Weed Control in Sugarbeet
Grand Forks

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Extension Sugarbeet Agronomist and

Weed Control Specialist

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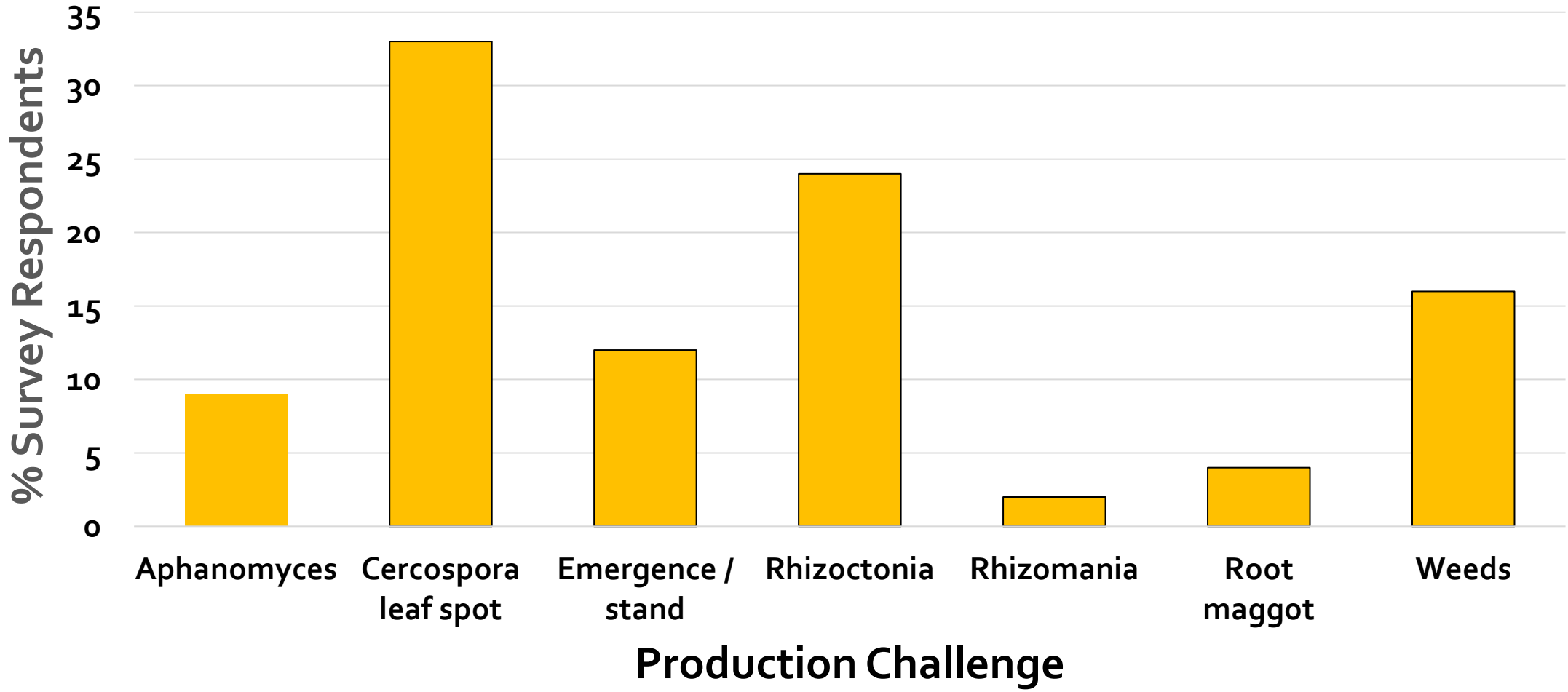
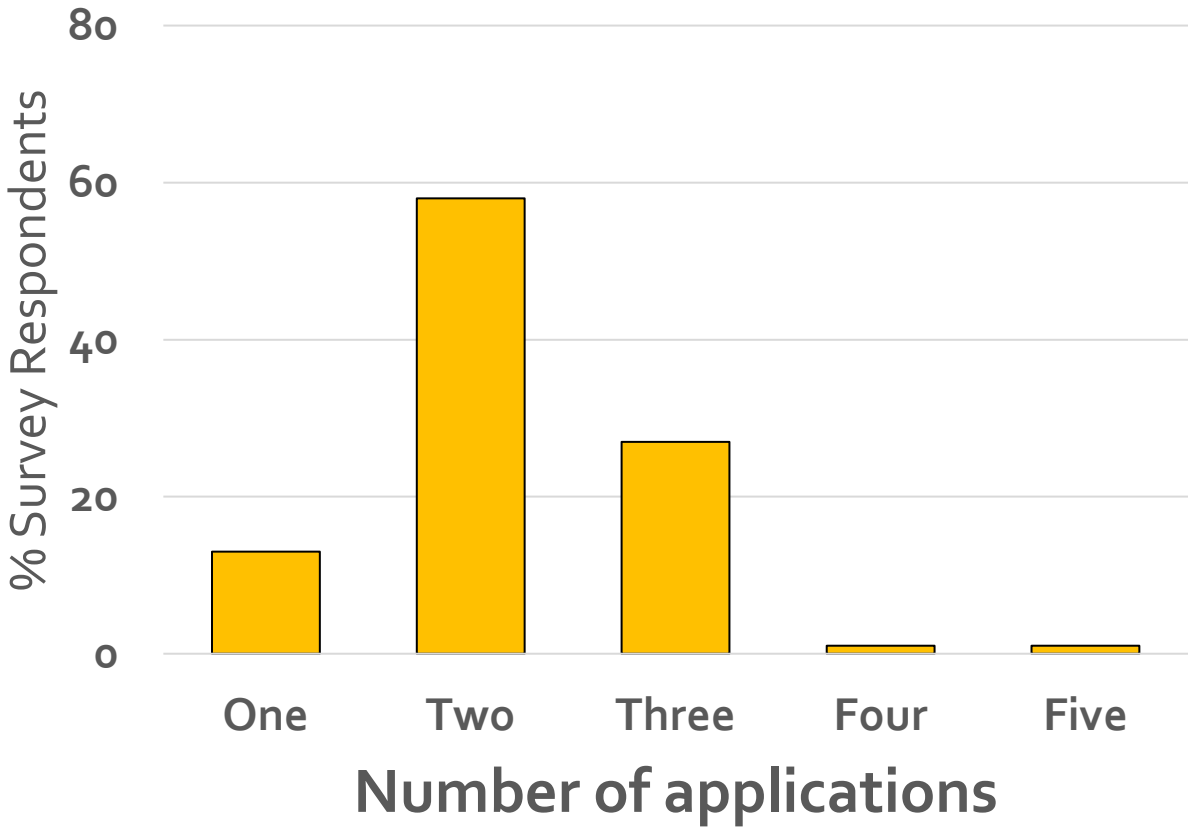
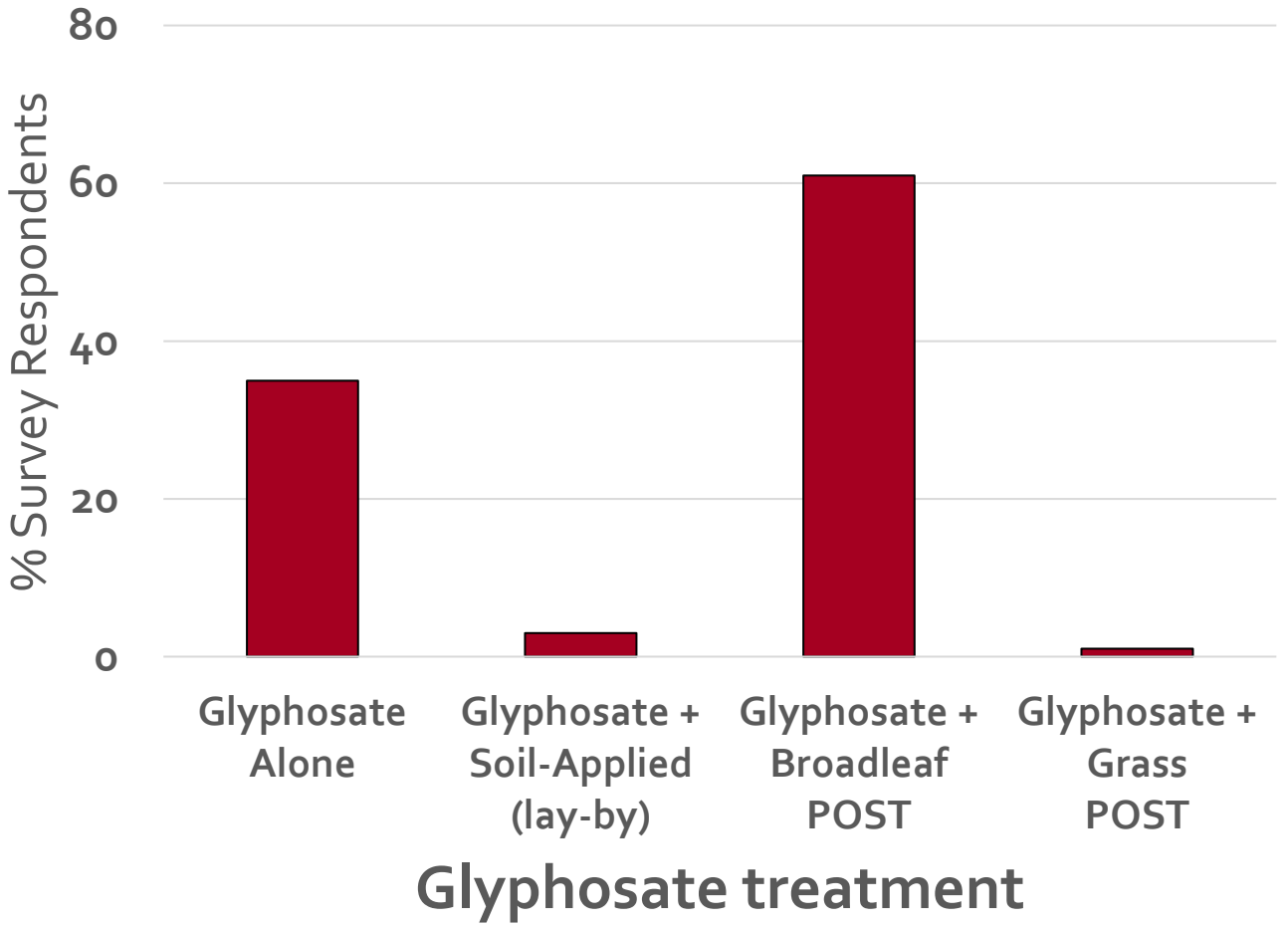
What was your most serious production problem?[a]



[a]Turning Point Survey of Growers; conducted at the 2019 Sugarbeet Growers Seminar, Grand Forks

