

Weed Control in Sugarbeet

Thomas J Peters

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and Weed control Specialist**

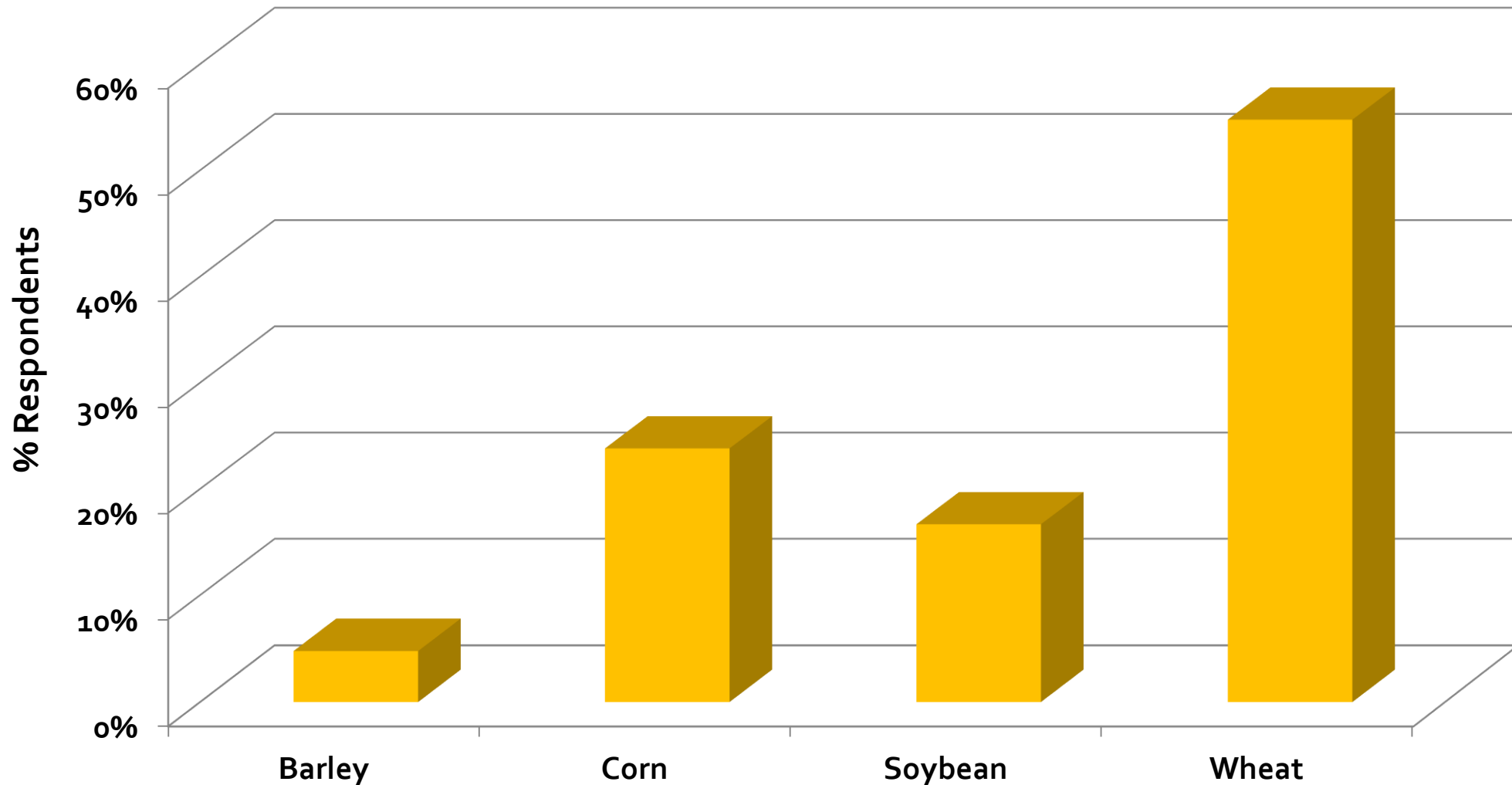
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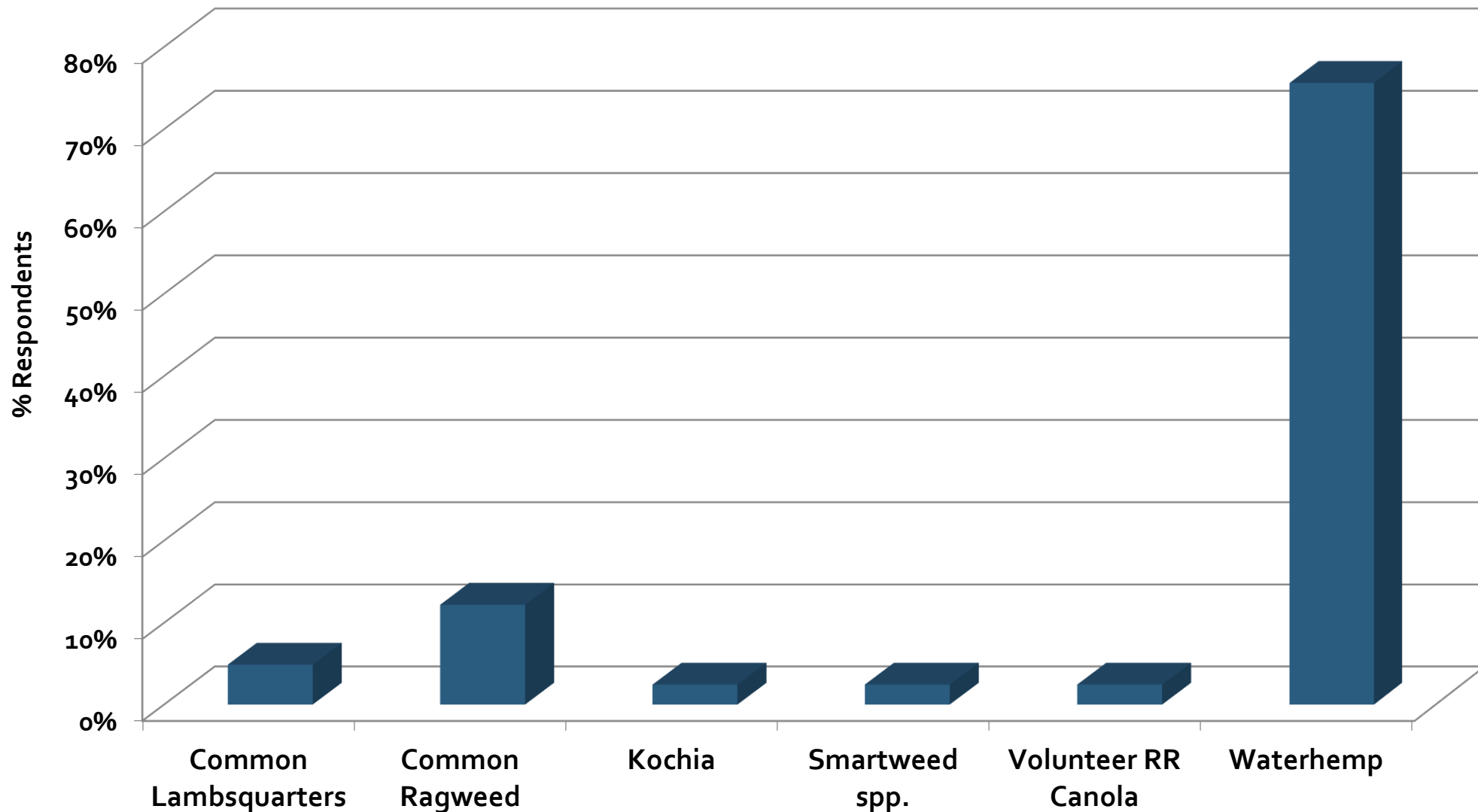
What crop preceded most of your sugarbeet acres?¹



