# Waterhemp Management Across the Crop Sequence

**Thomas J Peters**

**Extension Sugarbeet Agronomist**

**and Weed control Specialist**

**North Dakota State University / Univ of Minnesota**

NDSU EXTENSION

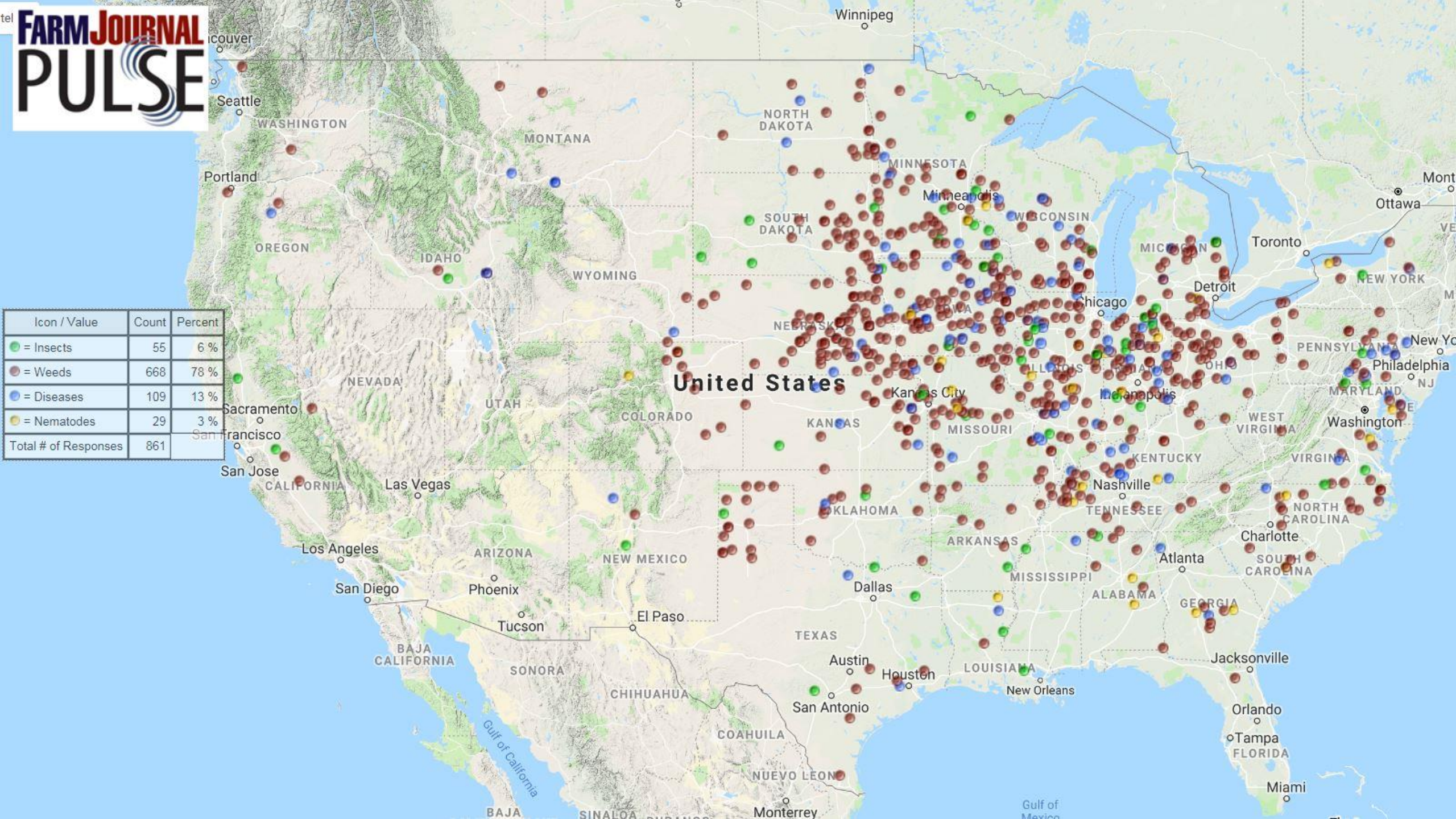
UNIVERSITY OF MINNESOTA EXTENSION

# Presentation Purpose and Outline

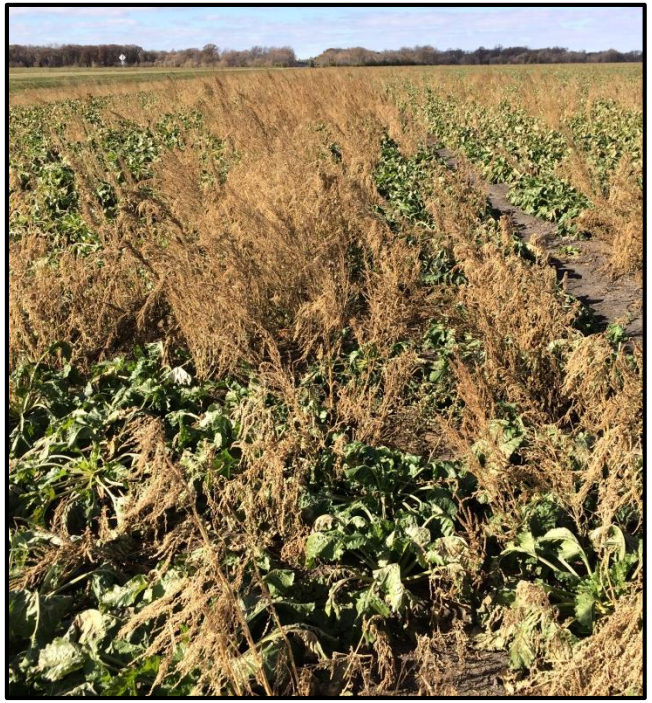
- Weed control in the crop sequence with sugarbeet

- Best Management Practices for waterhemp control
  - Effective herbicides / herbicides mixtures
  - Overlapping layers of residual herbicides
  - Cultural and mechanical control
  - Weed control along roadsides