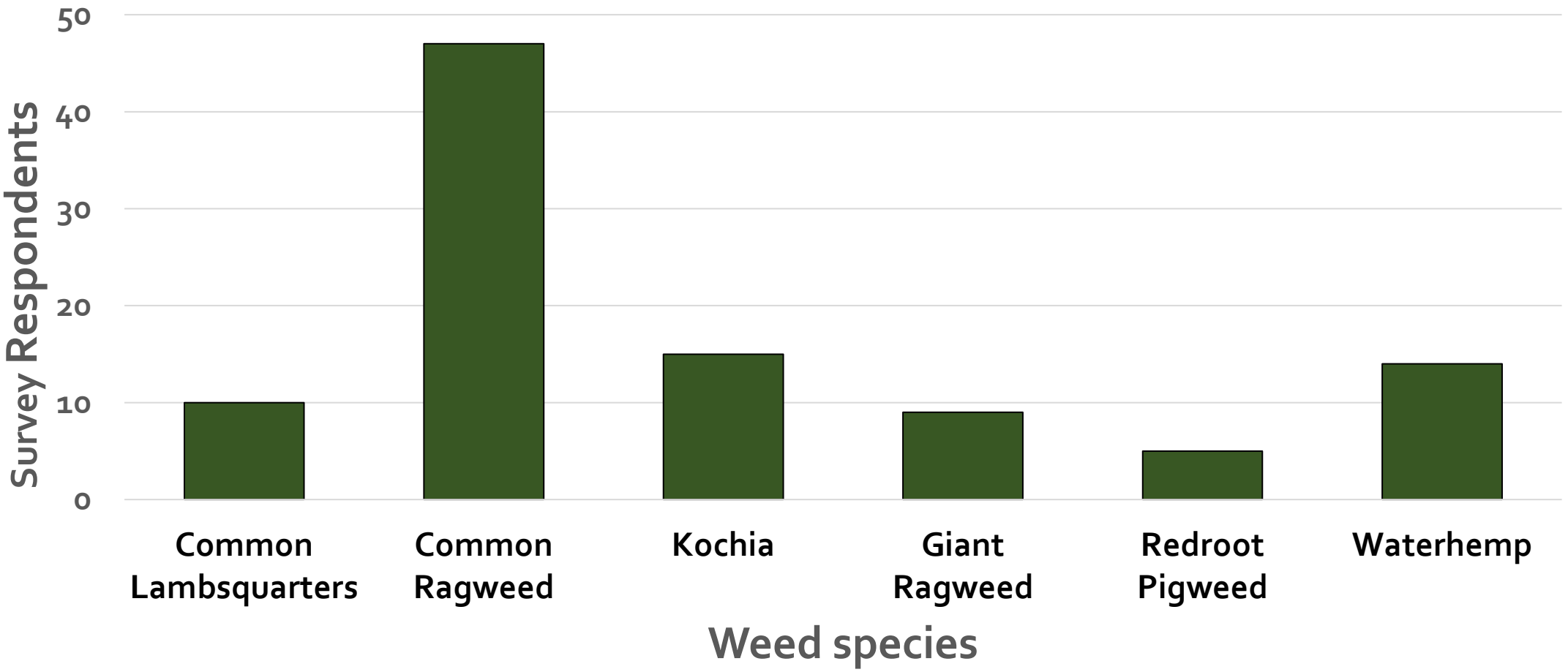
How many glyphosate applications did you use POST; what glyphosate application combination did you use?[a]





[a]Turning Point Survey of Growers; conducted at the 2019 Sugarbeet Growers Seminar, Grand Forks

What was your worst weed problem?[a]



[a]Turning Point Survey of Growers; conducted at the 2019 Sugarbeet Growers Seminar, Grand Forks

Resistant weeds in ND/MN*

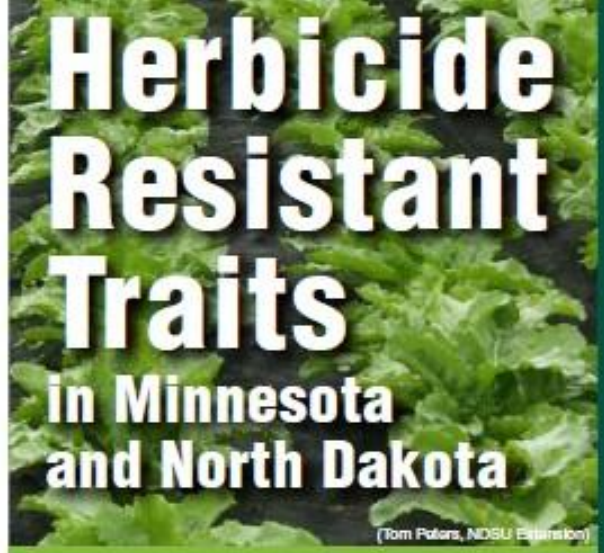
Herbicide Group	Weed
Group 1	Wild oat, Green foxtail
Group 2	**Kochia,** Green foxtail, **Common ragweed,** redroot pigweed, **Waterhemp,** Wild oat
Group 3	Green foxtail
Group 4	**Kochia**
Group 5 (atrazine)	**Kochia**
Group 9	**Kochia,** Horseweed, **Common ragweed, Waterhemp**
Group 14	**Common ragweed** and **Waterhemp**

*Not a complete list

HT2 Sugarbeet

- A biotech trait featuring glyphosate, glufosinate, and dicamba in the same vector.
- Commercialize in sugarbeet in the middle of the next decade.
- We need to ensure the herbicide traits are useful when they are introduced.
- **Reinforce strategies to preserve future herbicide tolerant trait products in sugarbeet by creating educational / outreach modules emphasizing weed management across the crop sequence.**

Herbicide Resistant Traits in Minnesota and North Dakota


(Tom Peters, NDSU Extension)

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It is important to read and follow label guidelines when applying herbicides to any crop. The label of some glyphosate products indicates they can be applied to Roundup Ready® and glyphosate-tolerant crops. Most glyphosate labels state the products are for use in Roundup Ready® crops or in crops that have the Roundup Ready® gene. Other glyphosate labels have language stating the glyphosate product can be applied to glyphosate-tolerant crops.

This reference guide is designed to help clarify which herbicide products can be applied to various trait packages. You always should check seed tags and herbicide labels to ensure missapplications do not occur.

Table 1. Alfalfa herbicide-resistant traits and herbicides that can be used in combination with resistant traits. A checkmark indicates that alfalfa herbicide trait packages have resistance to various herbicide products.[a]

Alfalfa Herbicide Trait	Glyphosate	Glufosinate	Growth Regulators
Conventional			
Roundup Ready Alfalfa[b]	✔		

[a]Always consult herbicide labels for application requirements.
[b]Always consult herbicide label to determine if glyphosate formulation is approved for RR alfalfa.

Table 2. Canola herbicide-resistant traits and herbicides that can be used in combination with resistant traits. A checkmark indicates that canola herbicide trait packages have resistance to various herbicide products.[a]

Canola Herbicide Trait	Glyphosate	Glufosinate	ALS Inhibitors
Conventional			
Roundup Ready	✔		
Roundup Ready TruFlex	✔		
LibertyLink		✔	
Clearfield Canola[b]			✔
SU Canola[c]			✔

[a]Always consult herbicide labels for application requirements.
[b]Apply Beyond (imazamox) to Clearfield canola varieties.
[c]Apply Draft (thifensulfuron and triberuron) to SU Canola varieties.

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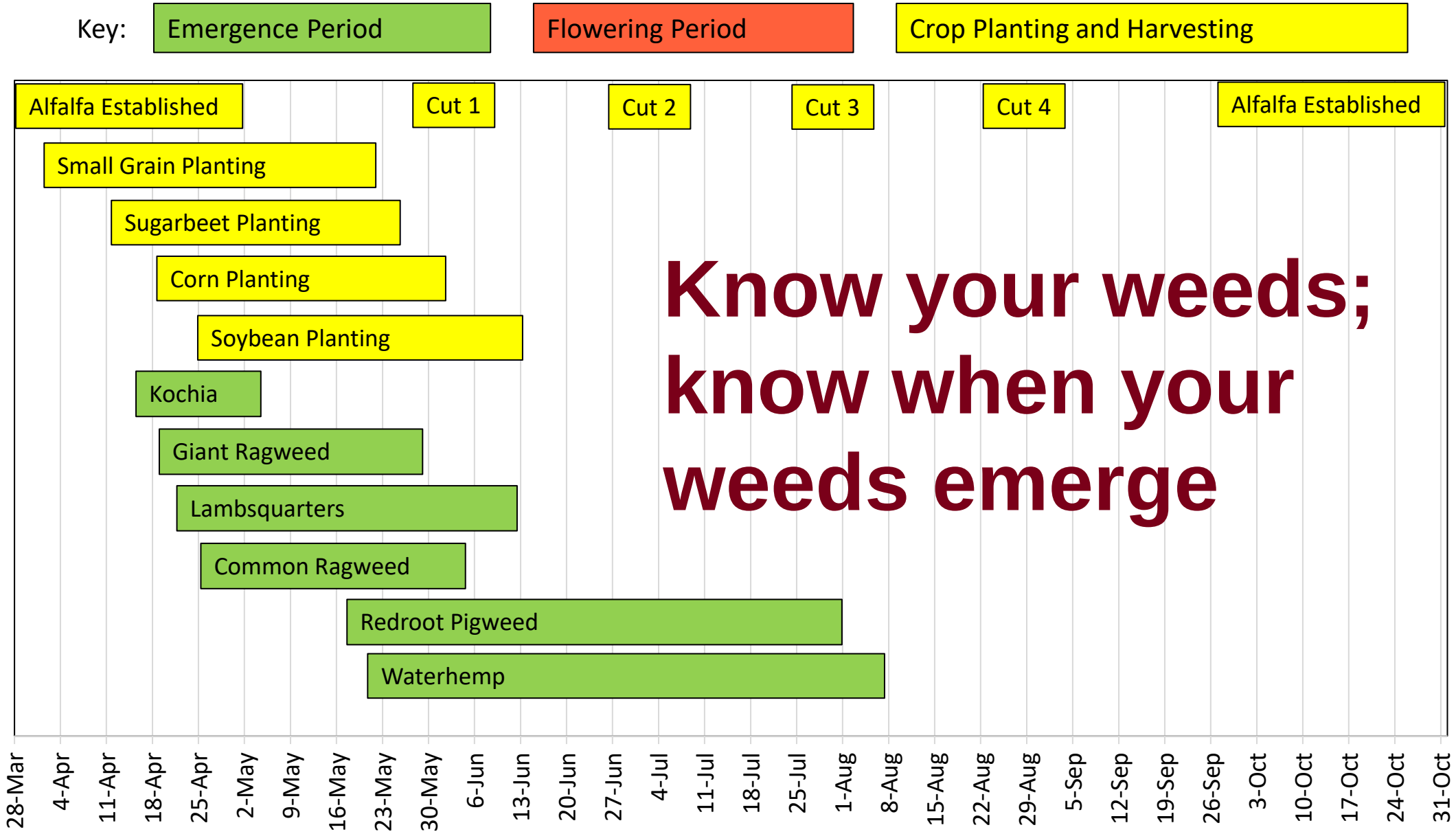