¹Turning Point Survey of Growers; conducted at the 2018 Sugarbeet Growers Seminar, Wahpeton



What was your worst weed problem?¹



¹Turning Point Survey of Growers; conducted at the 2018 Sugarbeet Growers Seminar, Wahpeton

Common Ragweed



- Life cycle: summer annual broadleaf
- Growth habit: fibrous root system, grows 2 to 4 feet high
- Germination: soil temperature triggers germination,
 - between 50 and 80 F
 - returns to dormancy when temperatures get hot in June and July
- Reproductive habit: male and female flowers are in separate flower heads on the same plant (monoecious)
- Seed production: 30,000 to 60,000 seeds per plant
- Longevity: 25 to 35 years
- Resistant biotypes to multiple classes of herbicides
 - ALS (SOA 2)
 - PPO inhibitor (SOA 14)
 - Glyphosate (9)



Sugarbeet injury and control of common ragweed, Doran ND, 2018

Three inch common ragweed

Herbicide Treatment ¹	Rate	June 21 sgbt inj	June 28 cora cntl	July 11 cora cntl
	fl oz/A	------(%)-----		
PowerMax ²	28	8	55	58
PowerMax+ethofumesate	28+4	18	55	53
PowerMax+Stinger	28+2	5	85	73
PMax+Stinger	28+4	8	94	93
PowerMax+Stinger/ PowerMax+Stinger	28+2/ 28+2	10	98	99
PowerMax+Stinger/ PowerMax+Stinger	28+4/ 28+4	8	100	100
LSD (0.1)		14	5	8

¹PowerMax alone and PowerMax+Stinger treatments were applied with N-Pak AMS at 2.5% v/v and Prefer 90 NIS at 0.25% v/v.

²Application May 31 and June 13

Sugarbeet injury and control of common ragweed, Doran ND, 2018

Six inch common ragweed

Herbicide Treatment ¹	Rate	June 21 sgbt inj	June 28 cora cntl	July 11 cora cntl
	fl oz/A	------(%)-----		
PowerMax ²	28	5	78	66
PowerMax+ethofumesate	28+4	18	71	65
PowerMax+Stinger	28+2	13	76	72
PMax+Stinger	28+4	23	75	73
PowerMax+Stinger/ PowerMax+Stinger	28+2/ 28+2	15	81	82
PowerMax+Stinger/ PowerMax+Stinger	28+4/ 28+4	28	76	91
LSD (0.1)		8	13	16

¹PowerMax alone and PowerMax+Stinger treatments were applied with N-Pak AMS at 2.5% v/v and Prefer 90 NIS at 0.25% v/v.

