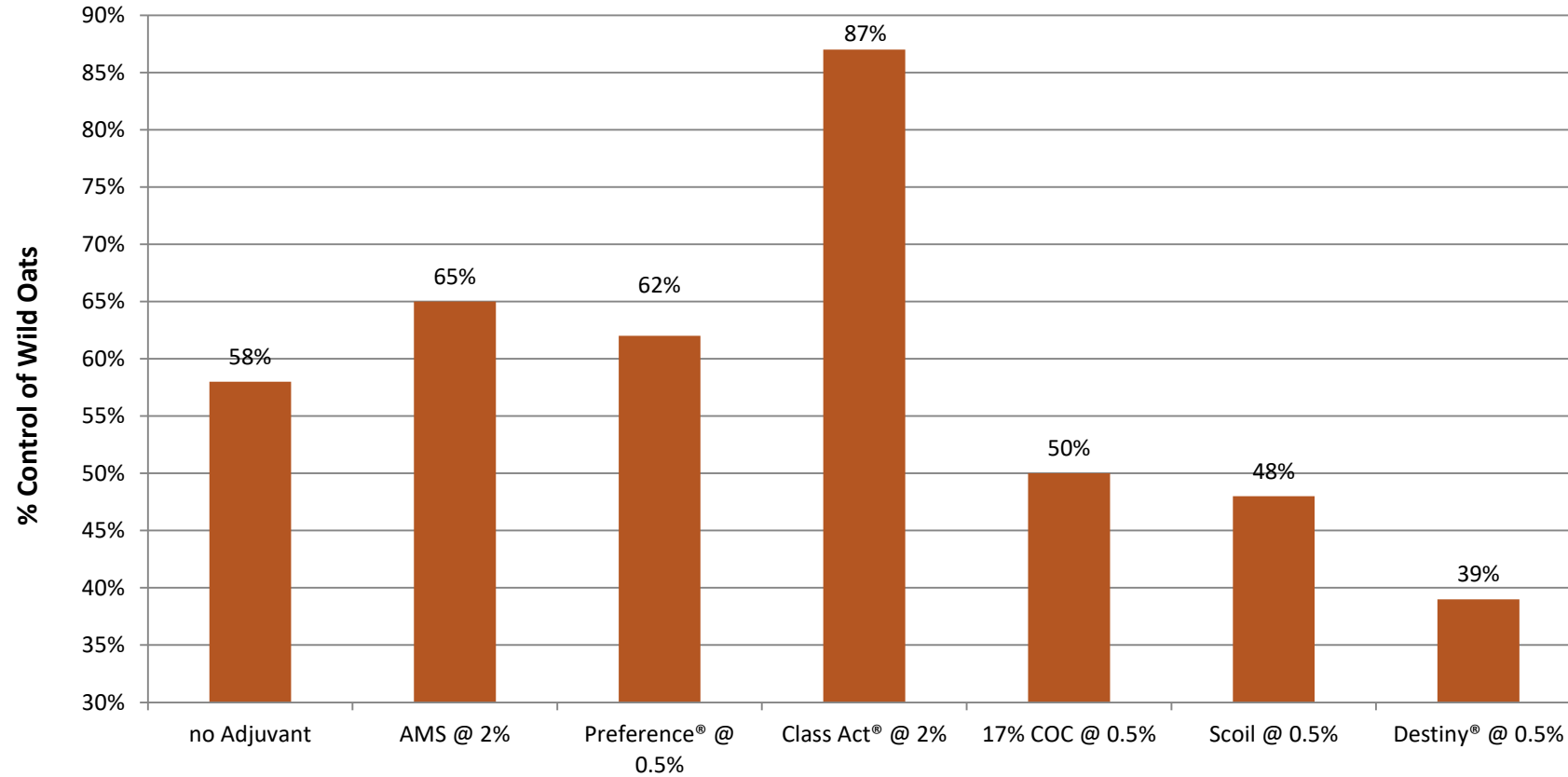
In addition to the amount of glyphosate acid, be sure to read the product label to determine if the addition of a surfactant is necessary. Many glyphosate products come "fully loaded," meaning they are formulated to include a surfactant. Some glyphosate products contain no surfactant or may require additional surfactant to increase activity. A non-ionic surfactant (NIS), at a rate of 0.25 percent to 1.0 percent (1 quart to 1 gallon per 100 gallons of spray solution) is recommended for glyphosate products. Crop oil concentrates (COC) or methylated seed oils (MSO) are not recommended for use with glyphosate. Previous research has indicated a reduction in weed control with glyphosate when using COC or MSO instead of NIS. When tank-mixing glyphosate with other herbicides or crop protection products, always check the labels to determine if additional adjuvants are required.