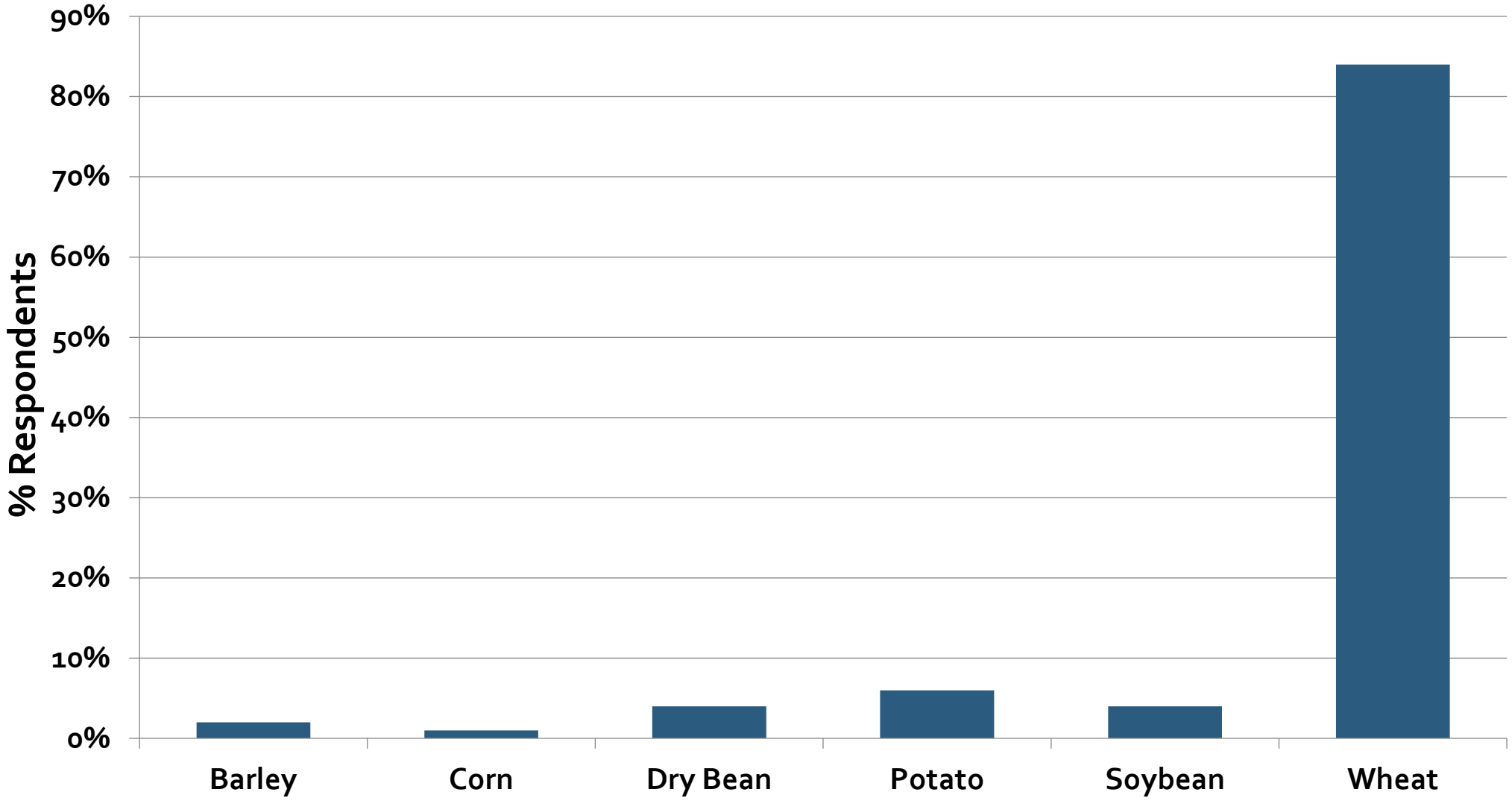
Adapted from Werle et al. 2014, Goplen et al. 2017, Weedometer 2008

Kochia

CBS-TumbleweedClip.mp4

- Life cycle, summer annual
  - One of the first weeds to emerge in spring
- Seed production, 15,000 seeds per plant
- Biology, very deep rooted, tolerates saline soils
- Biology, extremely competitive; a few plants will reduce yield
- Seed viability, 1 to 2 years
- Many document examples of herbicide resistance
  - ALS (SOA 2)
  - 2,4-D and dicamba (SOA 4)
  - Triazines (5)
  - Glyphosate (SOA 9)
  - Multiple resistance in ND, 2+4, 2+9, 2+4+9

What crop preceded most of your sugarbeet acres?[a]

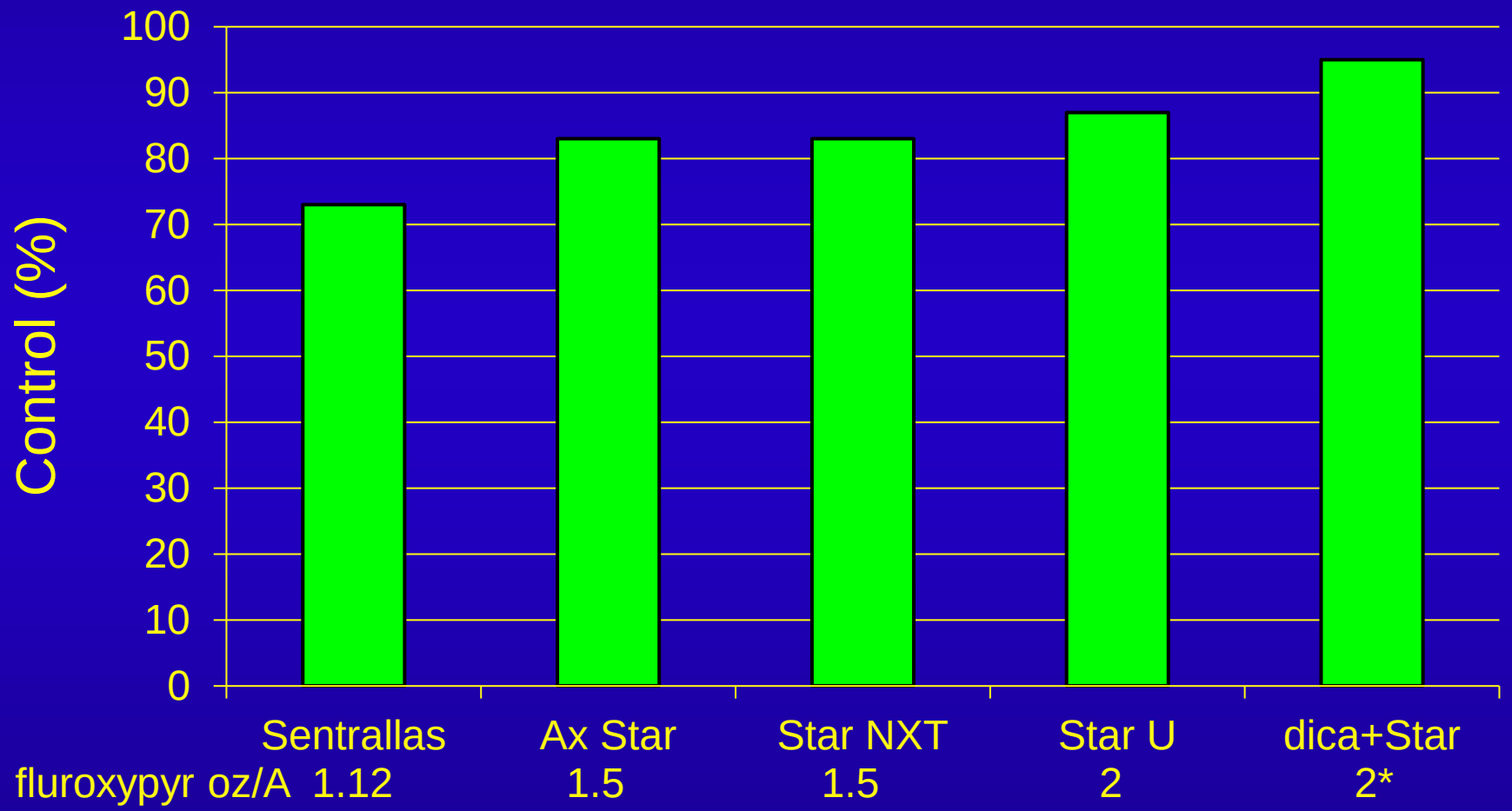


[a]Turning Point Survey of Growers; conducted at the 2019 Sugarbeet Growers Seminar, Grand Forks

Small grains are tremendous crop(s) to implement a kochia control protocol

- Narrow rows provide canopy closure
- Herbicides and herbicide families are complimentary
  - Growth Regulators (SOA4)
    - Fluroxypyr, Starane, or Starane Ultra
    - Dicamba
    - Widematch (clopyralid+fluroxypyr)
  - PSII Inhibitors (SOA6)
    - Bromoxynil
  - PPO Inhibitors (SOA14)
    - Aim
  - HPPD Inhibitors (SOA27)
    - Husky, Husky Complete