²Application May 31 and June 13



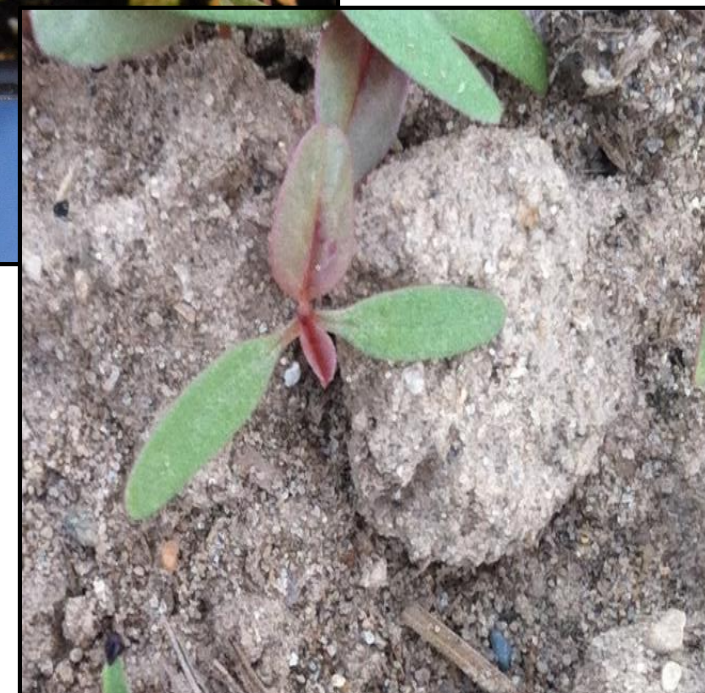
Redroot pigweed

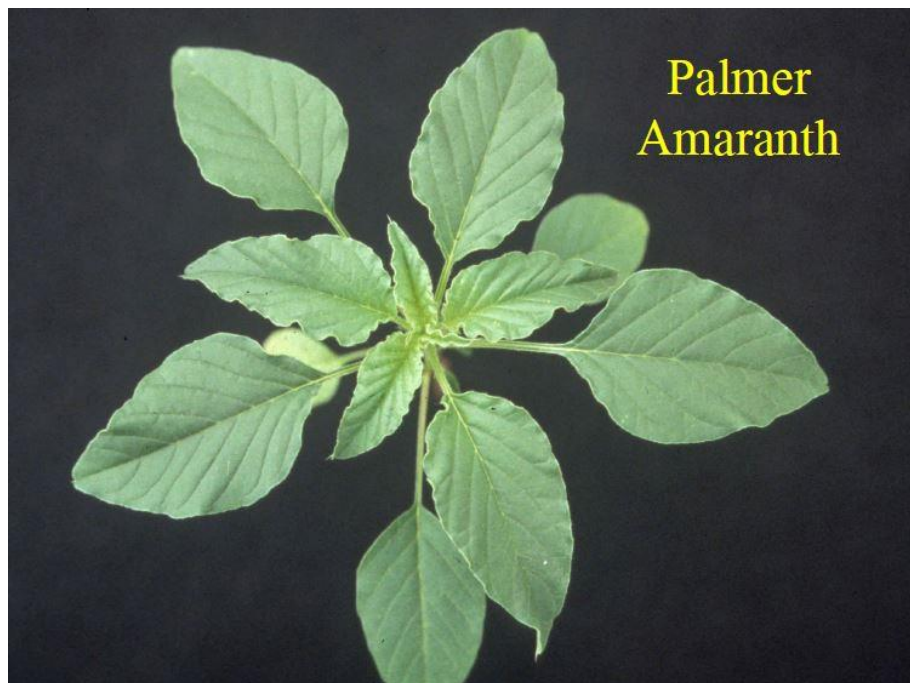
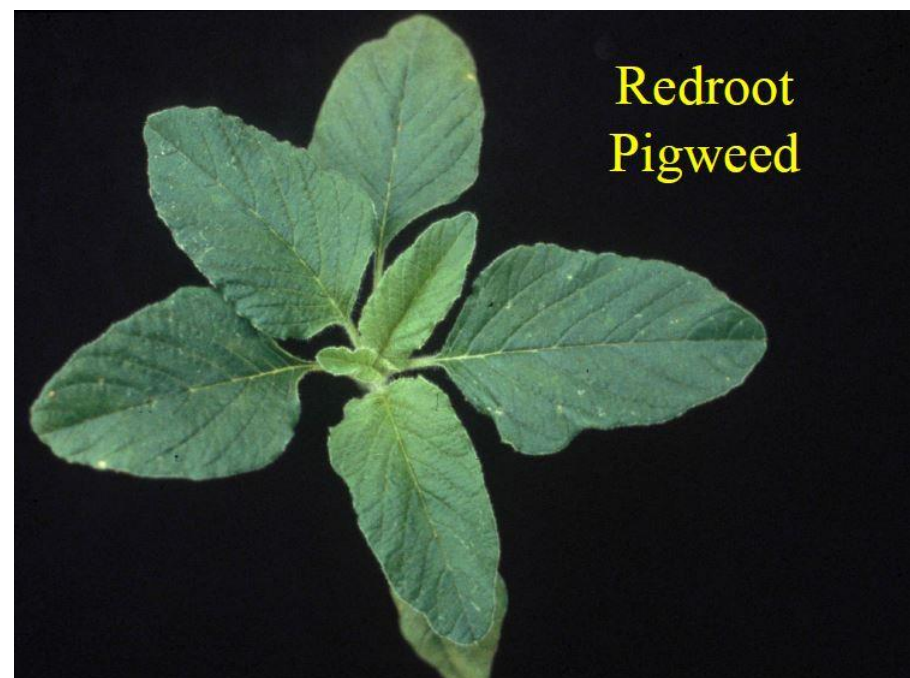


Palmer amaranth

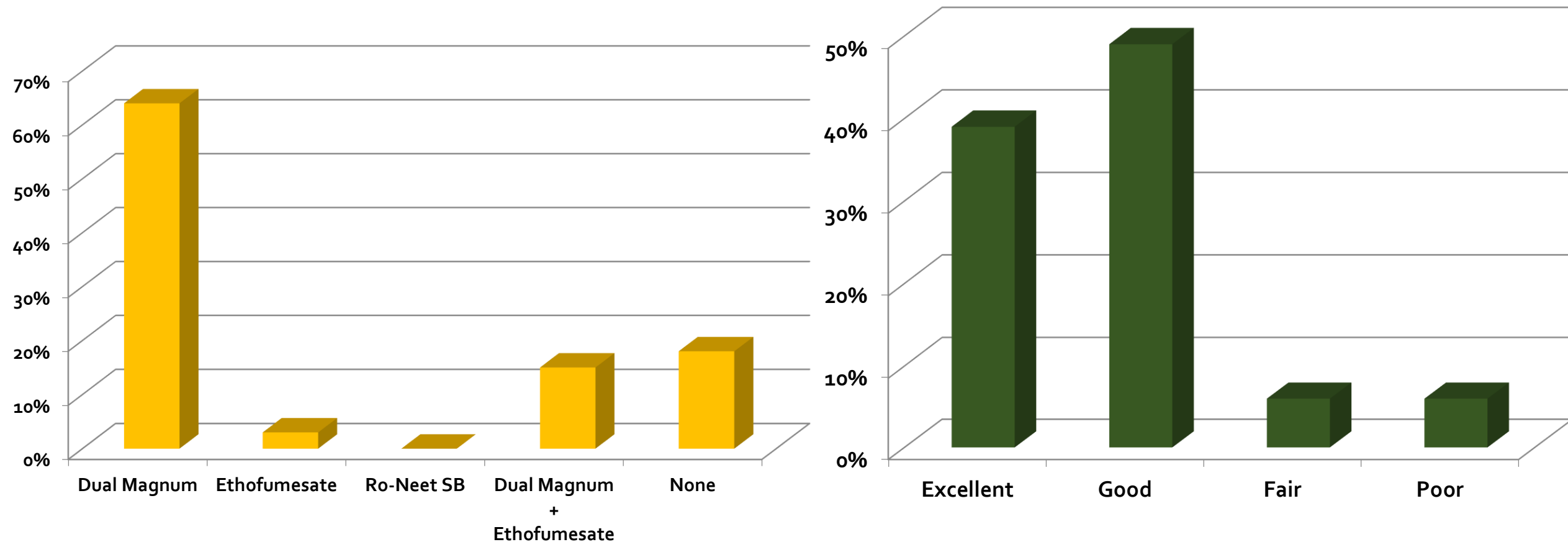


Waterhemp





Which soil-applied herbicide (PPI or PRE) did you use and how effective was it, 2017?¹