- Sprayer cleanout

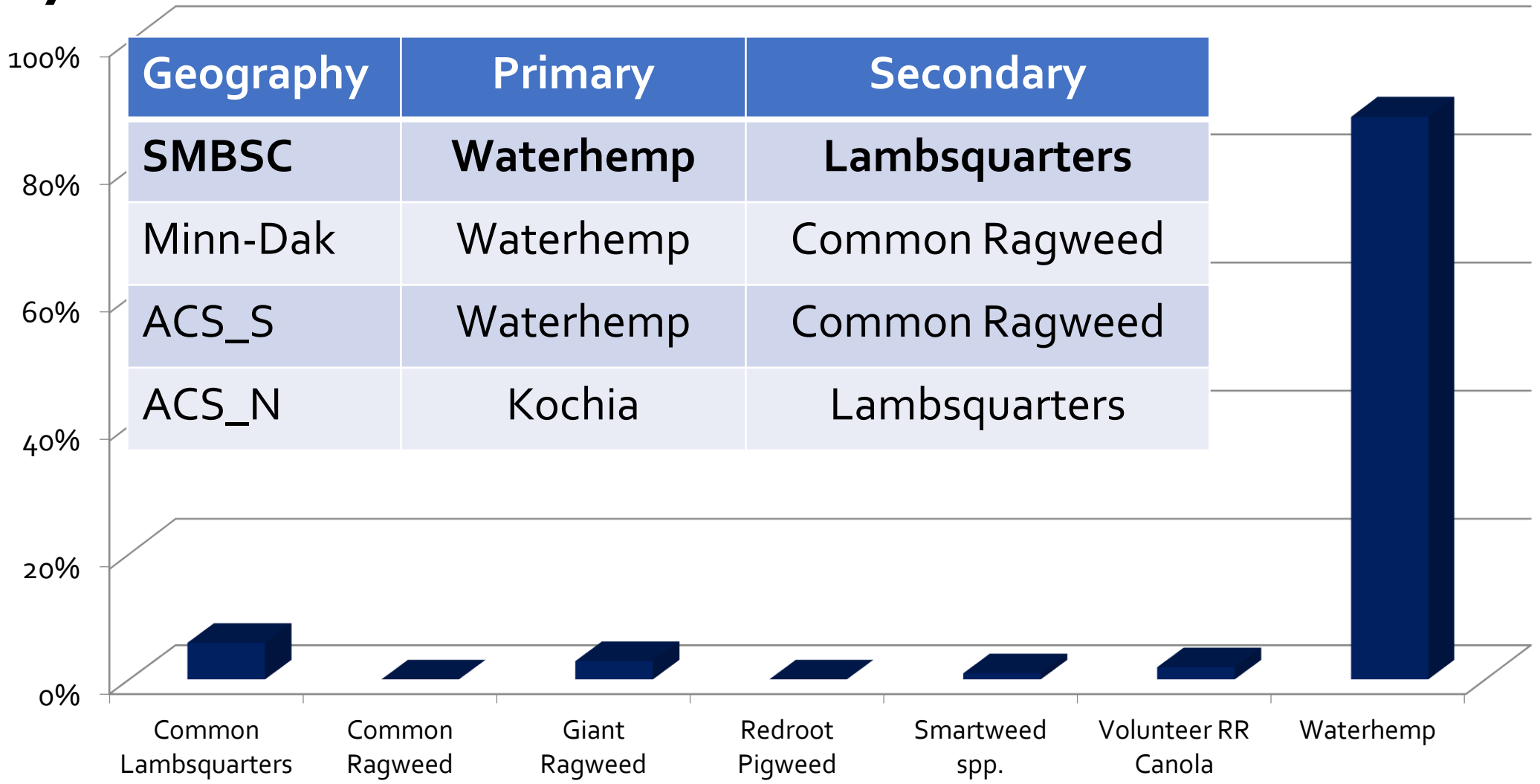



| Icon / Value | Count | Percent |
|---|---|---|
| = Insects | 55 | 6 % |
| = Weeds | 668 | 78 % |
| = Diseases | 109 | 13 % |
| = Nematodes | 29 | 3 % |
| Total # of Responses | 861 | |