Adding ammonium sulfate (AMS) to the water in the spray tank before adding glyphosate will act as a water conditioner and improve weed control, regardless of whether or not a surfactant is needed. The sulfate component of AMS ( $\text{SO}_4^-$ ) is negatively charged and will bind to positively charged hard water ions such as calcium ( $\text{Ca}^{2+}$ ), magnesium ( $\text{Mg}^{2+}$ ), and iron ( $\text{Fe}^{2+}$ ), preventing the hard water ions from binding to the glyphosate molecule and decreasing its activity in the plant. Therefore, adding AMS to the spray solution after adding the glyphosate will do little to improve the herbicide's activity. Dry, spray-grade AMS should be added at a rate of 8.5 pounds to 17 pounds of AMS per 100 gallons of spray solution. Dry and liquid AMS replacement products are available, but when using them be sure to add them at a rate equal to 8.5 pounds to 17 pounds of AMS per 100 gallons of spray solution. Other nitrogen fertilizers, such as 28 percent urea ammonium nitrate (UAN), do not have the same water conditioning effects as AMS.

## Glyphosate Application Timing

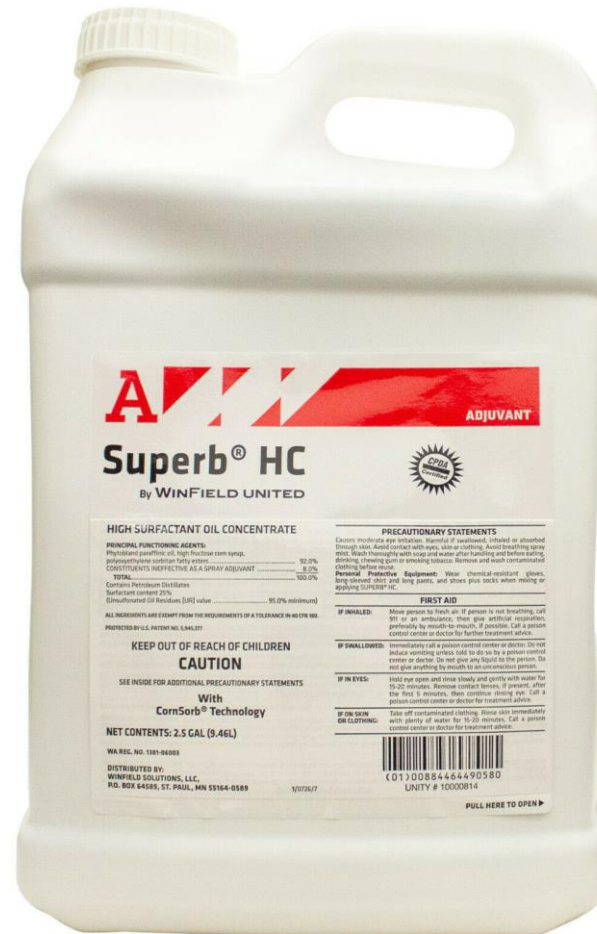
Like most herbicides, glyphosate will provide maximum activity on weeds when applied