¹Turning Point Survey of Growers; conducted at the 2018 Sugarbeet Growers Seminar, Wahpeton



Waterhemp emerged, image, May 22

PRE/POST vs. POST

Advantages

- Product layer buffers against delayed POST; activation of POST
- Our most efficacious program
- Reduces the likelihood of waterhemp POST escapes

Disadvantages

- Takes time and manpower; grower needs to plant and spray
- There is injury under certain environments
- Concerns with nurse crop

Precipitation during three applications timings, Mooreton, ND and Campbell, MN, 2014 to 2018

Treatment ¹	2014	2015	2016	2017	2018	Average
Mooreton, ND	-----precipitation (inches)----- -----					
PRE	0.12	0.35	0.94	1.63	0.02	0.61
EPOST	1.15	3.4	0.11	1.19	0	1.17
LPOST	0.86	2.10	0.54	0.05	1.49	1.01
Campbell, MN						
PRE	-	-	1.00	1.95	0.03	0.99
EPOST	-	-	0.27	0.93	0.02	0.41
LPOST	-	2.20	0.88	0	1.62	1.13

¹PRE, April 10 to April 20; EPOST, May 10 to May 20; LPOST, May 27 to June 6

How do I decide between ethofumesate or Dual Magnum PRE?

Ethofumesate (Nortron, Ethotron, Ethofumesate 4SC

- Needs 0.75 in precipitation to activate
- History of safe use on sugarbeet PRE and POST
- \$25 per acre

Dual Magnum

- Needs 0.5 inch precipitation to active
- Apply at 0.5 pt/A; safety greatest OM>3% or medium and fine texture
- Indemnified label
- \$7.50/acre

Waterhemp (count per meter square) or as a percent of control , June 6, 2017, Lake Lillian, MN

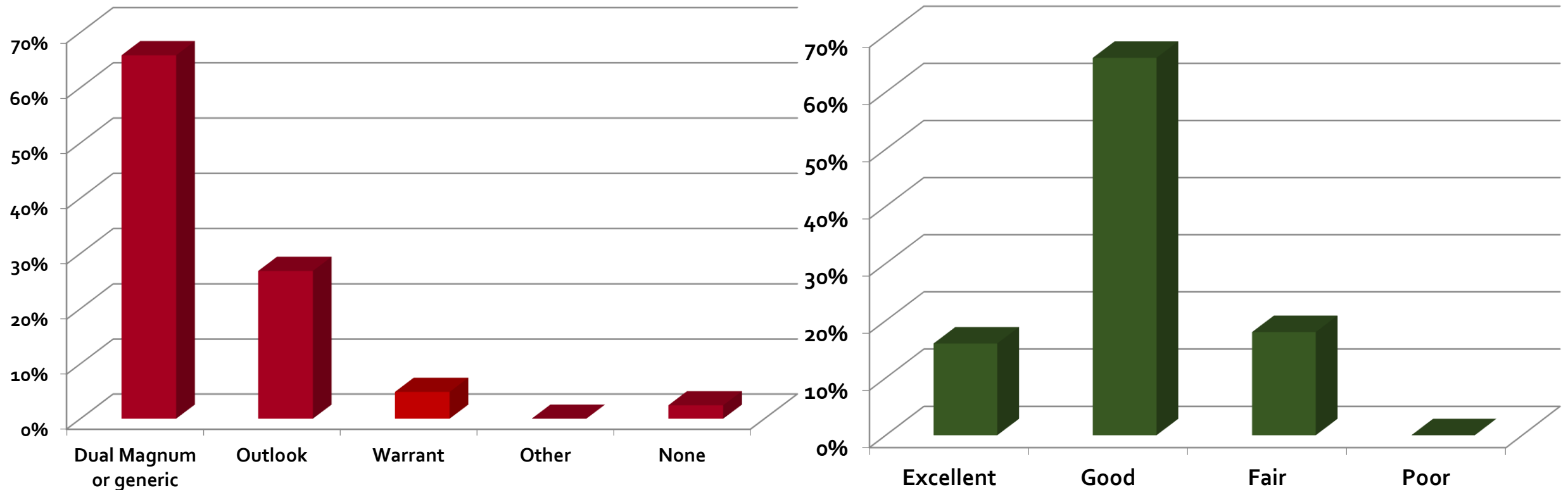
Herbicide	Rate	Application	Count	Visual Control
	fl oz/A		Num/m ²	%
Dual Magnum	8	PRE	25b	97
PowerMax	28	EPOST	192c	74
Control			727a	

Herbicide	Rate	Application	Count	Visual Control
	pt/A		Num/m ²	%
Ethofumesate	2	PRE	53bc	93
Ethofumesate	3	PRE	20cd	97
Ethofumesate	4	PRE	07d	99
PowerMax	1.75	EPOST	116b	85
Control			792a	

Etho in a weed management system for waterhemp control



Which soil-applied herbicide (lay-by) did you use and how effective was it, 2017?¹