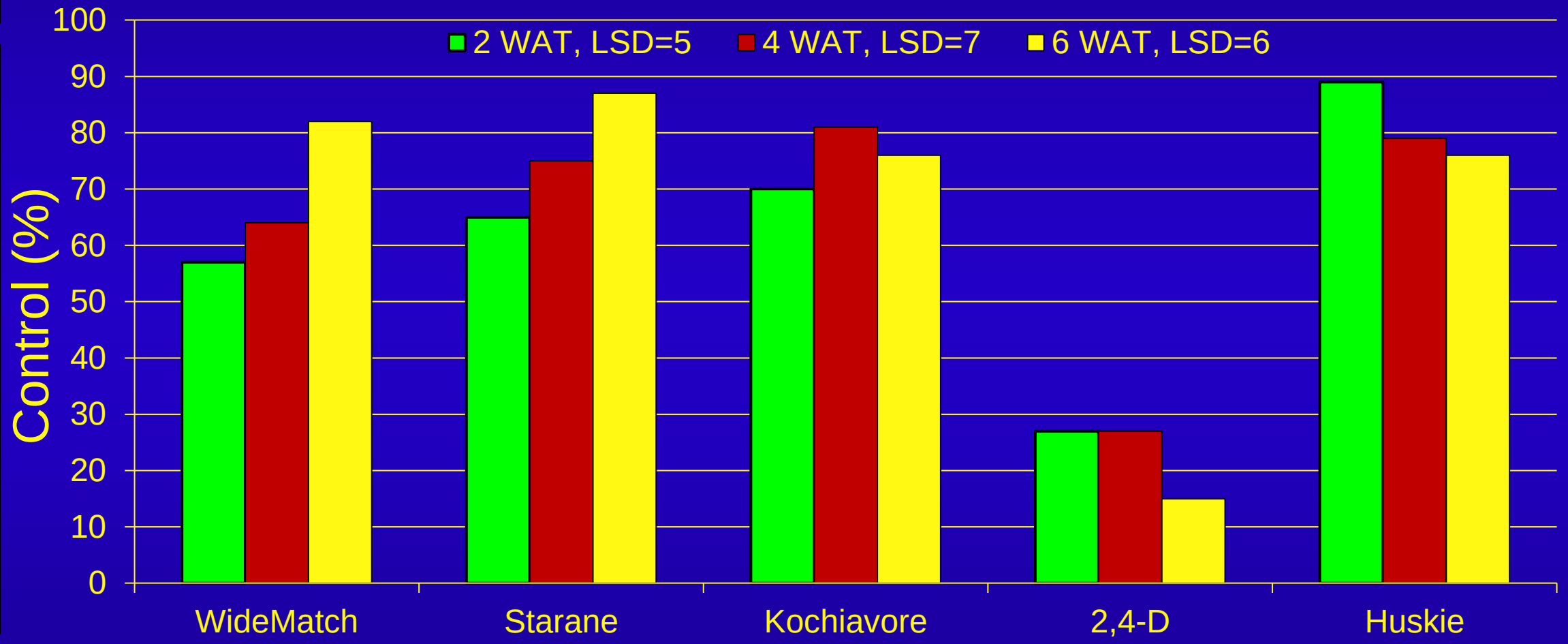
Kochia Control



LSD (0.05) = 5

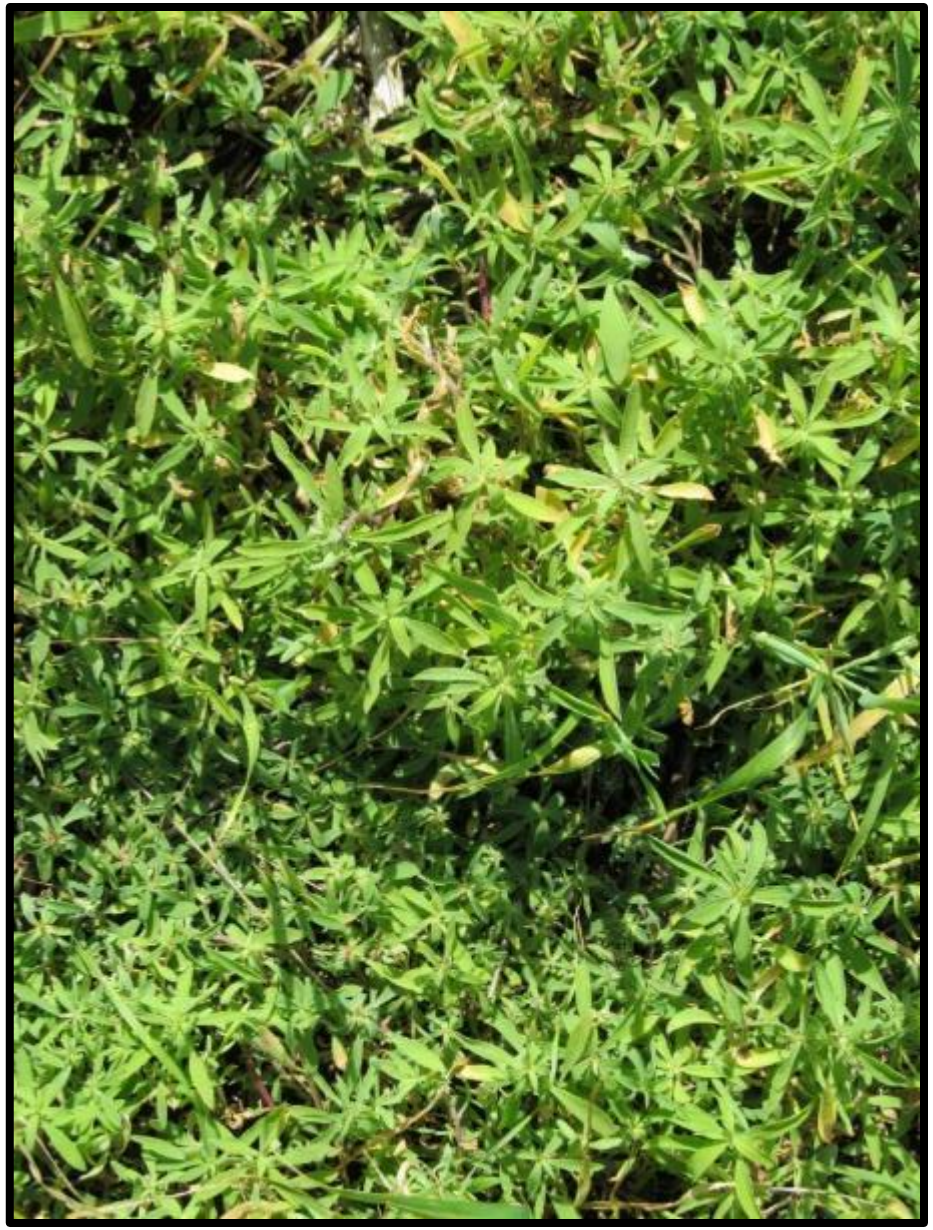
Slide from K Howatt, NDSU

Kochia Control



Slide from K Howatt, NDSU

Starane

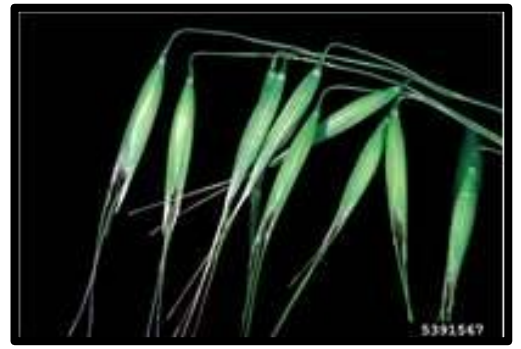


Products containing bromoxynil

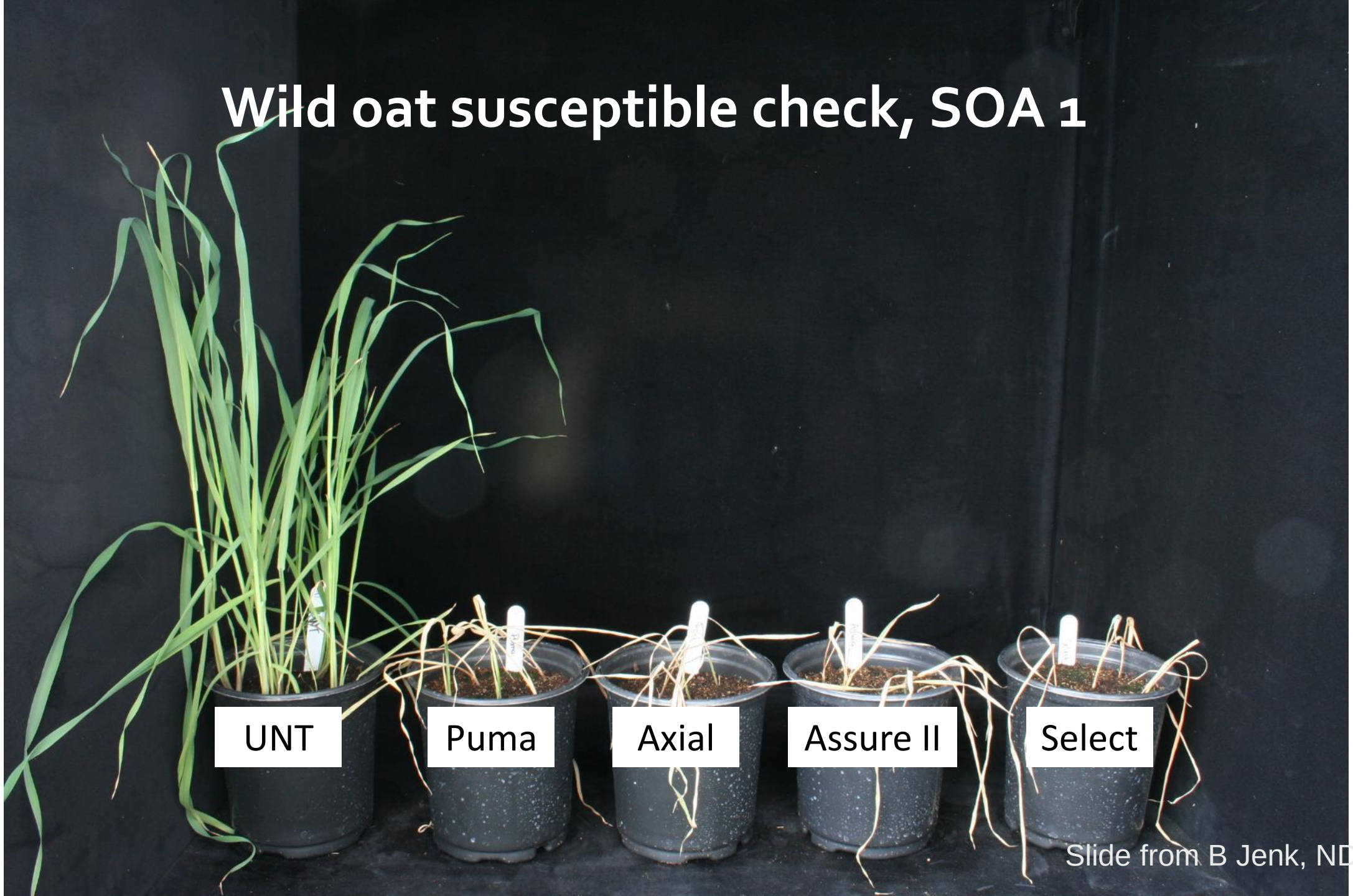
Slide from K Howatt, NDSU

Wild Oat

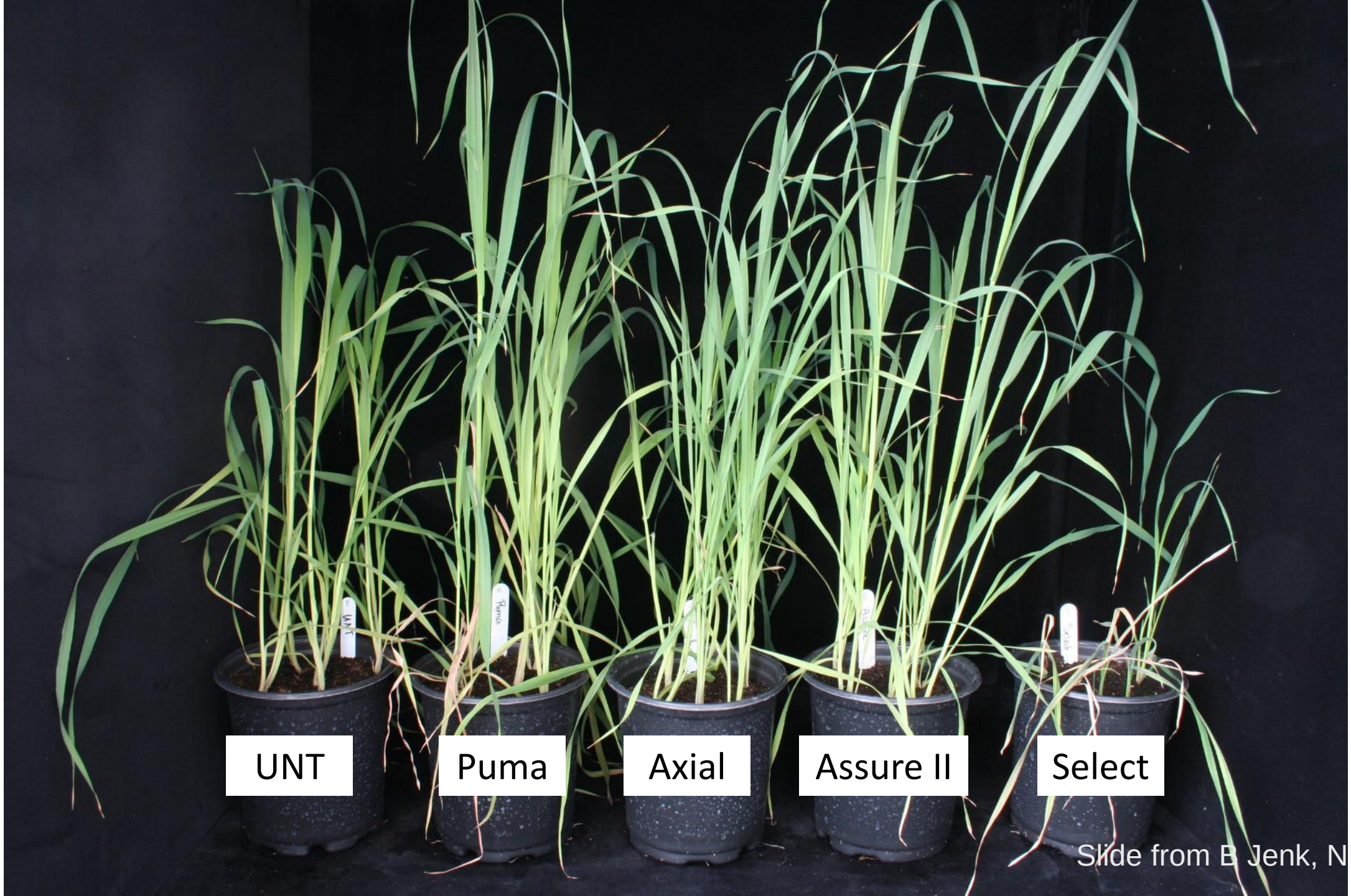
- Summer annual, germinate in response to moisture, oxygen, and 50F air temperature
- Hairs on the leaf margins and a membranous ligule, seedlings have an anti-clockwise twist
- Extremely competitive; 5 plants per sq. yard = 4 to 5% yield loss
- The panicle may contain up to 250 awned seeds
- Seed viability, 13 years; few beyond 3 years
- Document examples of herbicide resistance
  - ACC-ase Inhibitors (SOA 1)
  - ALS (SOA 2)



Wild oat susceptible check, SOA 1



Slide from B Jenk, NDSU



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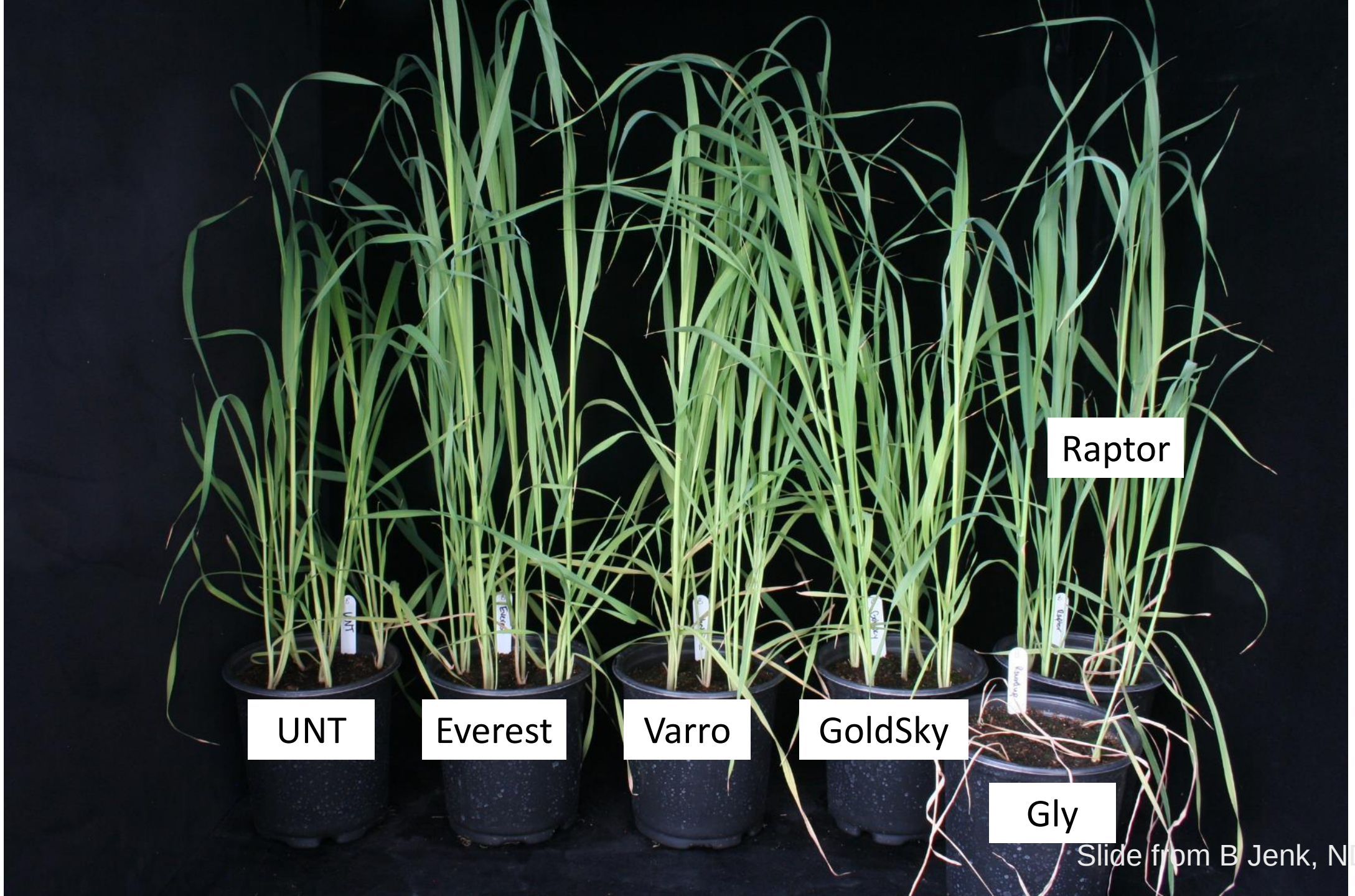


Slide from B Jenk, NDSU