# Comparison of Adjuvants with Glyphosate



NDSU Hettinger 1995

# High Surfactant Oil Concentrate

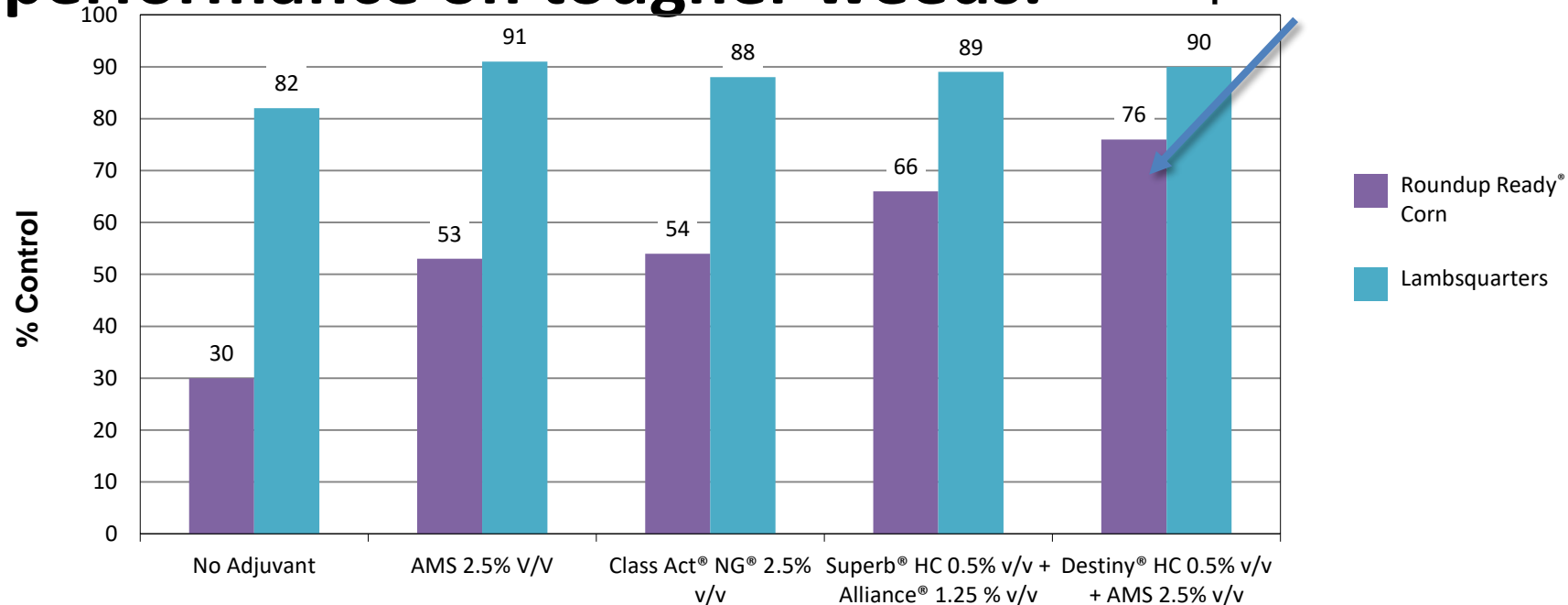




# Adjuvant Classification- Methylated or Ethylated Seed Oils

**The Destiny<sup>®</sup> HC advantage over other adjuvants:  
better performance on tougher weeds.**

**Destiny<sup>®</sup> HC outperforms  
Superb<sup>®</sup> HC!**



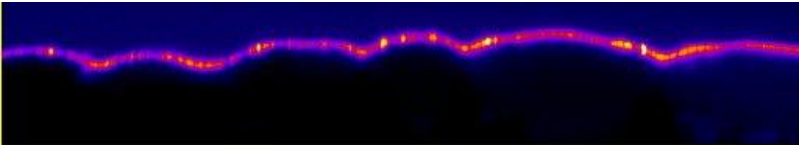
Herbicides applied: Select + Glyphosate

Winfield Solutions, UWRF, 2006

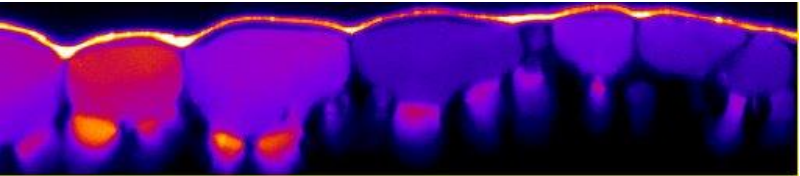
# Oils - Waterhemp

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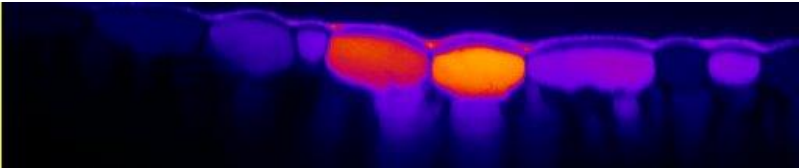
No Treatment



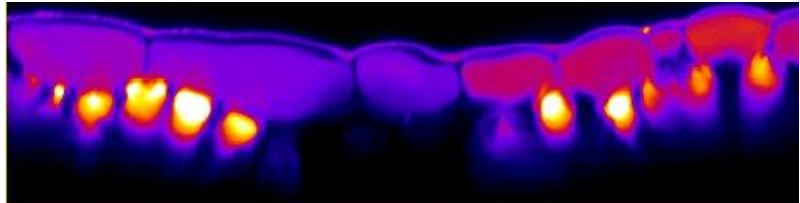
StrikeLock<sup>®</sup>



Destiny<sup>®</sup> HC



Noble<sup>®</sup>



3 hrs after addition  
60x magnification

Spraying  
issues

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Foaming

Incompatibility



**Things that need to  
get wet, need to get  
wet!**

Thanks Dr. Joe Ikley,  
NDSU and Everyone  
helping!

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## NDSU weed science group hosts regional student contest for first time

08/26/2021

The North Central Weed Science Society Student Contest was held at NDSU for the first time this year.

The society was incorporated in 1945 and has members from 16 states and four Canadian provinces. The contest was first held in 1981 at Kansas State University.

The contest, which took place on July 29, was planned by 56 NDSU weed scientists and alumni. A total of 52 graduate students and nine undergraduate students from 10 universities participated.