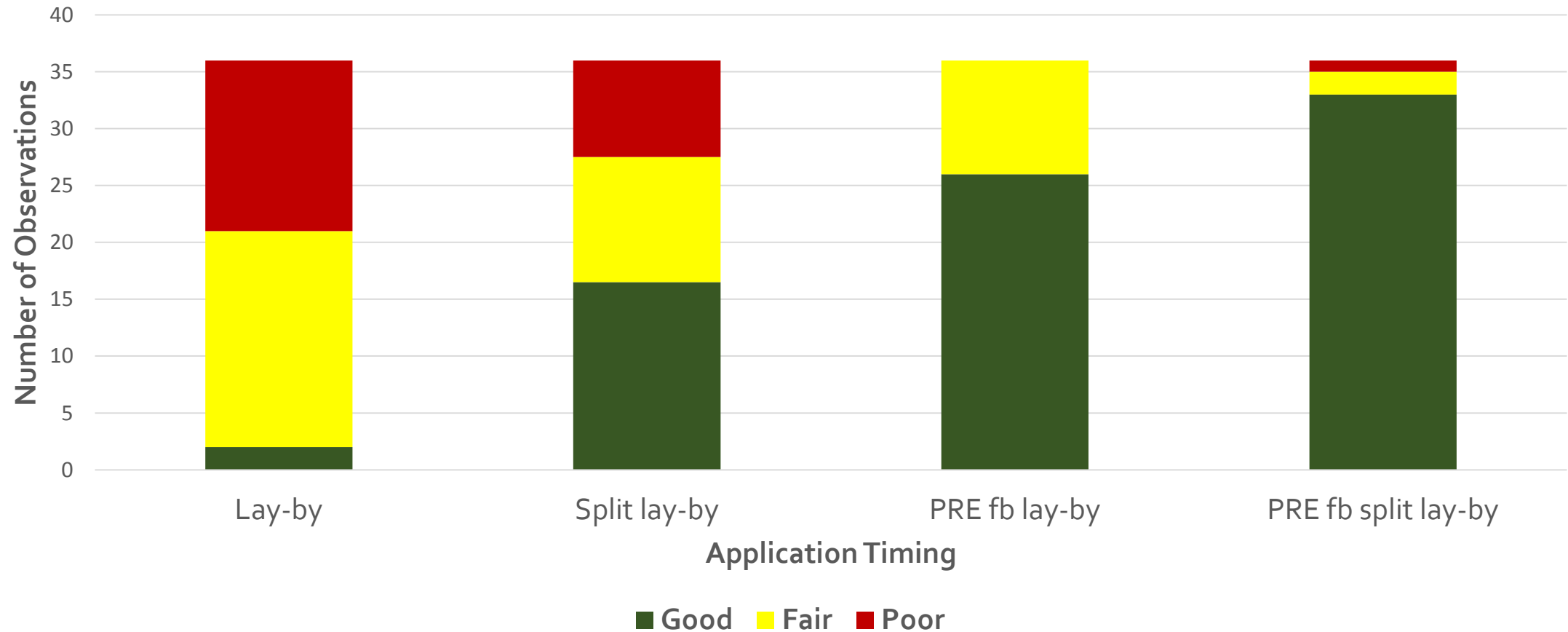
¹Turning Point Survey of Growers; conducted at the 2018 Sugarbeet Growers Seminar, Wahpeton

How do you decide what product to use?

Risk management

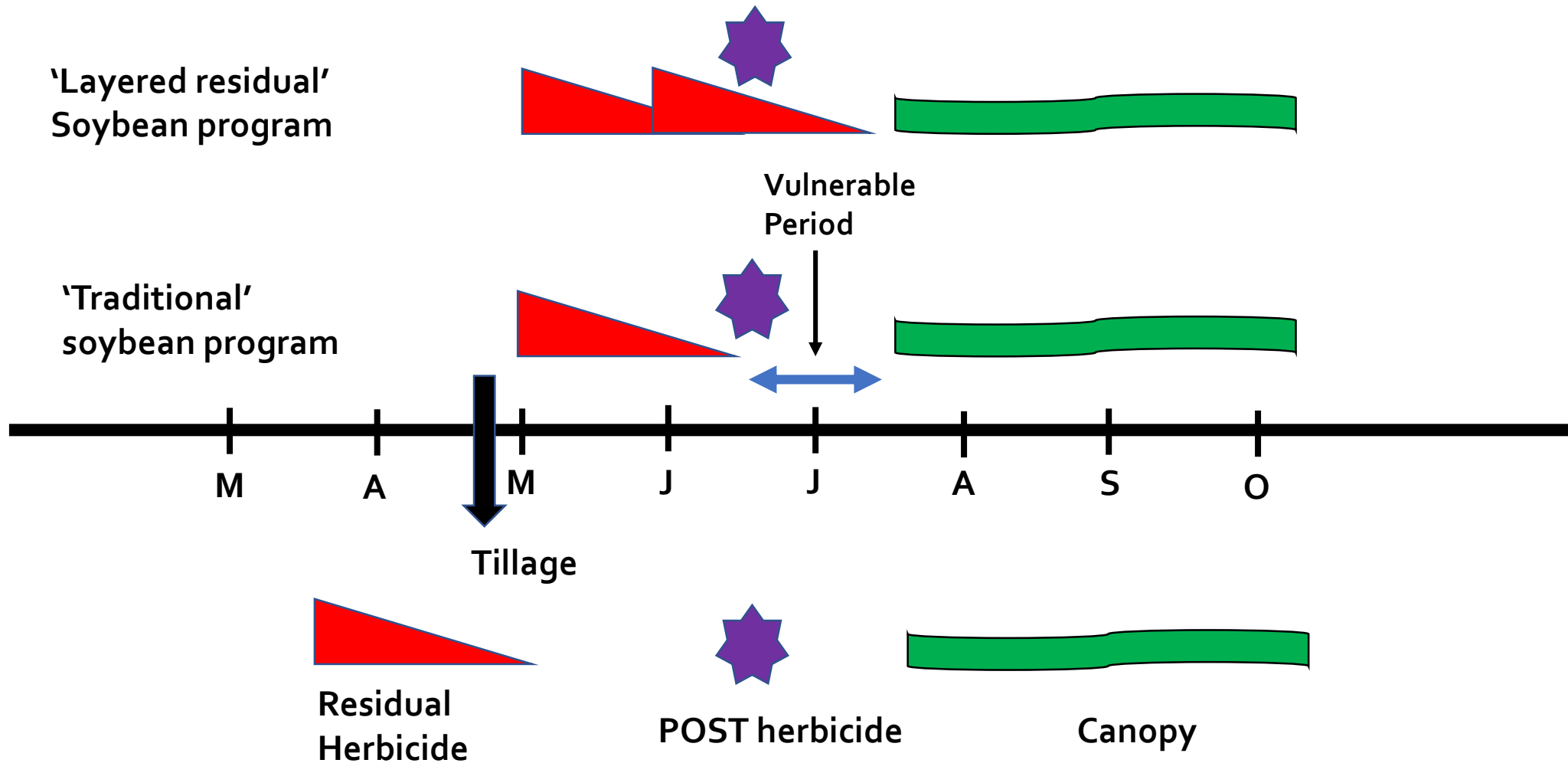
- Replanting, select Dual Magnum
- Activation early, select Outlook
- Sugarbeet safety, Dual Magnum or Warrant
- Length of control, Warrant
- Spectrum, Warrant
- Relationship with industry, ?