67 Wild oat samples

Herbicide	SOA	% resistant
Puma	1	85
Axial XL	1	48
Everest	2	76
GoldSky	2	87
Varro	2	96
Raptor	2	45
Assure II	1	78
Select	1	7

19 Green foxtail samples

Herbicide	% resistant
Puma	79
Axial XL	58
Discover	79
Everest	21
GoldSky	21
Varro	21
Raptor	0
Assure II	63
Select	0
Assure II + Select	0
Roundup	0

Wild oat and green foxtail collected in 2018.

Slide from B Jenk, NDSU

Why is waterhemp so difficult to manage?
Waterhemp is well-suited for modern agriculture

- Difficulty in weed identification
- Extended germination timing
- Rapid growth
- Well adapted for conserve tillage
- Has benefited from transition to POST herbicides
- Tremendous seed production
- Seed longevity in soil
- Genetic diversity and resistance


No hair on stem
Waterhemp


Hair on stem
Redroot pigweed

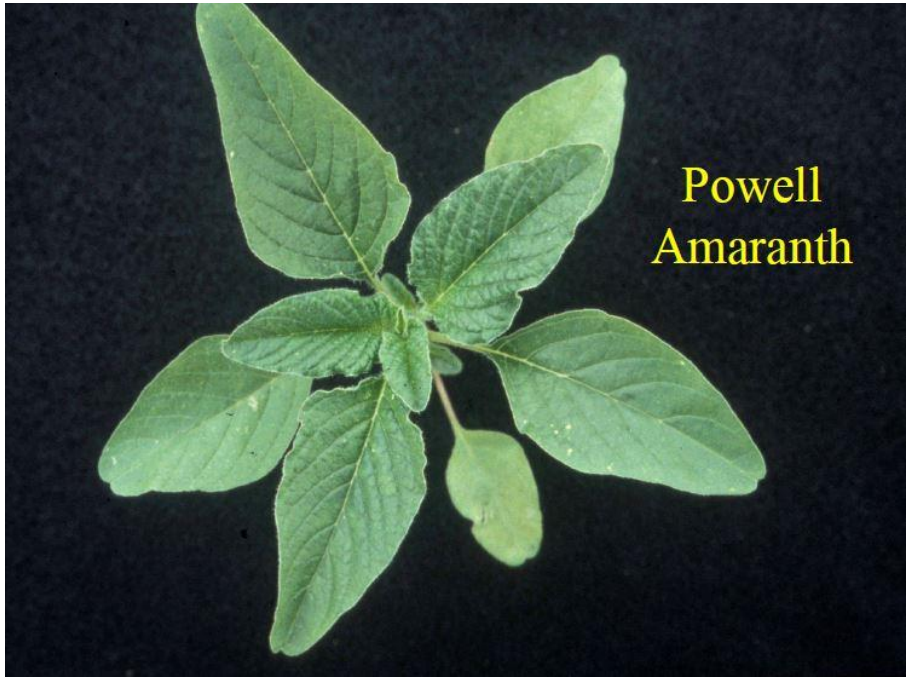
Waterhemp cotyledons are wider and shorter (row boats) than redroot pigweed (canoes)

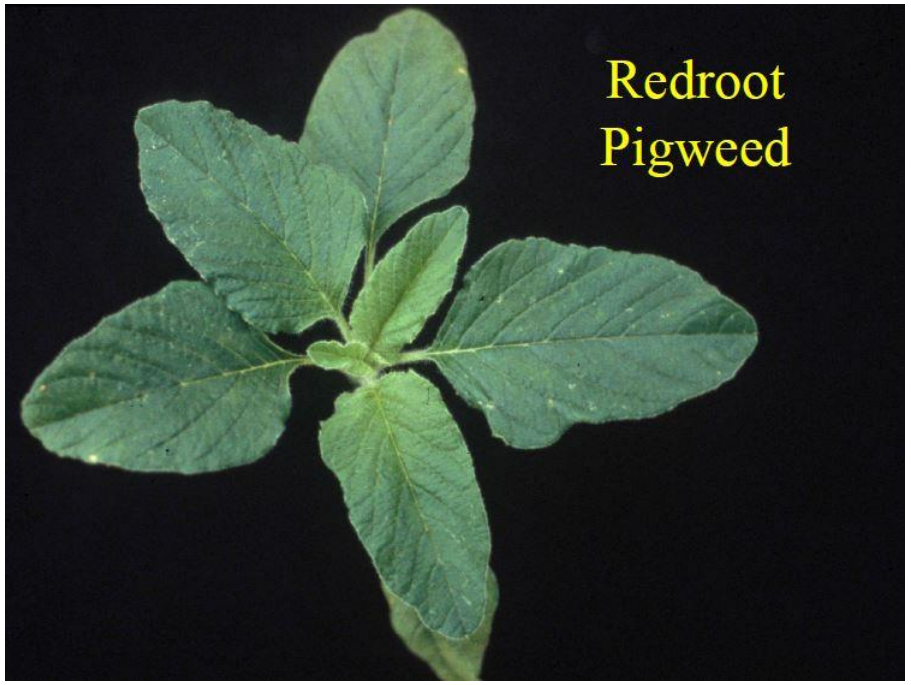
Waterhemp, credit, M. Horak, Kansas State Univ.