**NCWSS  
Student Weed  
Contest 1982**

**Winning Team NDSU**

**Bev Durgan**

**Greg Dahl**

**Dave Grafstrom**

**Diane Dancy (Manthey)**

**Coach Dr. Charlotte Eberlein**



# Women in Agriculture

**Thanks Charlotte:**

**Women in Agriculture  
Thanks for ALL you Do!**



# Alar Issue Food Safety Scare

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Phone Call

Extension Issue

NDSU Food

Safety Specialists.





**Pesticides much  
feared in food but not  
much real risk.**

**There ARE threats to  
your health from  
things in your food.**

**When in Doubt,  
Throw it Out!**

**Biggest Way to Keep  
Food Safe!**

**Don't Put Poop on  
Food!**

**1960's – 1980's**  
**PPE Mostly not used**  
**or Available**  
**anywhere.**

**Get Dealers to have  
PPE Available.**

**Gemplers.**

**Women made  
Husbands Wear PPE.**



**PROJECT  
SAFE SEND**

## Project Safe Send

Private citizens could not properly dispose of banned, cancelled waste pesticides on their own.

Many North Dakota County Agents had collections of banned products that they were storing as a service for their clients.

Rudy Radke, Cass County Agricultural Agent hosted a meeting to address this issue.

There were many people and organizations that were interested in solving this issue.

Many people worked very hard.

The North Dakota Legislature passed legislation to develop a pesticide disposal program.

The North Dakota Department of Agriculture conducted the program with help from many other organizations, including the NDSU Extension Service, the ND Experiment Station, the North Dakota Agricultural Association and many others.

## Project Safe Send 1992

Three Locations Oriska, Dickinson and Rugby, ND

2,4-D	6,211 lbs.	Some was 2,4-D Dust.
DDT	5,537 lbs.	
Toxaphene	5,139 lbs.	
Carbyne	3,649 lbs.	
Vitavax	3,145 lbs.	
Total of Above	20,681 lbs.	29% of Total
Total All	80,910 lbs.	

Collected and Properly Disposed of. North Dakota Department of Agriculture was the Generator of the waste.



## Project Safe Send 1994

Eleven Locations, Six in Summer, 5 in Fall.

Total 131, 838 lbs.

Banned Products Collected

DDT	4,585 lbs.	2,4,5 T	730 lbs.
Mercury ST	8,545 lbs.	Toxaphene	3,825 lbs.
Chlordane	495 lbs.	Dieldrin	545 lbs.
Cyanides	145 lbs.	Arsenic	380 lbs.
Bromides	340 lbs.	Aldrin	270 lbs.

Collected and Properly Disposed of. North Dakota Department of Agriculture was the Generator of the waste.

# Project Safe Send

The Project Safe Send Program in 1992 was one of the first Pesticide Amnesty Programs conducted in the United States.

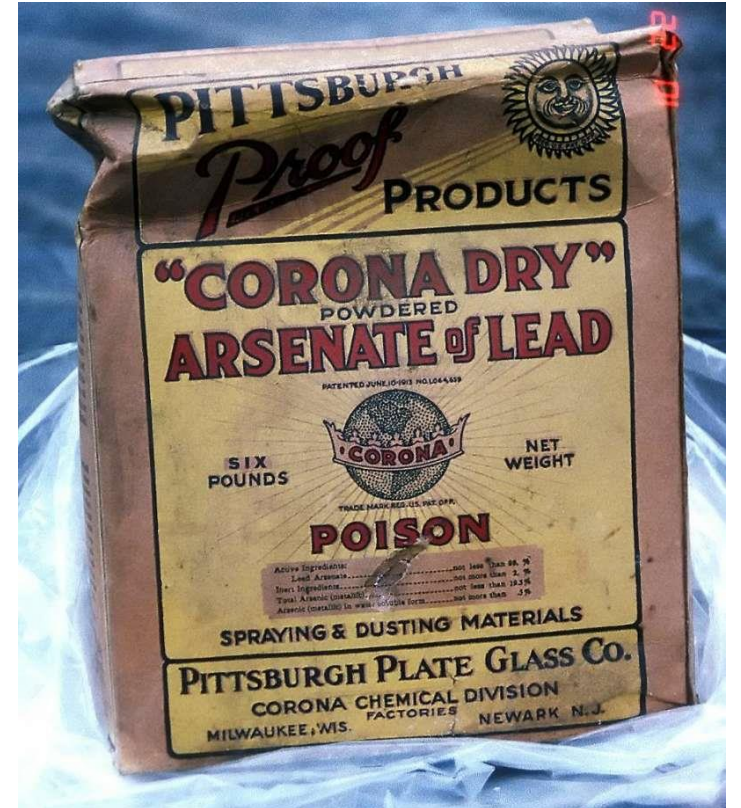
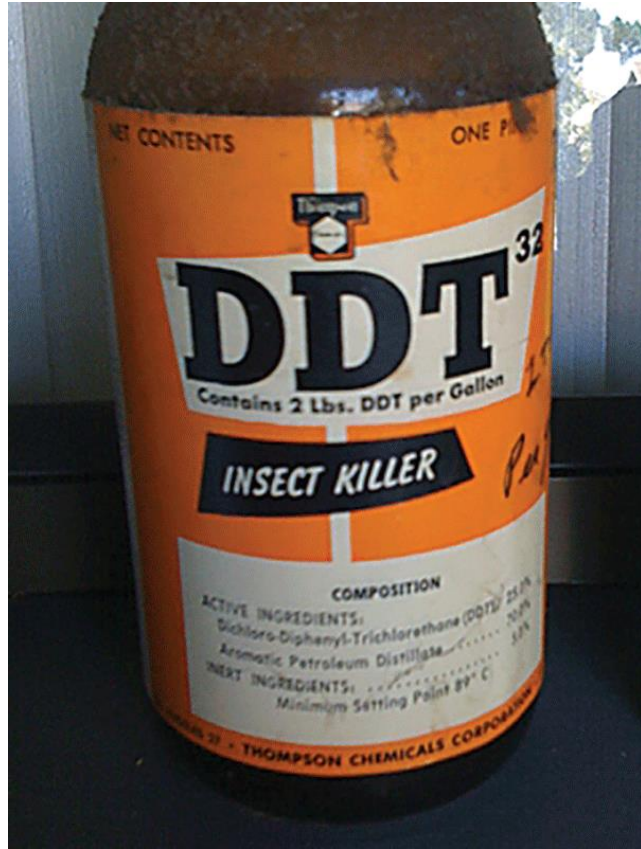
The Greatest User of the first Project Safe Send Program was the NDSU Extension Service. County Agents got rid of the waste that they had been storing for clients for years (some decades).