Number of good, fair, and poor estimates of waterhemp control across herbicides and application timing, summed across evaluations, locations, and years



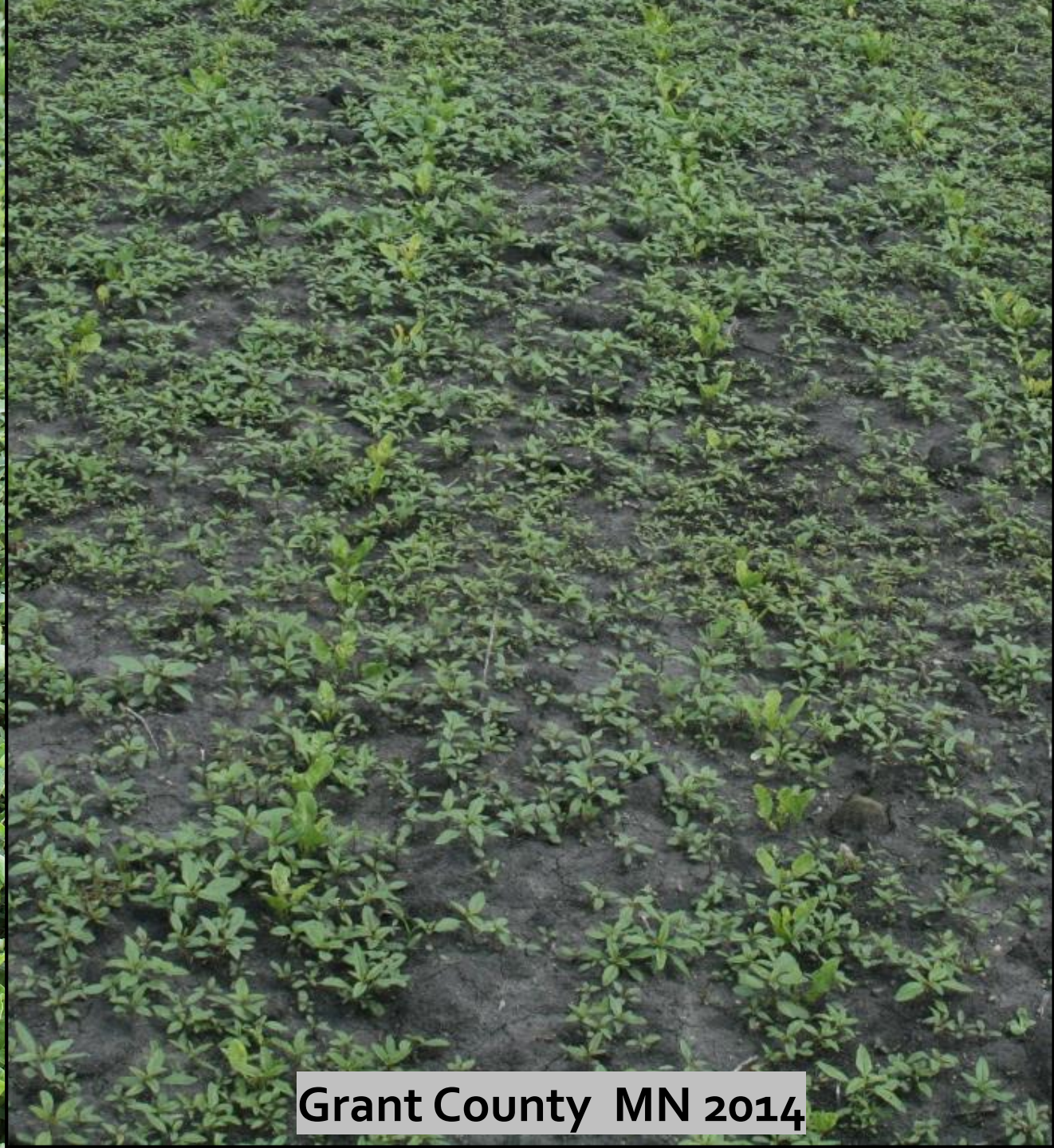
Layered Residual Herbicides

Objective: Prolong PRE activity until canopy fills





Redwood County MN 2018



Grant County MN 2014

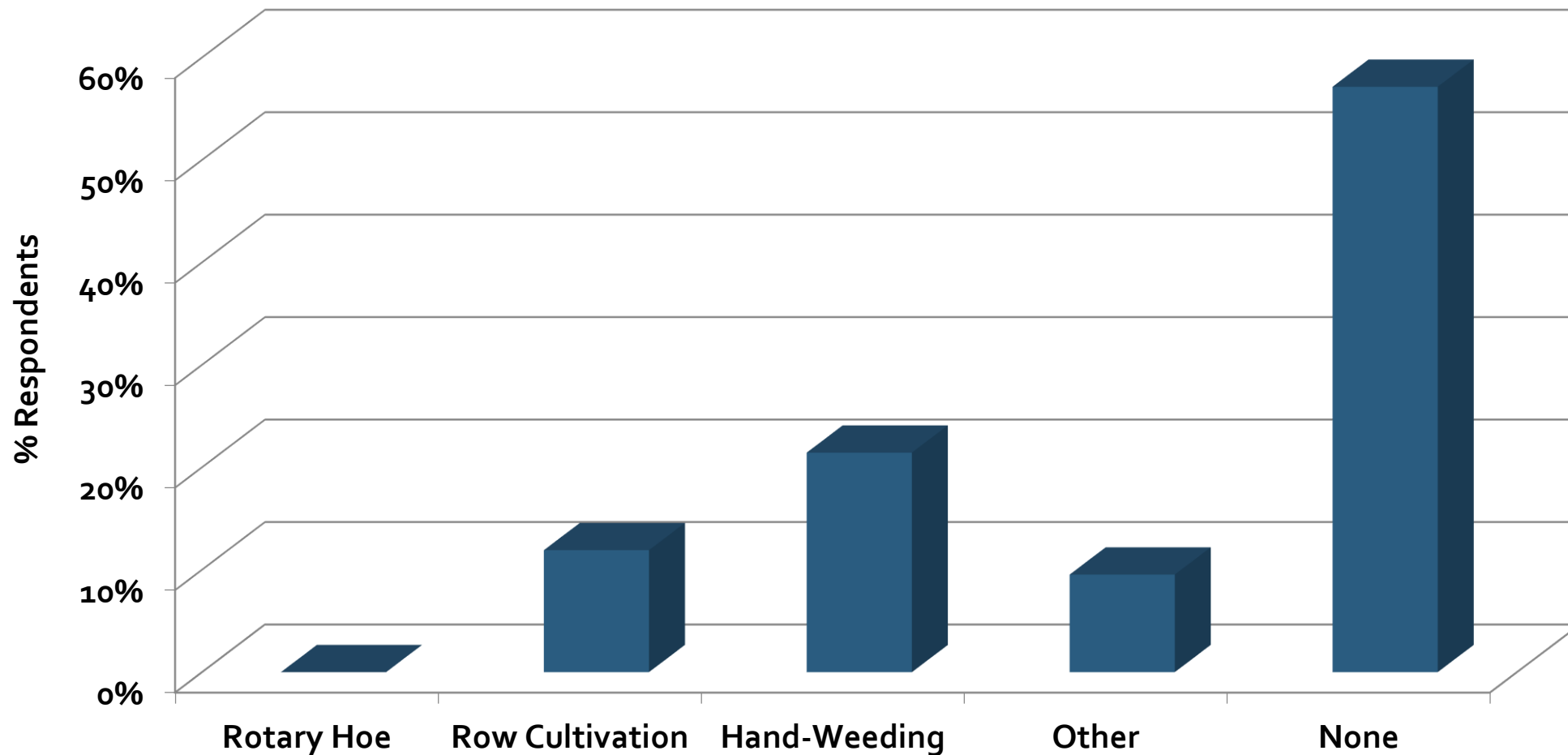
Sugarbeet injury and waterhemp control from glyphosate or glyphosate mixtures, 4-, 6- to 8- and 10- to 12-sugarbeet leaf stage, across environments, 2014 and 2015^a.