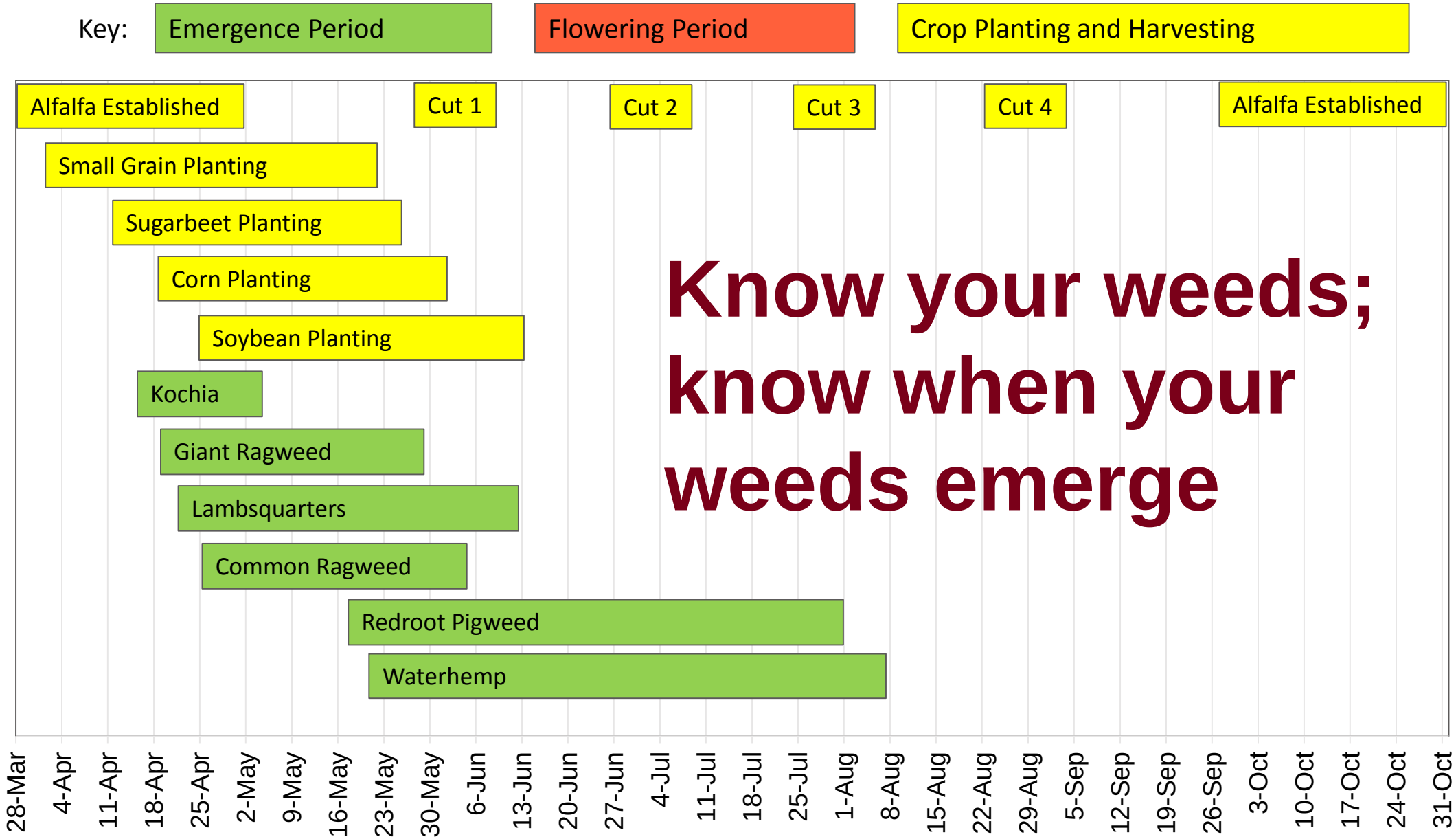


# What was your worst weed control challenge in 2017?

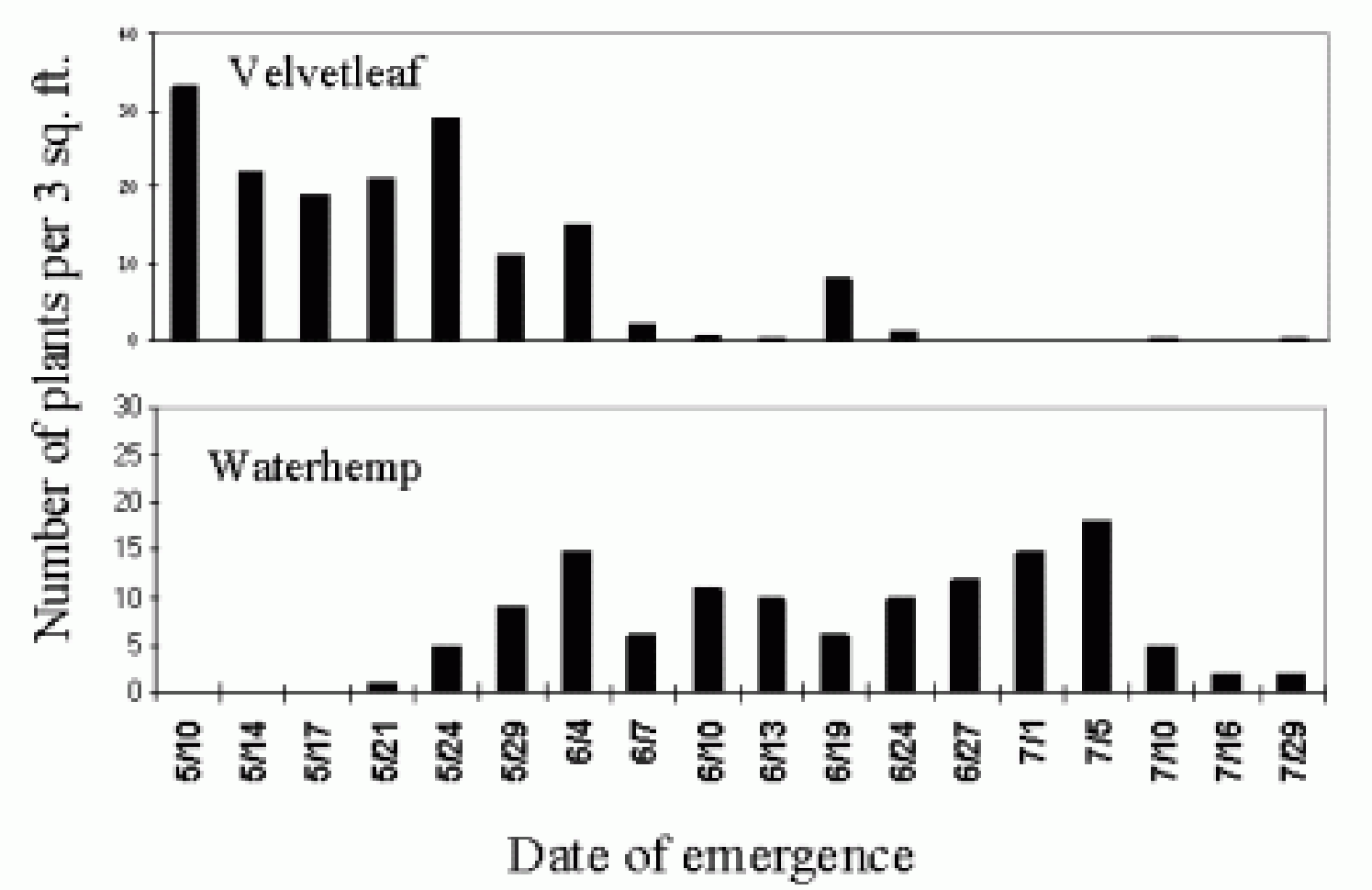
| Geography | Primary | Secondary |
|---|---|---|
| **SMBSC** | **Waterhemp** | **Lambsquarters** |
| Minn-Dak | Waterhemp | Common Ragweed |
| ACS_S | Waterhemp | Common Ragweed |
| ACS_N | Kochia | Lambsquarters |




[1]Turning Point Survey of Growers; conducted at the 2018 Sugarbeet Growers Seminar, Willmar