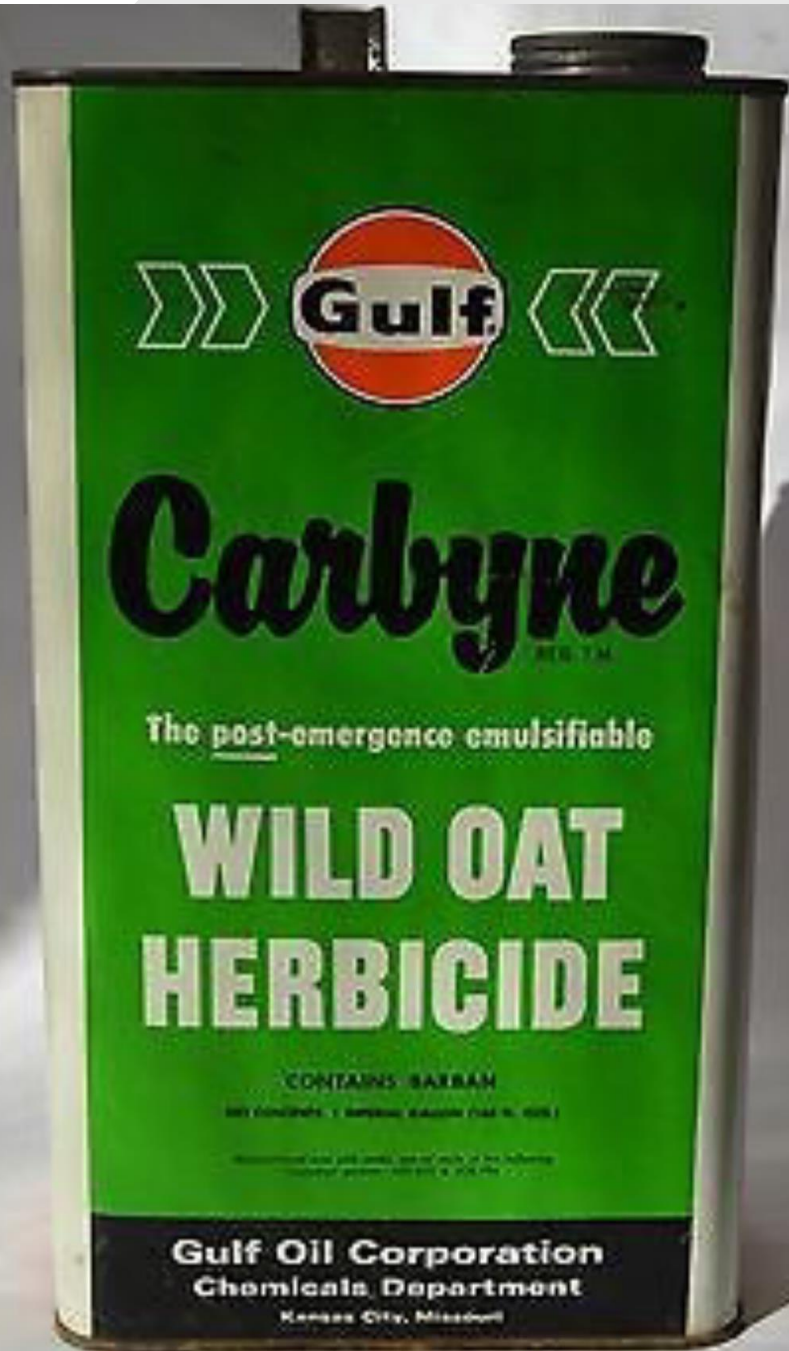
The Greatest User of the second Project Safe Send Program was NDSU (Main Campus). Dr. Rod Lym was committed to cleaning up old product all over campus.