Treatment ^b	Rate	Sugarbeet 9-16 DAT	Waterhemp mid-season	Waterhemp pre-harvest
	oz or fl oz/A	%	%	%
PowerMax/PMax/PMax	28/28/22	1	63 d ^e	48 e
PowerMax+etho/PMax+etho/ PMax+etho/	28+4/28+4/ 22+4	2	76 c	67 cd
PowerMax+UpBeet/PMax+UpB/ PMax+UpBeet	28+0.75/28+0.75/ 22+0.75	3	84 abc	73 abc
PMax+Betamix/PMax+Betamix/ PMax+Betamix	28+12/28+16/ 28+24	5	81 abc	67 cd
PMax+Stinger/PMax+Stinger/ PMax+Stinger	28+2/28+2/ 22+2	5	66 d	59 d
p-value (0.05)		0.0877	<.0001	<.0001

^aHerman MN 2014, Herman MN 2015, and Moorhead MN 2015

^bPowerMax with Prefer 90 non-ionic surfactant at 0.25% v/v plus N-Pak ammonium sulfate at 2.5% v/v. PowerMax tank-mixes with Destiny HC at 1.5 pt/A plus N-Pak ammonium sulfate at 2.5% v/v.

What other POST weed control methods did you use in 2017?¹



¹Turning Point Survey of Growers; conducted at the 2018 Sugarbeet Growers Seminar, Wahpeton

Summary of Cultivation Research in Sugarbeet

Nathan Haugrud and Tom Peters, NDSU

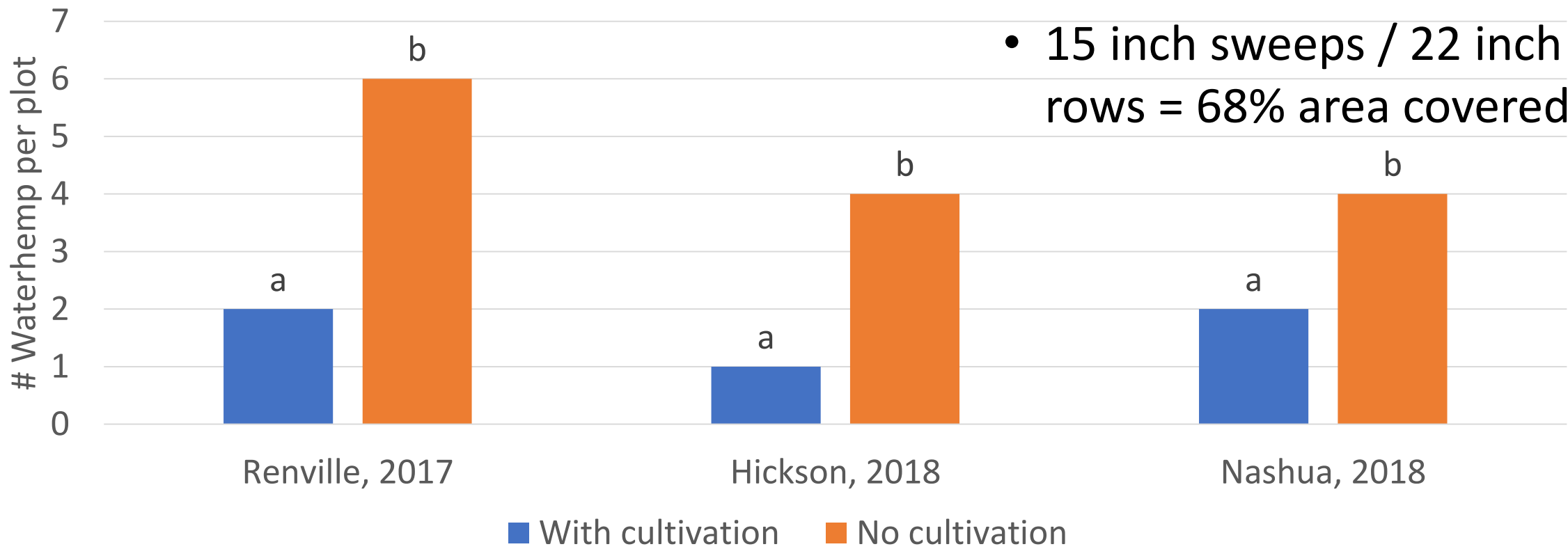


Technical questions

- Cultivation to remove herbicide-resistant weeds?
 - Effects on weed emergence?
- Interactions with residual herbicide?
 - Incorporation and activation
 - Damage to an established herbicide barrier?
- Negative effects on sugarbeet yield and quality?