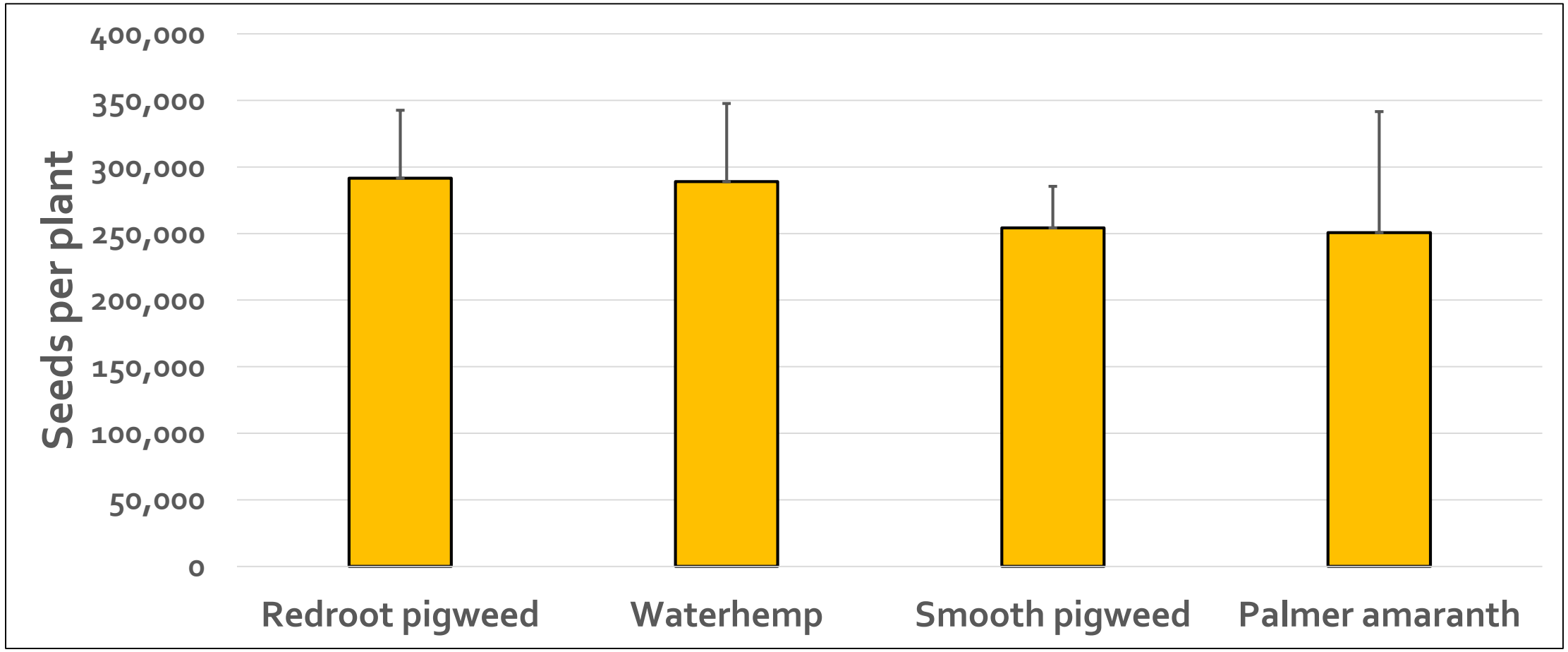


# Delayed and prolonged emergence of waterhemp creates weed management challenges



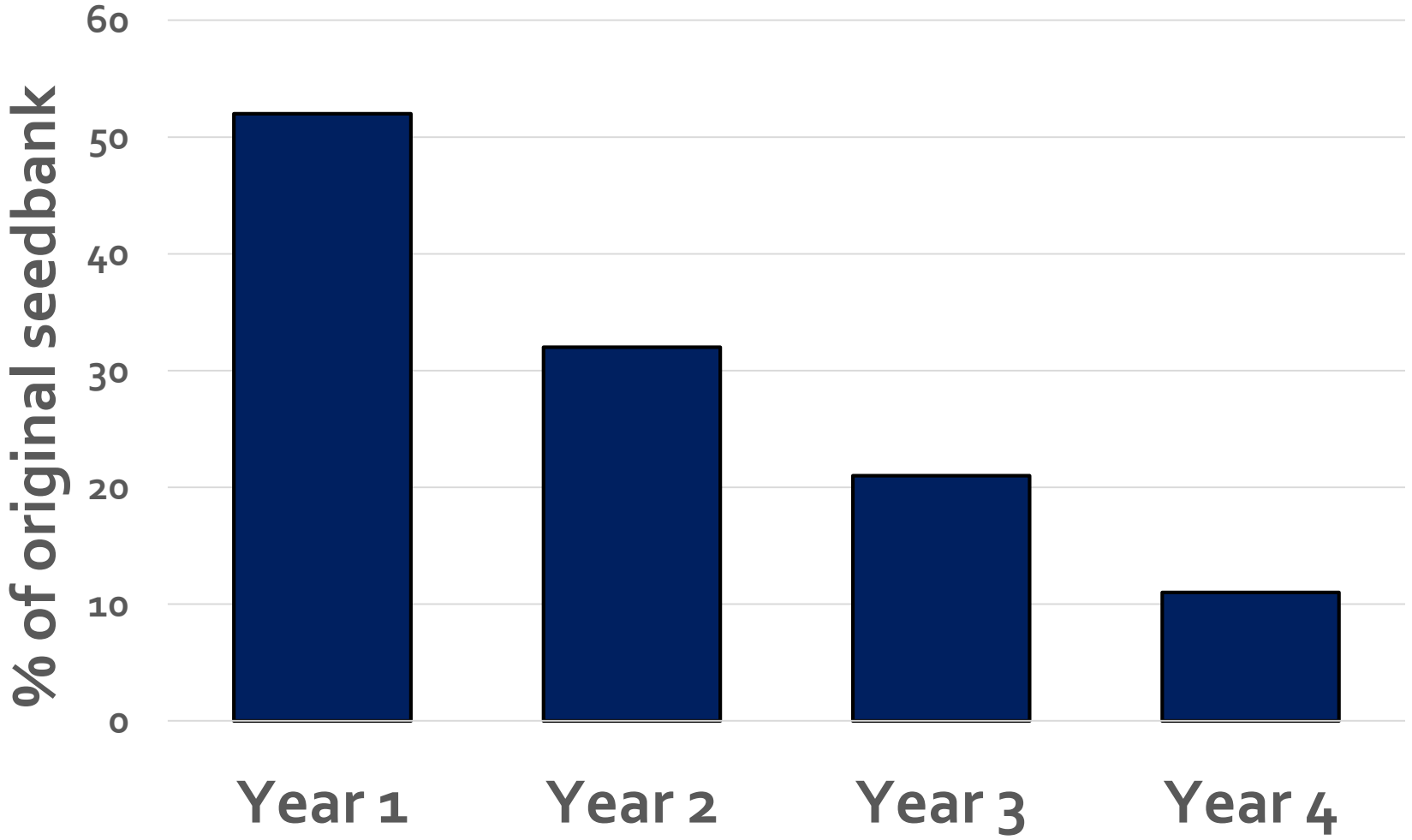

Hartzler and Buhler, ISU and USDA-ARS, 1996

# Pigweed species make a lot of seed




Sellers et al. 2003

# Percent of waterhemp seed viable four years following burial




Source: Buhler and Hartzler, 2001. Weed Science: 49:230-235

# Crop sequence across region and Cooperative

Sugarbeet production in Minnesota and North Dakota

**South – Southern Minnesota Beet Sugar Cooperative**

- Corn, soybean, corn, sugarbeet – most common
- Soybean, corn, corn, sugarbeet – second most common