The Greatest User of the third Project Safe Send Program were the NDSU Research and Extension Centers.

Since 1992, more than 10,600 people have brought in over 5.5 million pounds of pesticides to Project Safe Send.

Thanks to all who helped clean up the State of North Dakota.







## Project Safe Send Carbyne 2 EC

Farmer brought in some Carbyne 2 EC in 2 one-gallon bleach jugs.

First Bleach jug was labelled:

Carbyne 2 EC

1 pint/acre

2 leaf wheat

1.5 leaf wild oats

5 gallons/acre



# Project Safe Send Carbyne 2 EC

Farmer brought in some Carbyne 2 EC in two 1 gallon bleach jugs.  
Second Bleach jug was labelled:

Carbyne 2 EC

Use First!

Directions on other jug



## 2022 PROJECT SAFE SEND SITES

8 am - 12 pm (local time) at North Dakota Department of Transportation (NDDOT) facilities

July 6	Minot	1305 Hwy 2 Bypass E
July 7	Rugby	603 1 St NE
July 11	Dickinson	1700 3rd Ave W Ste 101
July 12	Beulah	205 Hwy 49 S
July 13	Tioga	425 2nd St SE
July 14	Bismarck	218 S Airport Rd
July 19	Adams	804 1st Ave
July 20	Devils Lake	1905 Schwan Ave NW
July 21	Larimore	1524 Towner Ave
July 25	Ashley	520 7th St SW
July 26	Lilsbon	12999 Hwy 27
July 27	Valley City	1524 8th Ave SW

# Competition and Control of Broadleaf Weeds in Spring Wheat

First Plant out of the ground wins!

If there is a patch of kochia in your wheat, go around.

There is no wheat there.

Loss of wheat was greatest when wheat yield potential was highest. (True for other crops)

Wild mustard was very competitive with wheat, but was controlled easily with 2,4-D.

Common Lambsquarters was controlled easily with 2,4-D.



# Competition and Control of Broadleaf Weeds in Spring Wheat

No chapter on Redroot Pigweed competition in wheat.

Several studies.

Lots of RRPW when wheat was at 2 to 3 leaf stage.

Pigweed was 1 to 2 inches tall.

In untreated plots the RRPW was dead in the wheat  
by the boot stage of the wheat.

**BEST WEED CONTROL TOOL**

**in wheat is increase planting rate by another half bushel!**

# Dusty: Thank you very much for the Flight of a Lifetime!

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Dusty Larson,  
Dusty's Spraying Service,  
Casselton, ND.  
June, 2019.



# Thanks Warren Walkinshaw: Crop Duster Aerial Applicator for our farm!

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Pioneer Aerial Applicator  
North Dakota and  
Minnesota  
Argusville, ND.



# Thanks Ron Deck!

I learned so much from him!  
First ND Dept of Agriculture  
“Outstanding Pesticide  
Applicator of the Year, 1991”

“Temperature Inversions”

## NORTH DAKOTA AVIATION HALL OF FAME

**Ronald P. Deck**

**Inducted: 2010**



Ron Deck of Hillsboro, North Dakota, grew up on a family farm near Harvey, found something he loved to do, and figured out a way to earn a living at it. While on a tour of duty in the Navy, Ron began taking flying lessons at a local airport. He earned his Private Pilot's license, soon followed by his Commercial license and Instrument rating. He later added ratings as a Flight Instructor, Instrument, Multi-Engine Airplane, Helicopter, and Ground Instructor.

Ron started Deck Flying Service in 1970 and has been active in aerial application ever since. Ron participated in many aspects of aviation, excelled, and enjoyed himself in all of them. His contributions to the local community, North Dakota, and across the country are many and varied, including his company, Sky Tractor Supply Company, LLC, which promoted GPS as an important technology in aerial application, and has provided employment for many people for 40 years.