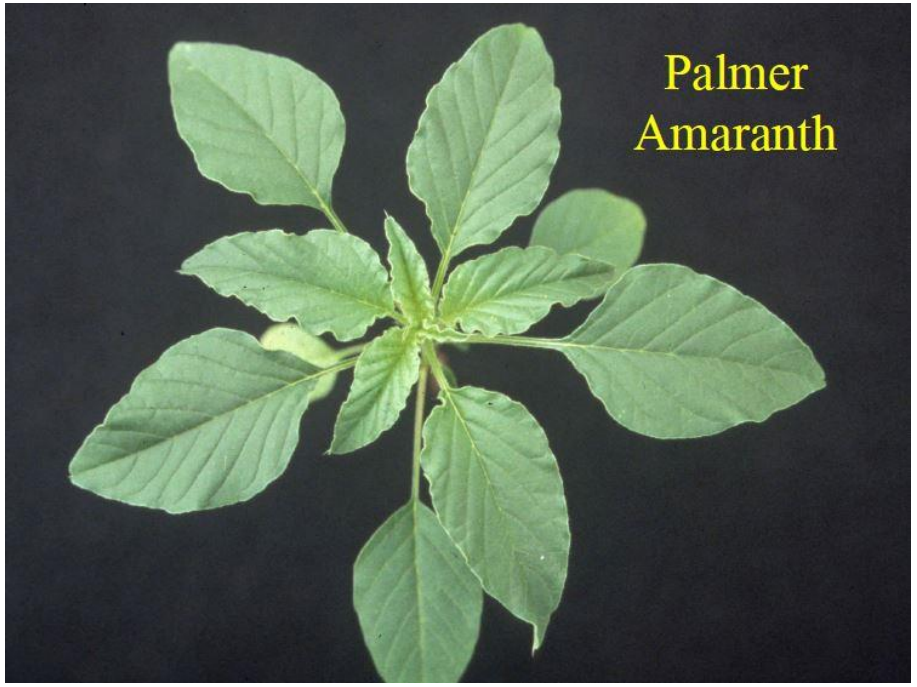
Waterhemp

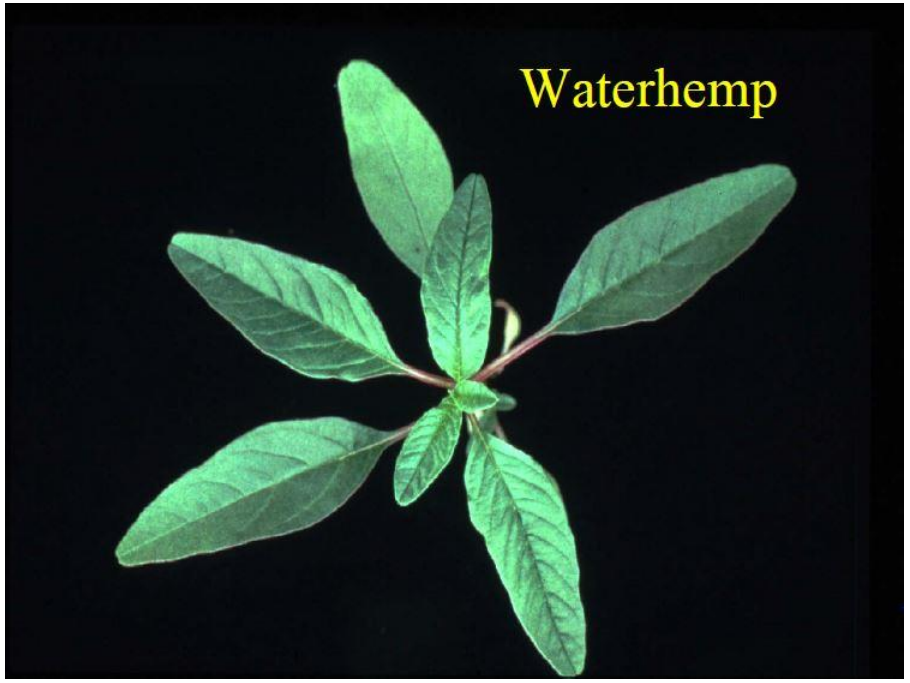
Redroot pigweed, credit, Bruce Ackley, The Ohio State Univ., Bugwood.org