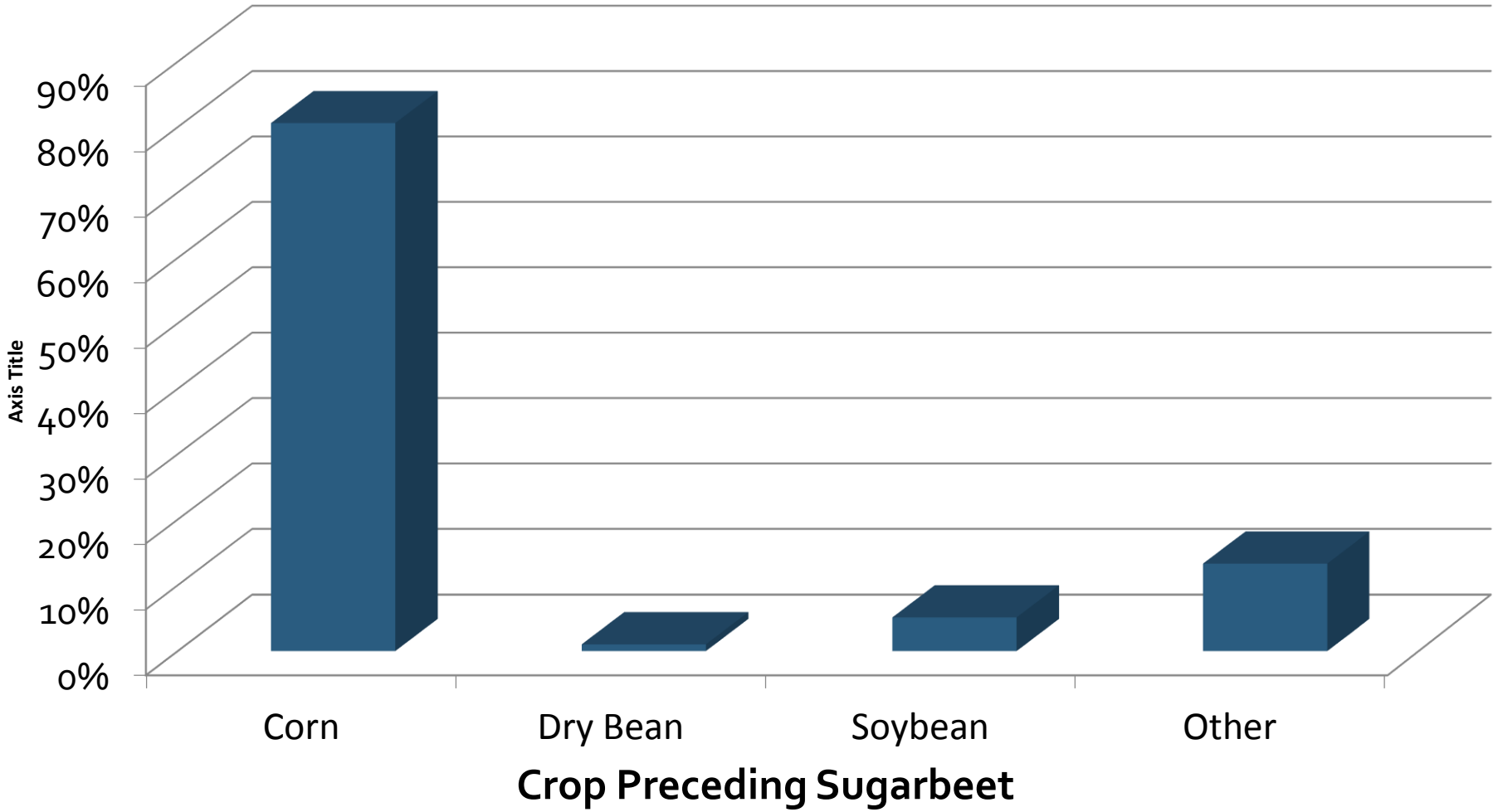
**Mid – Minn-Dak Farmers Cooperative**

- Corn, soybean, corn, sugarbeet

**North --American Crystal Sugar Company**

- Corn, soybean, wheat, sugarbeet

# What crop precedes most of your sugarbeet acres?




[1]Turning Point Survey of Growers; conducted at the 2018 Sugarbeet Growers Seminar, Willmar

# Corn rotate to Sugarbeet

| Premergence | SOA | Postemergnece[a] | SOA |
|---|---|---|---|
| Chloroacetamide (Dual Magnum / Harness / Outlook) | 15 | Dicamba & diflufenzopyr & safener | 4 & 1 9 |
| Chloroacetamide & Sharpen | 15+14 | Dicamba & safener | 4 |
| | | Laudis + atrazine | 27+5 |
| | | dicamba & Laudis & safener | 4 & 27 |
| | | glyphosate | 9 |

[a]& = premix; + = tank-mix

# Waterhemp control in corn, Herman, MN and Moorhead, MN, 2014, 2015, and 2016

| | | | Waterhemp Control, Preharvest | | | |
|---|---|---|---|---|---|---|
| Herbicide treatment[1] | Appli | Herbicide rate (pt, fl oz or oz/A) | Herman 2014 | Herman 2015 | Moorhead 2015 | Moorhead 2016 |
| | | | ----------% control---------- | | | |
| Harness + Sharpen | Pre | 2 pt + 2.5 fl oz | 98 | 95 | 75 | 88 |
| Harness / Status | Pre / Post | 2 pt / 5 fl oz | 100 | 99 | 86 | 96 |
| Sharpen / Status + Warrant + PowerMax | Pre / Post | 2 oz / 3.5 oz + 3 pt + 28 oz | 100 | 100 | 96 | 95 |
| Laudis + atrazine / Status + PowerMax | Post / Post | 3 oz + 12 oz / 3.5 oz + 28 oz | 100 | 100 | 98 | 100 |
| LSD (0.05) | | | 3 | 5 | 7 | 11 |

[1]Laudis, atrazine, and Status applied with MSO at 1.5 pt/A plus N-Pak AMS at 2.5% v/v; Roundup PowerMax, Status, and Warrant applied with HSMOC at 1.5 pt/A plus N-Pak AMS at 2.5% v/v


Herman, MN, June 26, 2015

# Corn rotate to Sugarbeet

**Products with crop rotation restrictions preventing sugarbeet planting the following year**

| Premergence | months | Postemergence[a] | months |
|---|---|---|---|
| **Anthem Maxx** (puroxasulfone & fluthiacet) (15 & 14) | 15 | **Armezon Pro** (atrazine & topramezone & dimethenamid-P) (5 & 27 & 15) | 18 |
| **Corvus** (isoxaflutole & safener) (27) | 17 | **Halex GT** (glyphosate & S-metolachlor & mesiotrione) (9 & 15 & 27) | 18 |
| **Acuron Flexi** (S-metolachlor & mesiotrione & bicyclopyrone & safener) (15 & 27 & 27) | 18 | **Realm Q** (rimsulfurone & mesotrione & safener) (2 & 27) | 18 |
| **Balance Flexx** (isoxaflutole & safener) (27) | 18 | | |
| **Resicore** (acetoachlor & mesotrione & clopyralid) (15 & 27 & 4) | 18 | | |
| **Surestart II** (acetochlor & flumetsulam & clopyralid) (15 & 2 & 4) | 26 | | |

[a]& = premix; + = tank-mix

# Waterhemp control in soybean, Herman, MN and Moorhead, MN, 2014, 2015, and 2016

| | | | Waterhemp Control, Preharvest | | | |
|---|---|---|---|---|---|---|
| Herbicide treatment[1] | Appli | Herbicide rate (pt, fl oz or oz/A) | Herman 2014 | Herman 2015 | Moorhead 2015 | Herman 2016 |
| | | | ----------% control---------- | | | |
| Dual Magnum + Valor/ Liberty[2] | Pre / Post | 1.91 + 0.1 / 0.53 | 97 | 98 | 99 | 85 |
| Verdict / Basagran / Basagran | Pre / Post / Post | 0.22 / 0.63 / 0.63 | 85 | 42 | 64 | 96 |
| Sharpen + Warrant / Basagran / Basagran | PRE / Post / Post | 0.02 + 1.13 / 0.63 / 0.63 | 85 | 65 | 65 | 99 |
| Basagran + Cadet / Basagran + Cadet | Post / Post | 0.63 + 0.005 / 0.63 + 0.005 | 61 | 68 | 64 | 94 |
| LSD (0.05) | | | 13 | 9 | 8 | NS |

[1]Liberty applied with N-Pak ammonium sulfate at 3 lb/A, Basagran and Cadet applied with MSO at 1.5 pt/A.
2Experiment was planted to LibertyLink soybean