He introduced many into aviation through his flight instruction, mechanical training, sky diving flights, or as his employee. Ron flew planes, rebuilt planes and engines, providing

the spark to encourage many of the people in aviation today. Ron's company has developed a reputation as a national supplier of aerial application parts with good customer support and training, helping North Dakota to become a leader in new technologies. Ron's successes have been featured in many publications, including National Geographic magazine. He was president of the Red River Valley Aerial Applicators Association before it merged with the state's North Dakota Aerial Applicators Association.

He was awarded the inaugural Outstanding Pesticide Applicator of the Year in 1991 by the North Dakota Department of Agriculture. He served as president and on the board of directors for the National Aerial Applicators Association and was their first recipient of the Outstanding Aerial Applicators Award. He has been recognized by the NAAA numerous times, including the prestigious Falcon Award, the Allied Industry Individual Award, and the Outstanding Service Award. Ron attended and exhibited at the annual NAAA convention for 38 straight years.

He supports local businesses, school events, the 4-H club, tractor and horse pulls, and the championship old pro softball team, the Sky Tractors. In the 1997 spring flood, Ron was asked to fly school teachers over the flooded Red River, saving them more than 100 miles driving around the flooded areas to get to work. In 2003, Ron was honored by the American Red Cross' Everyday Heroes program, receiving the Good Samaritan Hero award after saving a neighbor's farmhouse from fire by dropping a load of water from his airplane before the fire department arrived.

**North Dakota  
Aviation Council**



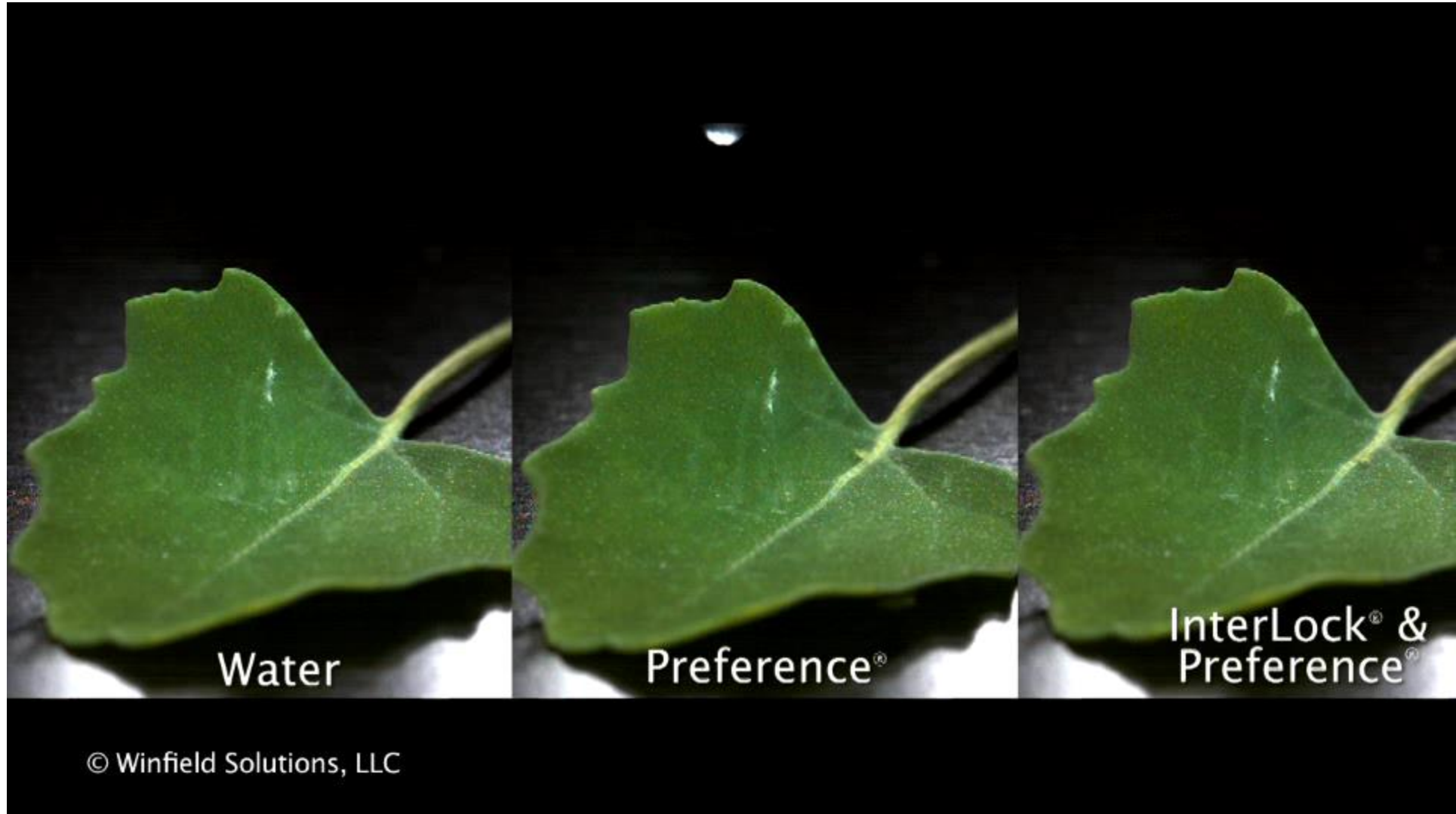


Thank you  
very much!