Waterhemp


Powell
Amaranth

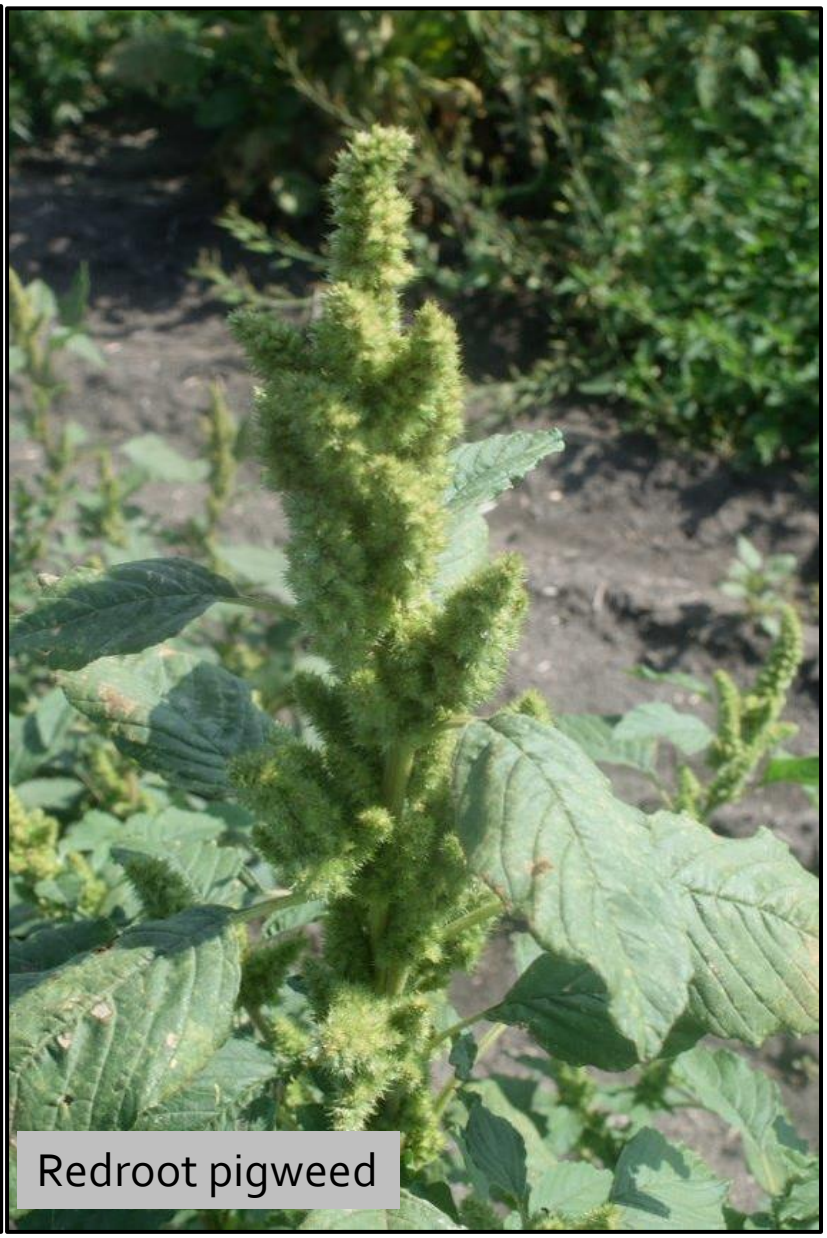

Redroot
Pigweed


Palmer
Amaranth


Waterhemp

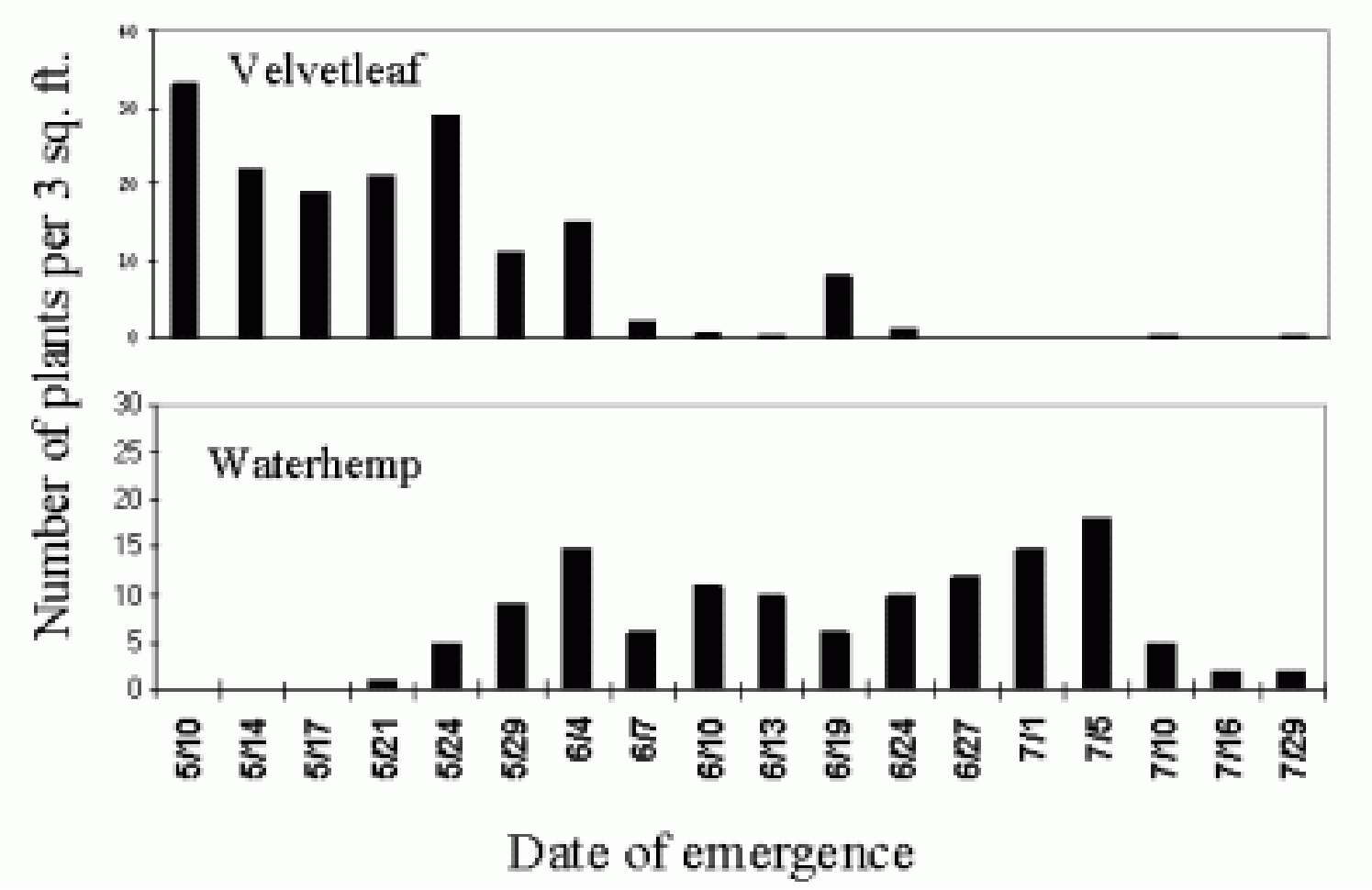

Powell amaranth


Waterhemp


Redroot pigweed

Waterhemp emerged, image, May 22

Delayed and prolonged emergence of waterhemp creates weed management challenges



Hartzler and Buhler, ISU and USDA-ARS, 1996

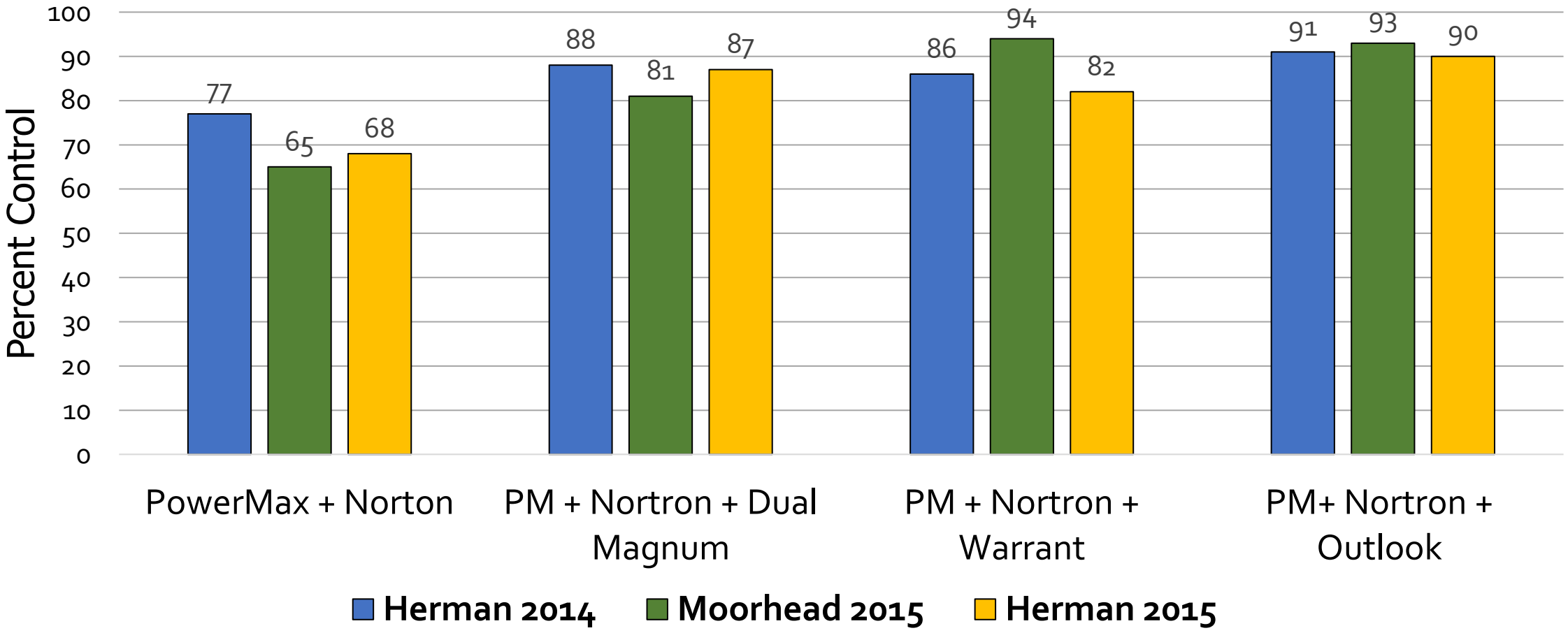
Etho might be our most versatile herbicide

Rate (pt/A)	Response
0.25	With PowerMax POST
0.38	With PowerMax POST
0.75	With PowerMax POST
1	With S-metolachlor
2	With S-metolachlor
3	With S-metolachlor
4	Kochia control PRE
5	Kochia control PRE
6	PRE for waterhemp control
7	PRE for waterhemp control

Nortron® SC
HERBICIDE

ETHOTRON®
HERBICIDE

Waterhemp control from postemergence herbicides, across locations and years



How do you decide what product to use lay-by?
Risk management

- Replanting, select Dual Magnum
- Activation early, select Outlook
- Sugarbeet safety, Dual Magnum or Warrant
- Length of control, Warrant
- Spectrum, Warrant
- Relationship with industry?
- Don’t forget about the generic versions

WARRANT® HERBICIDE

Dual Magnum®

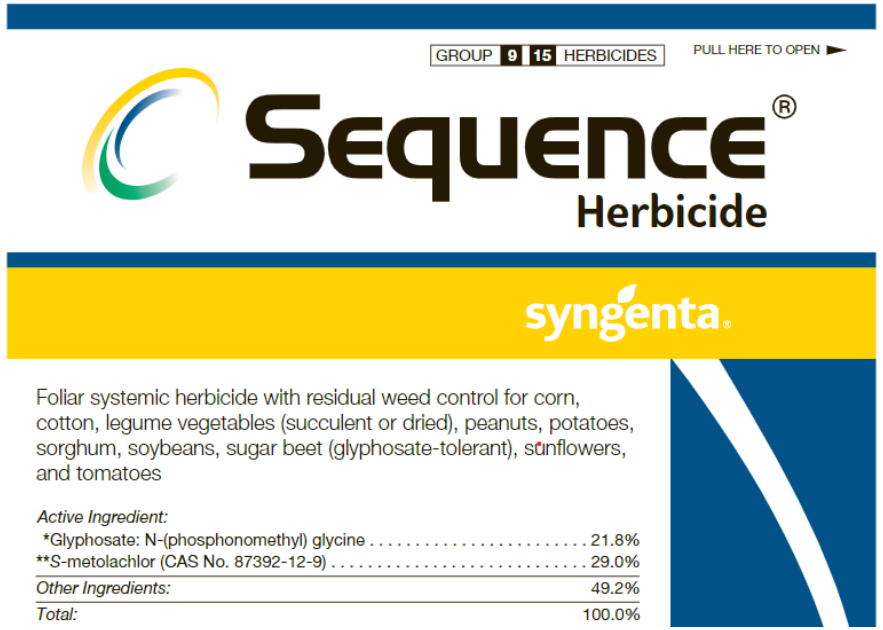
Outlook®
Herbicide

Sequence is glyphosate K salt and *S*-metolachlor

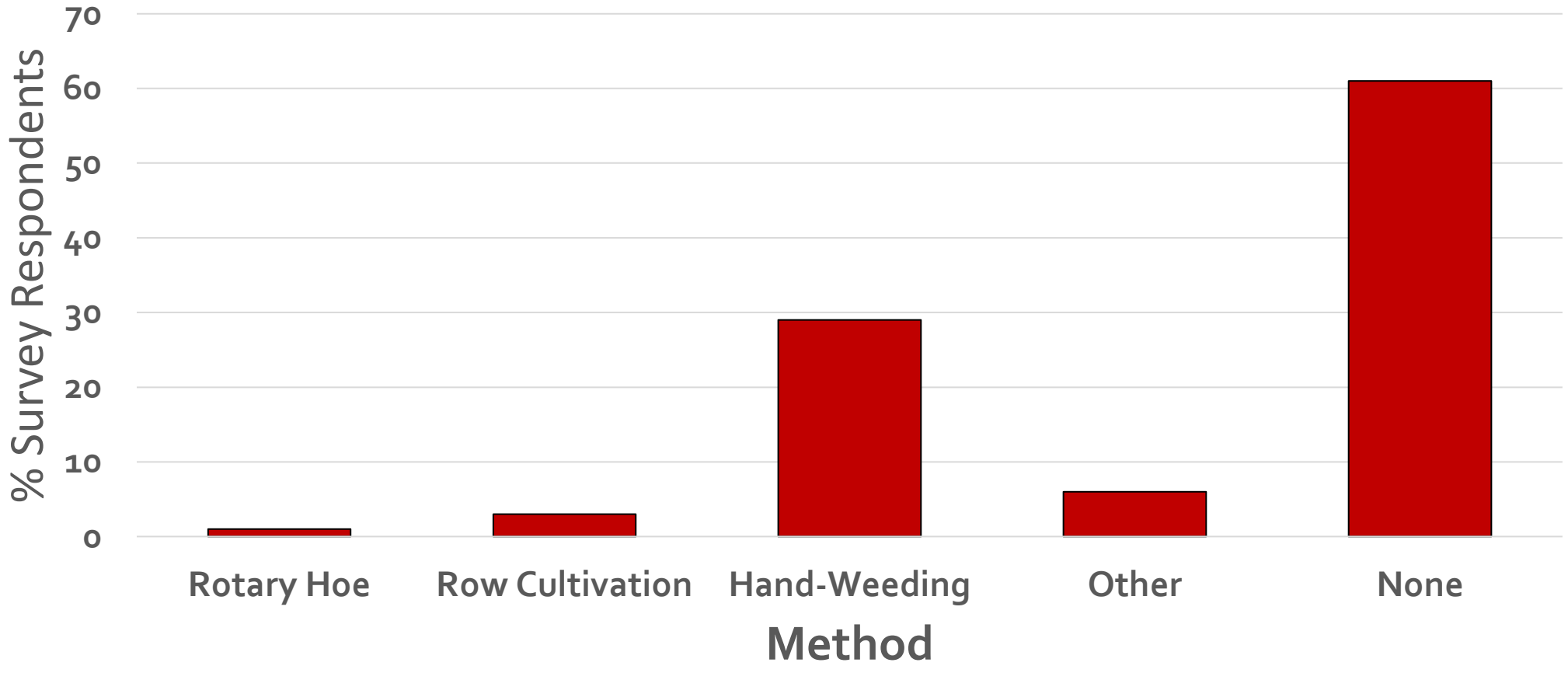
Sequence (pt/A	S-metolachlor (pt/A)	Glyphosate (fl oz /A)	PowerMax 28 fl oz/A	PowerMax 32 fl oz/A
2.5	0.98	20	8	12
2.75	1.08	22	6	10
3	1.18	24	4	8

Sugarbeet Growth Stage	Soil Texture	Single application (pt/A)	Season (pt/A)
Two to eight leaves	Coarse	2.5	6.8
Two to eight leaves	3	2.5	6.8

- Add AMS at 1% weight or 2.5% v/v liquid (8.5 lb/100 G water)
- Non-ionic surfactant or HSMOC (tank-mixes)
- Minimum 10 GPA
- 14 to 21 days between applications
- 60 day PHI



What other POST weed control methods did you use



[1]Turning Point Survey of Growers; conducted at the 2019 Sugarbeet Growers Seminar, Grand Forks

Electrical Discharge System (EDS)

Electricity traveling in a copper bar contacts the stem of a plant, boiling the water in cells and bursting them. The more moisture in plants the more effective the result.