Basagran +Cadet / Basagran + Cadet

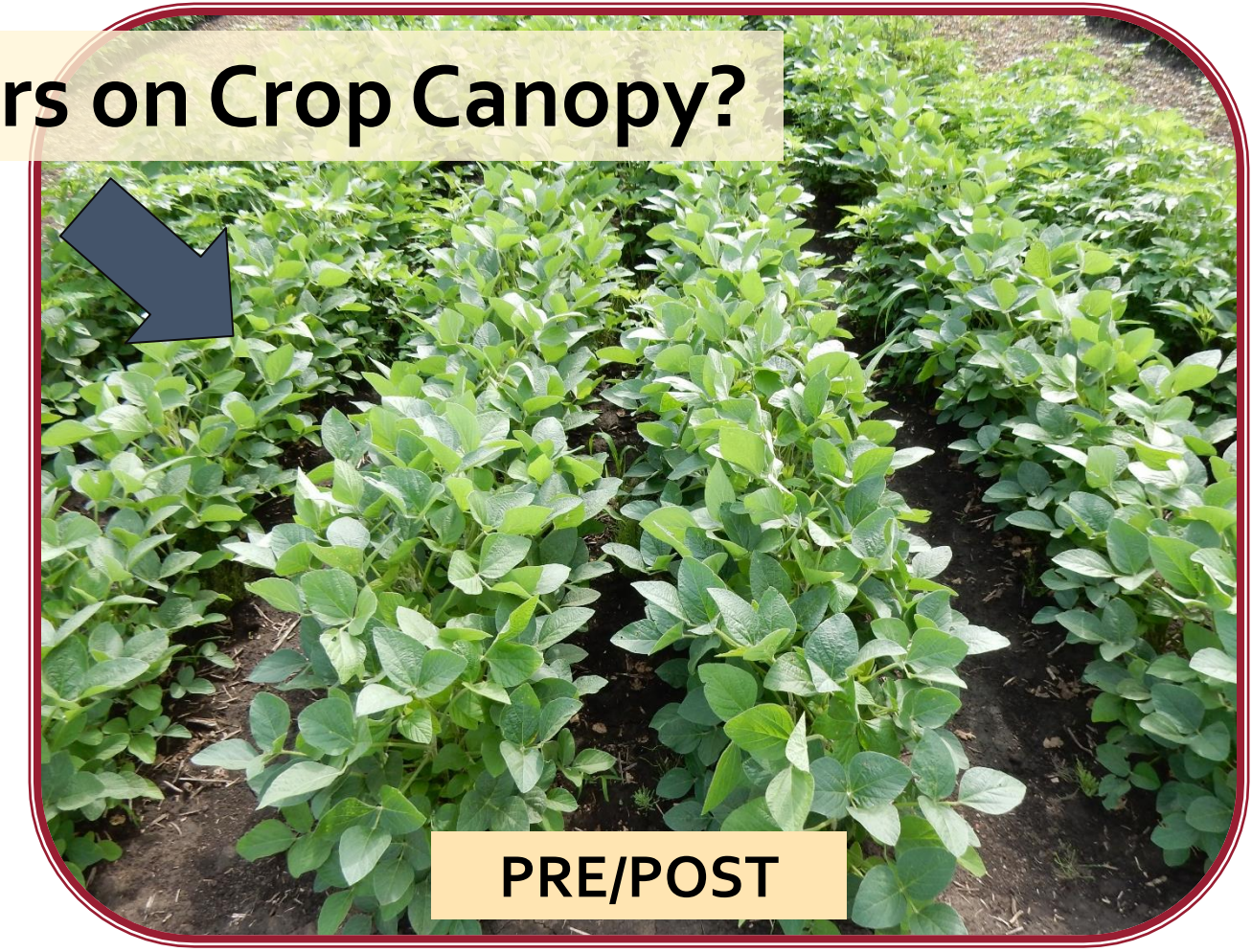
S-metolachlor + Valor / Liberty


Verdict / Basagran /Basagran

Liberty / Liberty

# Effect of PPO inhibitors on Crop Canopy?


POST system with Prefix (S-meto + fomesafen) + Liberty 280 on 6/9 fb Liberty 280 on 6/25. Photo taken 7/27/15.



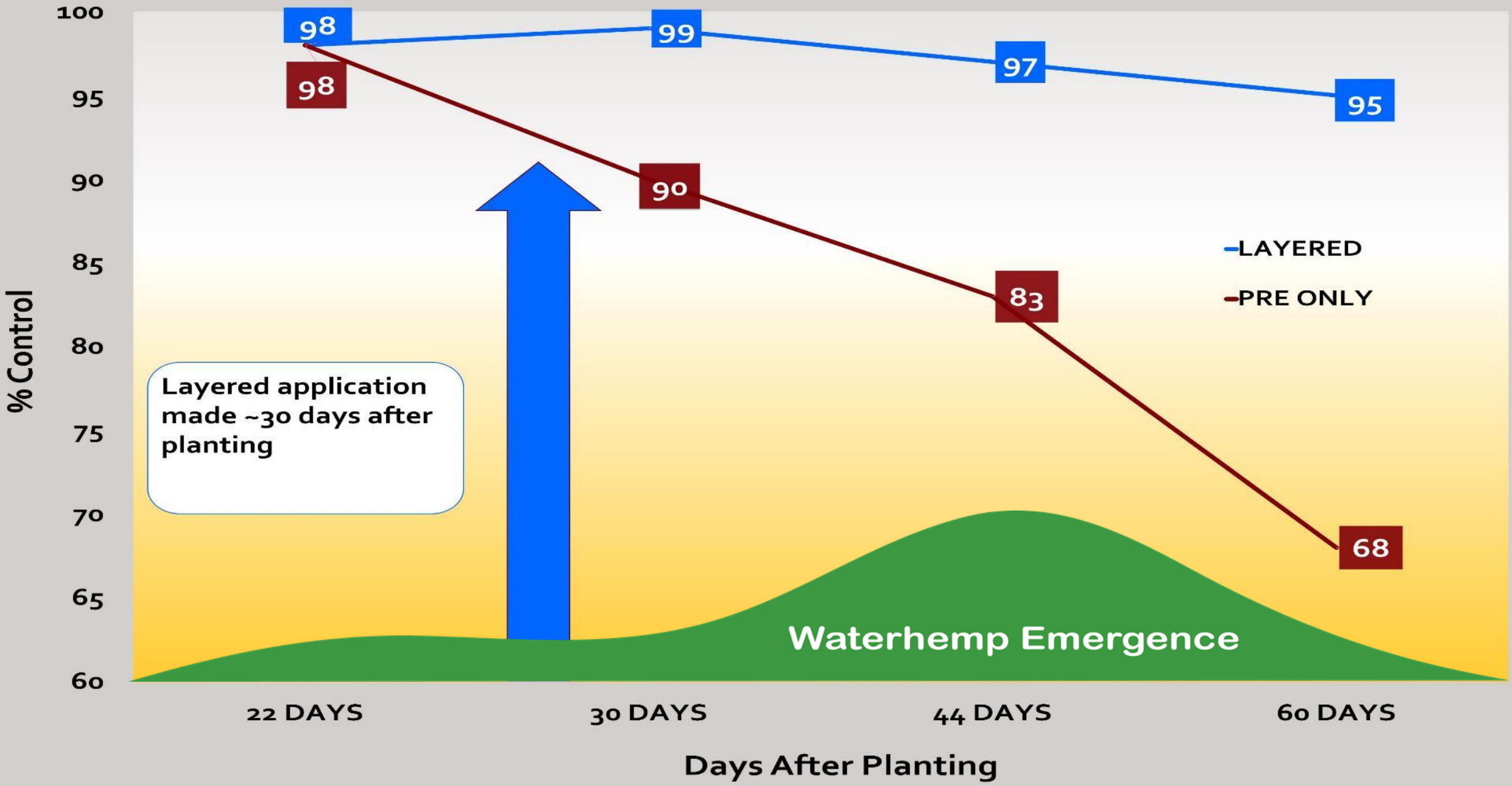

Verdict + Zidua PRE fb Cobra + Roundup PowerMAX POST on 6/24. Photo taken 7/27/15.