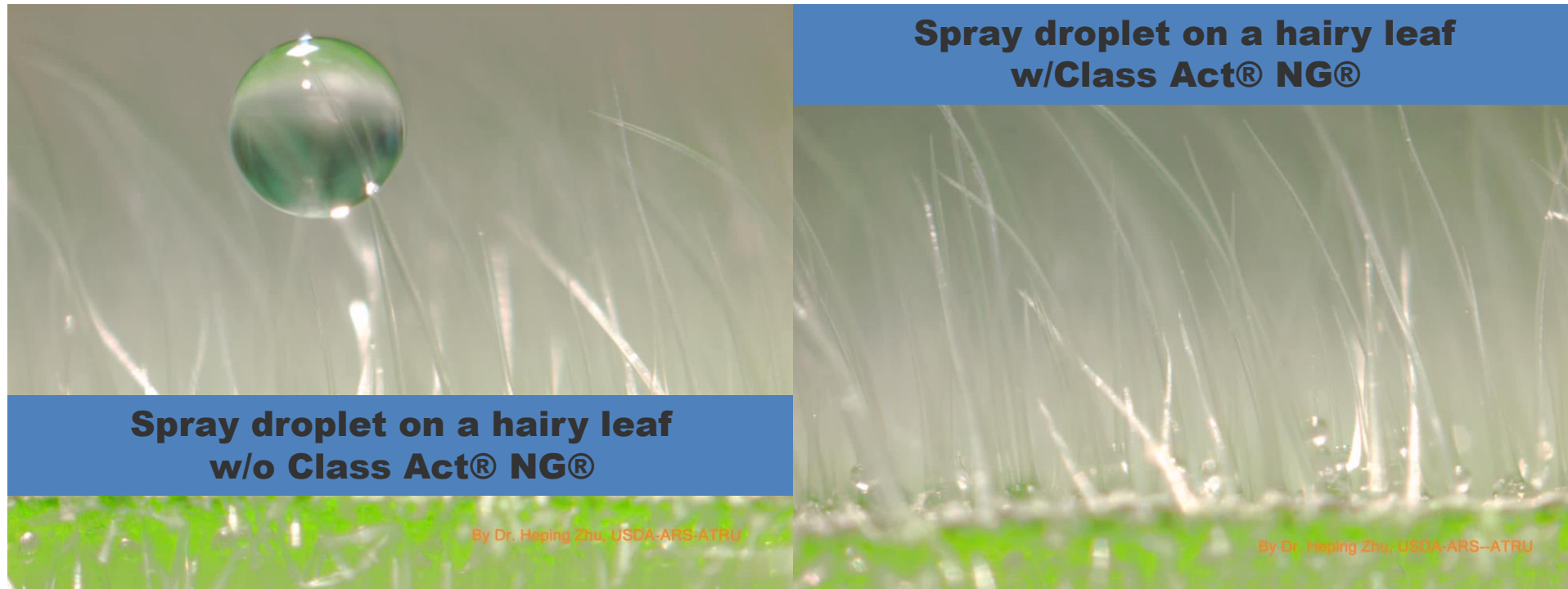
- Fargo Air and Space Museum.

**Don't Ever Tell Someone  
Something That You Can  
Show Them!**

## Winfield™ Adjuvant Products



# Non Ionic Surfactants



Droplets with high surface tension bead up on hairy leaves and never reach the leaf surface for absorption.

Droplets with relaxed surface tension do not bead and reach the leaf surface to be absorbed.



# Non Ionic Surfactants

**Spray droplet on a waxy leaf  
w/o Class Act® NG®**



By Dr. Heping Zhu, USDA-ARS-ATRU

Droplets with high surface tension bead up on waxy leaves with minimal contact with leaf surface for absorption.

**Spray droplet on a waxy leaf  
w/Class Act® NG®**



By Dr. Heping Zhu, USDA-ARS-ATRU

Droplets with relaxed surface tension do not bead and increase contact with the leaf surface for absorption.

# Temperature Inversions

**Air Temperature Inversions Causes,  
Characteristics and Potential  
Effects on Pesticide Spray  
Drift (AE1705, Revised Oct. 2019)**

**<https://tpsalliance.org/pdf/conference/2012/Thostenson-Inversions-TPSA-2012.pdf>**

# Good Spray Day!

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Thank you  
very much!

- Work in Progress!