- Lasco Lightning Weeder
- Developed in 1979
- Grand Forks County, ND
- 50,000 watts
- 125 HP tractor
- PTO driven
- EDS

EDS, generation II, 2019

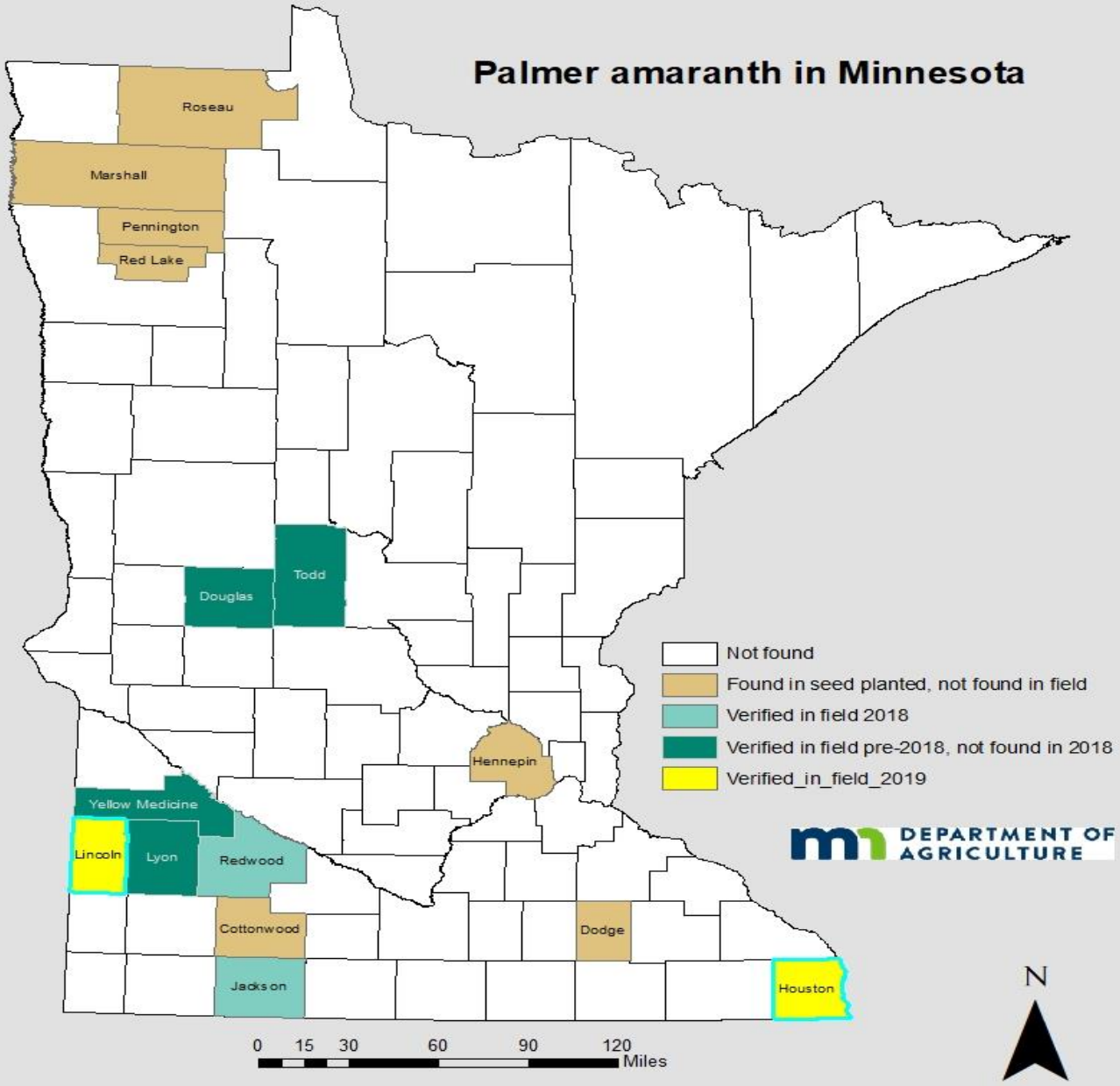
- Weed Zapper
- Developed in 2018
- Sedalia, MO
- 200,000 watts
- Boom front-end mounted
- PTO driven generator
- Requires a 275 PTO HP tractor
- Safety improvements
- Morris, MN 2019.mov

Experiment

- Collected waterhemp seed from brown and green flowering structure tissue from three fields.
- Planted 50 seeds per pot, 3 replications.
- Seeded and covered with plastic until emergence.
- Control was viable seed from a different source to evaluate technique.

Location	Stem color	Waterhemp	
		#	%
Glyndon, MN	brown	0 a	0 a
Perley, MN	brown	2.7 a	5.3 a
Perley, MN	green	2.3 a	4.7 a
Control		33.3 a	66.7 b
P-value		<0.0001	<0.0001

Status of Palmer amaranth in Minnesota



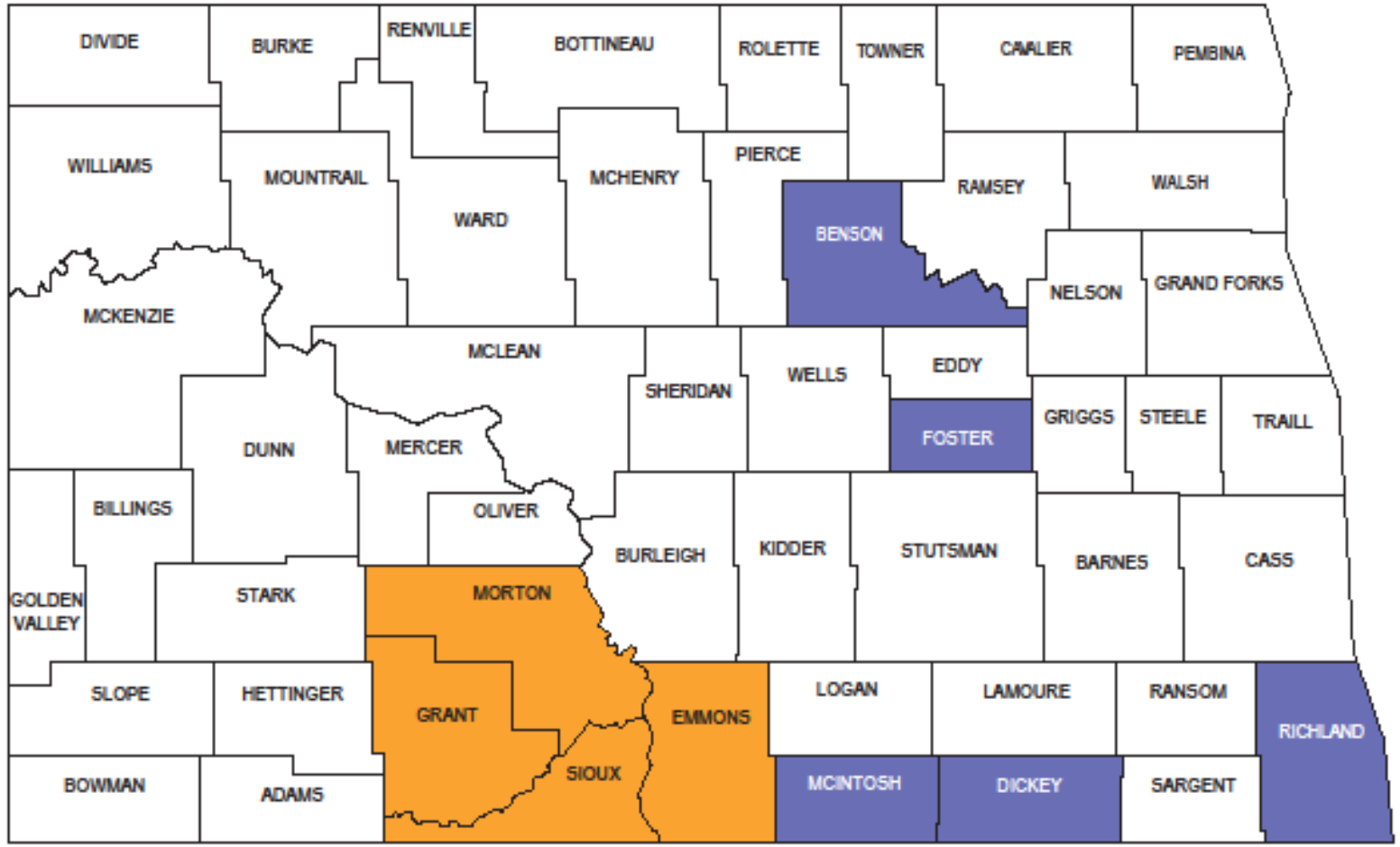
In accordance with the Americans with Disabilities Act, this information is available in alternative forms of communication upon request by calling 651/201-6000. TTY users can call the Minnesota Relay Service at 711 or 1-800-627-3529. The MDA is an equal opportunity employer and provider.

2019 New Counties

Lincoln County – Millet

Houston County – Two sites, no relation

North Dakota Department of Agriculture
Palmer Amaranth Distribution



Lab confirmed positive for Palmer amaranth
- 2018
- 2019

As of 10/15/19

Acknowledgements

- Sugarbeet Research and Education Board for funding these research

- Our cooperators: **James Bergman (Oslo), Glenn and Danny Brandt (Ada), Pinta Brothers (Minto),** American Crystal Sugar (Moorhead)

- North Dakota State University Experiment Station and Crookston Research and Outreach Center

Thank you for your Support

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