# Soybean tolerance and waterhemp control from preemergence and postemergence herbicides, near Renville, MN in 2016

| | | | Soy Injry | Waterhemp Control | | |
|---|---|---|---|---|---|---|
| Treatment[1] | Rate oz/A* or fl oz/A | Code | June 22 | June 8 | June 22 | Aug 8 |
| | | | ----------%---------- | | | |
| PowerMax | 32 | POST | 1 | 41 | 55 | 48 |
| Warrant + PowerMax | 24 + 32 | POST | 6 | 21 | 74 | 48 |
| Authority MTZ / PowerMax | 12* / 32 | PRE | 3 | 90 | 83 | 68 |
| Authority MTZ / Warrant + PowerMax | 12* / 24 + 32 | PRE / POST | 8 | 97 | 99 | 95 |
| LSD (0.05) | | | 12 | 19 | 18 | 21 |

[1]Tank-mixes with PowerMax with Destiny HC at 1.5 pt/A plus N-Pak AMS at 2.5% v/v. PowerMax alone with Prefer 90 NIS at 0.25% v/v plus N-Pak AMS at 2.5% v/v.

# Layered residual herbicide for waterhemp control in soybean, Renville, MN



# Waterhemp control with residual herbicides applied as layered PRE fb POST at 20, 29 or 44 DAP in soybean in 2016.

| Treatment[1] | Rate | Appl.[2] | 5/27/16 | 6/10/16 | 6/27/16 | 7/8/16 | 9/26/16 | YIELD |
|---|---|---|---|---|---|---|---|---|
| Herbicide | Per acre | Time | (% Control)[3] | | | | | (Bu/A)[4] |
| Dual II Magnum/ Dual II Magnum (20 DAP) | 1.5 pt / 1.0 pt | A B | 98 | 98 | 94 | 93 | 93 | 52 |
| Dual II Magnum/ Dual II Magnum (29 DAP) | 1.5 pt / 1.0 pt | A C | 99 | 96 | 93 | 92 | 94 | 48 |
| Dual II Magnum/ Dual II Magnum (44 DAP) | 1.5 pt / 1.0 pt | A D | 99 | 93 | 85 | 83 | 83 | 48 |
| LSD P = 0.10 | | | NS | 3 | 3 | 4 | 6 | NS |

1. All PRE treatments included 0.6 fl oz FirstRate
2. Application date: A = PRE: 5/4/16, C = POST: 6/2/16, D = POST: 6/17/16
3. Waterhemp density on June 17 was 41/sq ft in FirstRate check
4. FirstRate check yielded 28 Bu/A

# Waterhemp control with chloroacetamide herbicides applied as layered PRE and POST at full labelled rates in soybean in 2016

| Treatment[1] | Rate | Appl.[2] | 5/27/16 | 6/10/16 | 6/27/16 | 7/8/16 | 9/26/16 | YIELD |
|---|---|---|---|---|---|---|---|---|
| Herbicide | Per acre | Time | (% Control)[3] | | | | | (Bu/A)[4] |
| Dual II Magnum / Dual II Magnum | 1.5 pt / 1.0 pt | A C | 99 | 96 | 93 | 92 | 94 | 48 |
| Outlook / Outlook | 14 fl oz / 10 fl oz | A C | 98 | 98 | 96 | 95 | 95 | 52 |
| Warrant / Warrant | 1.6 qt / 1.6 qt | A C | 97 | 97 | 91 | 91 | 91 | 53 |
| Zidua / Outlook | 2.5 oz / 18 fl oz | A C | 98 | 99 | 94 | 93 | 93 | 51 |
| LSD P = 0.10 | | | NS | 1 | NS | NS | NS | NS |

1. All PRE treatments included 0.6 fl oz FirstRate
2. Application date: A = PRE: 5/4/16, C = POST: 6/2/16
3. Waterhemp density on June 17 was 41/sq ft in FirstRate check
4. FirstRate check yielded 28 Bu/A

# Crop sequence across region and Cooperative

Sugarbeet production in Minnesota and North Dakota

**South – Southern Minnesota Beet Sugar Cooperative**

- Corn, soybean, corn, sugarbeet – most common
- Soybean, corn, corn, sugarbeet – second most common

**Mid – Minn-Dak Farmers Cooperative**

- Corn, soybean, corn, sugarbeet

**North --American Crystal Sugar Company**

- Corn, soybean, wheat, sugarbeet

# Soybean rotate to Sugarbeet

**Products with crop rotation restrictions**

| Premergence | months | Postemergence[a] | months |
|---|---|---|---|
| Boundary (S-metolachlor & metribuzin) ( 15 & 5) | 18 | **Flexstar GT** fomesafen & glyphosate) (14 & 9) | 18 |
| **Fierce MTZ** (pyroxasulfone & flumioxazin & metribuzin | 18 | | |
| **Authority MTZ** (sulfentrazone & metribuzin) (14 & 5) | 24 | | |
| **Authority Supreme** (sulfentrazone & pyroxasulfone) (14 & 15) | 24 | | |
| **Authority First / Sonic** (sulfentrazone & cloransulam) (14 & 2) | 30 | | |
| **Surveil** (flumioxazin & chloransulam) (14 & 2) | 30 | | |
| **Zidua Pro** (pyroxasulfone & saflufenacil & imazethapyr) (15 & 14 & 2) | 40 | | |

[a]& = premix; + = tank-mix

# Lambsquarters control (early germinator) from preemergence and postemergence herbicides, near Moorhead, MN in 2017

| | | | Lambsquarters | |
|---|---|---|---|---|
| Treatment[1] | Rate oz/A* or fl oz/A | Timing | Jul 27 | Aug 23 |
| | | | % | % |
| PowerMax / PowerMax | 28 / 28 | EPOST / POST | 98a | 96a |
| Rowel + XtendiMax / XtendiMax +PM | 2* + 22 / 22 + 32 | PRE / POST | 96a | 83a |
| Dual Magnum + Valor SX / Liberty | 1.3 pt + 2* / 29 | PRE / POST | 78b | 58b |
| Liberty / Liberty | 29 / 29 | EPOST / POST | 94a | 73ab |
| Authority MTZ / Liberty | 15* / 29 | PRE/POST | 98a | 94a |

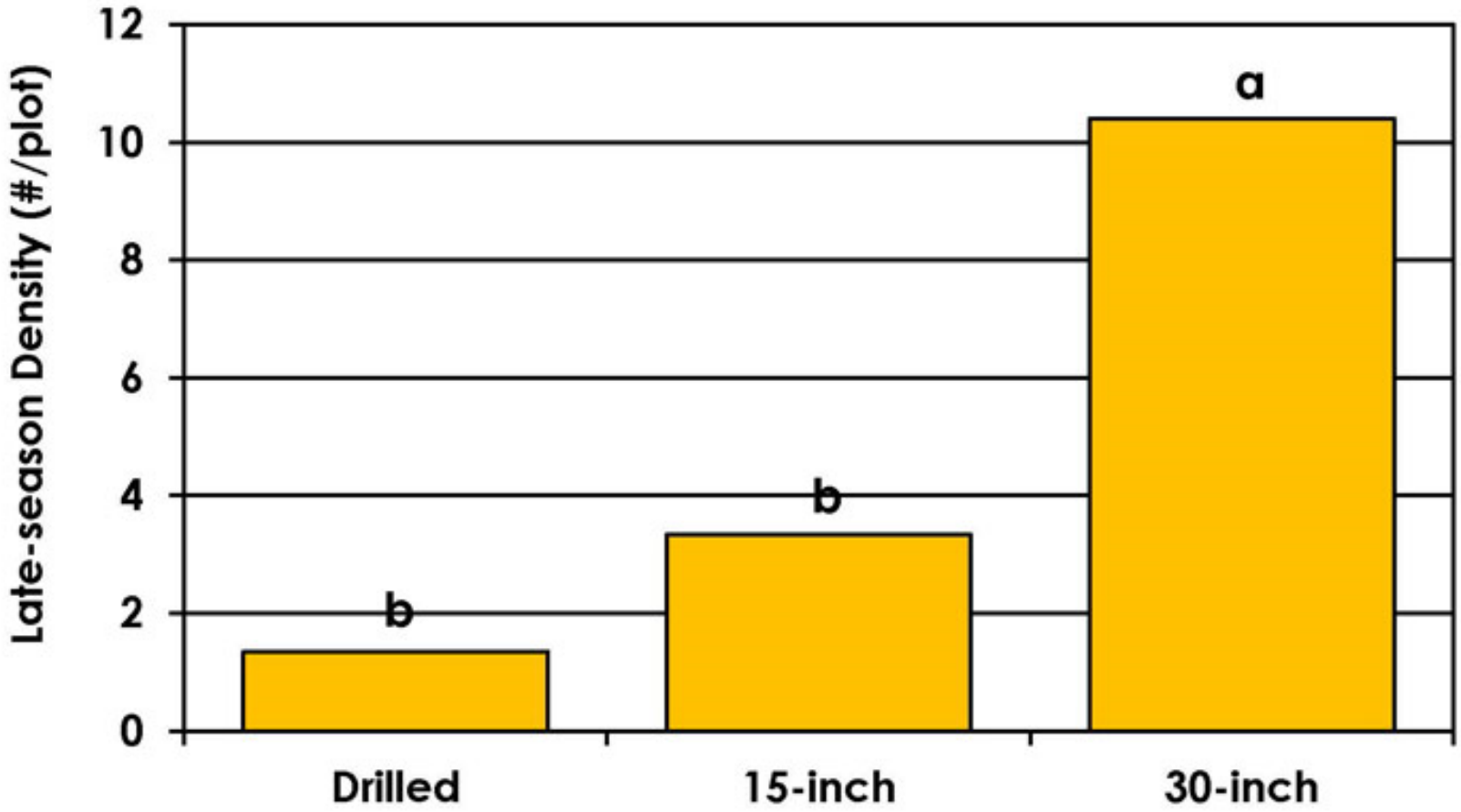
[1]PowerMax + XtendiMax with Class Act Ridion at 2% v/v plus Intact at 0.5% v/v. PowerMax alone with Prefer 90 NIS at 0.25% v/v plus N-Pak AMS at 2.5% v/v. Liberty alone or in tank-mixes with N-Pak AMS at 5% v/v.

# Waterhemp control (late germinator) from preemergence and postemergence herbicides, near Moorhead, MN in 2017

| | | | Waterhemp | |
|---|---|---|---|---|
| Treatment[1] | Rate oz/A* or fl oz/A | Timing | Jul 27 | Aug 23 |
| | | | % | % |
| PowerMax / PowerMax | 28 / 28 | EPOST / POST | 13b | 0c |
| Rowel + XtendiMax / XtendiMax +PM | 2* + 22 / 22 + 32 | PRE / POST | 88a | 66b |
| Dual Magnum + Valor SX / Liberty | 1.3 pt + 2* / 29 | PRE / POST | 88a | 79b |
| Liberty / Liberty | 29 / 29 | EPOST / POST | 93a | 70b |
| Authority MTZ / Liberty | 15* / 29 | PRE/POST | 98a | 98a |

[1]PowerMax + XtendiMax with Class Act Ridion at 2% v/v plus Intact at 0.5% v/v. PowerMax alone with Prefer 90 NIS at 0.25% v/v plus N-Pak AMS at 2.5% v/v. Liberty alone or in tank-mixes with N-Pak AMS at 5% v/v.

# What effect does soybean row spacing have on pigweed control?




*Results summarized across herbicide programs, tillage types, and planting populations.

**Means followed by the same letter are not different, P≤0.05

# Mechanical weed control

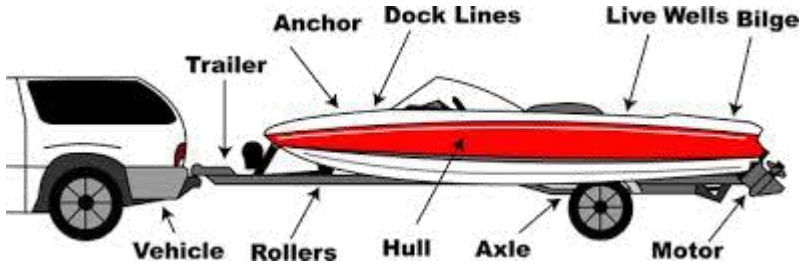
Tillage to control first flush of weeds

- Time **tillage** to crop planting to eliminate first flush of weeds
- **Mowing** to prevent weeds from producing seed in non-cropped areas, mow close and monitor for regrowth
- **Row crop cultivation**
- **Hand-removal** – largest 10% may make 90% of seed
- Delay **fall tillage** to maximize weed seed predation

Clean your equipment, especially in weedy fields

# Equipment cleanout

- Clean your tillage and harvest equipment to ensure weed seeds will not be carried between fields
- Especially important with crops that utilize a platform header.
- Open trap doors and use compressed air to remove seeds
- Takes 4 to 5 hours
- Don’t have time - - consider harvest order; harvest weedy fields last


# Integrated Seed Destructor

Photo: www.ihsd.com


Photo: www.ihsd.com

# Seven steps of sprayer cleanout

1. Spray out booms every night (or when herbicides demand it)
2. First rinse is in the field
3. Remove and clean all screens
4. Remove and clean boom end caps
5. Second rinse with water
6. Add tank cleaner
7. Final rinse and flush

# Acknowledgements


- The Sugarbeet Research and Education Board for funding this research
- The SMBSC Research Team; Mark Bloomquist, David Mettler, Cody Groen, Gary Lindahl, Nicole VanOs, Bob Johnson
- Our field cooperators, Chris and Brian Schlegel and Jeff Schmoll (Lake Lillian)

# Thank you for your Support

Tom Peters

- Extension Sugarbeet Agronomist and Weed Control Specialist
- thomas.j.peters@ndsu.edu

BeetWeedControl @tompeters8131

- 701-231-8131 (office)
- 218-790-8131 (mobile)

NDSU EXTENSION

UNIVERSITY OF MINNESOTA EXTENSION