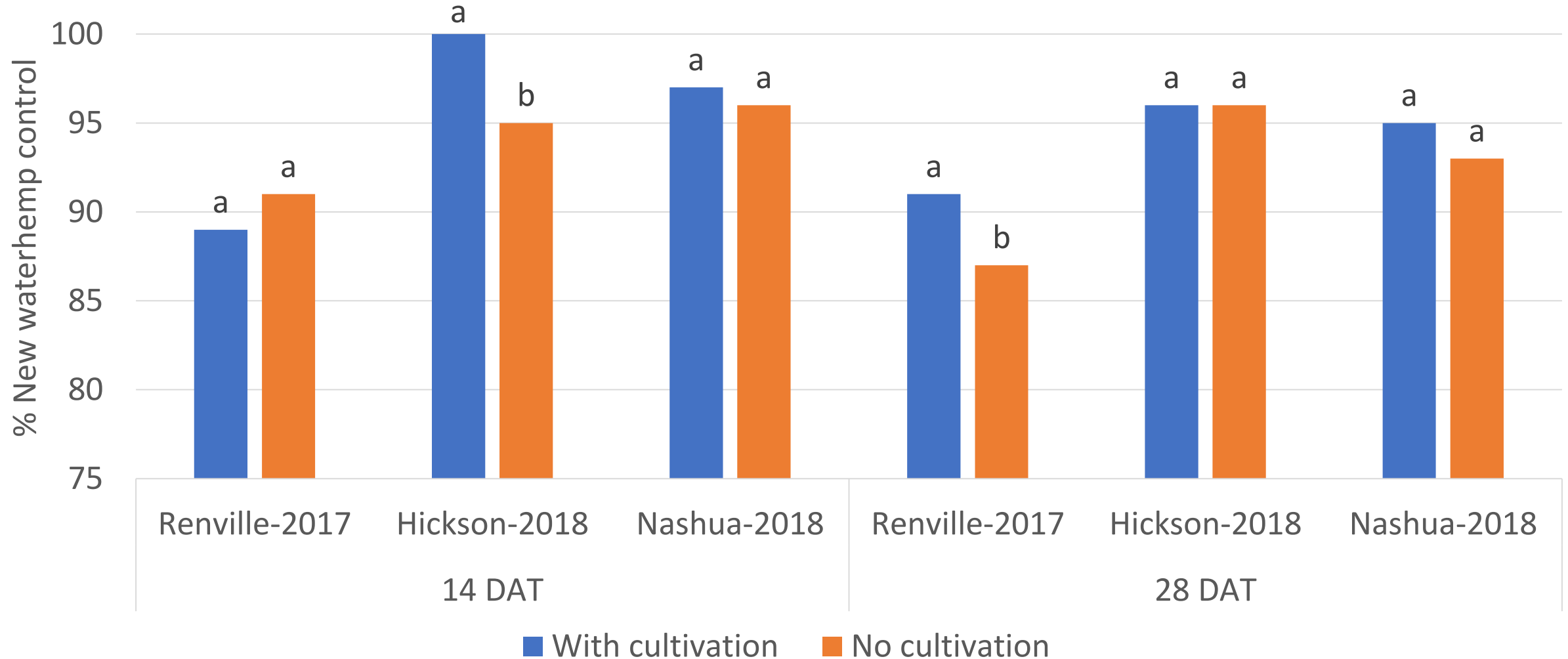


Cultivation immediately after herbicide resulted in 50-75% less waterhemp, 14 DAT

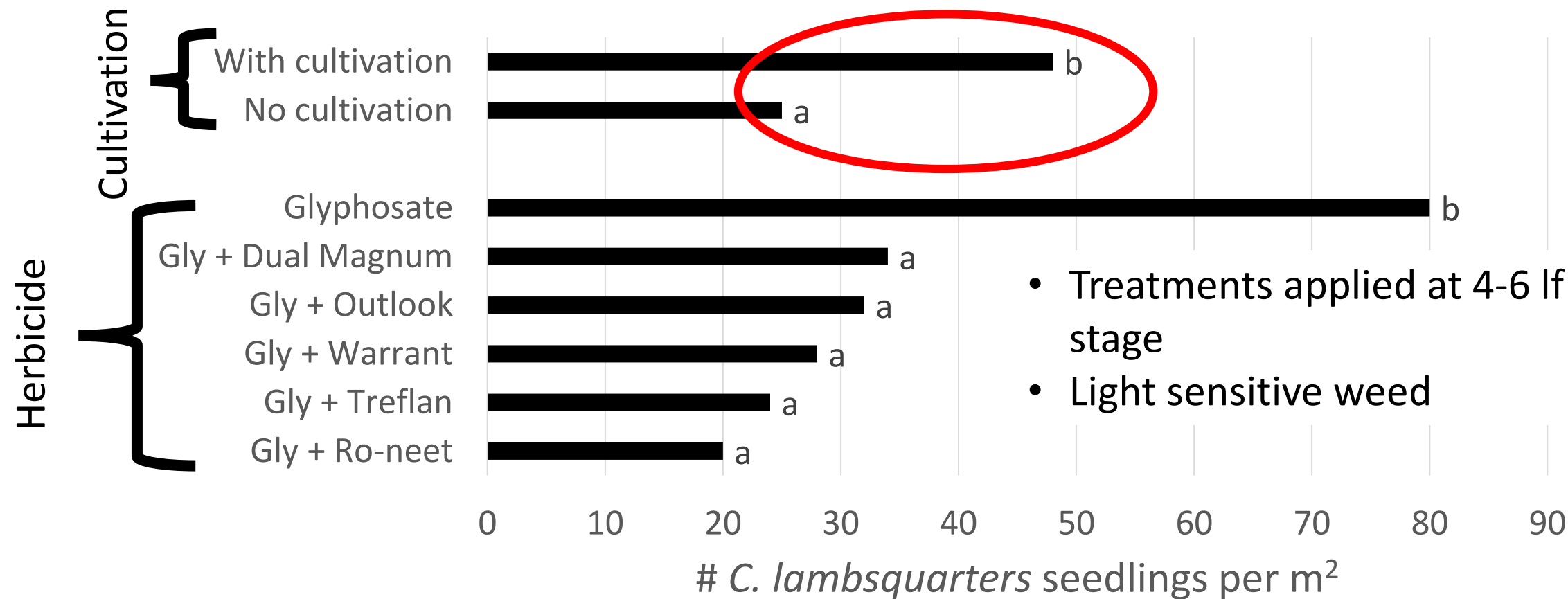


	Cultivation			Herbicide	C X H Interaction
ANOVA	Renville, 2017	Hickson, 2018	Nashua, 2018	All environments	
P-value	0.009	0.002	0.019	NS	NS

Early cultivation generally had no effect on new waterhemp emergence control



Early cultivation increased common lambsquarters emergence, Galchutt-2018, 28 DAT



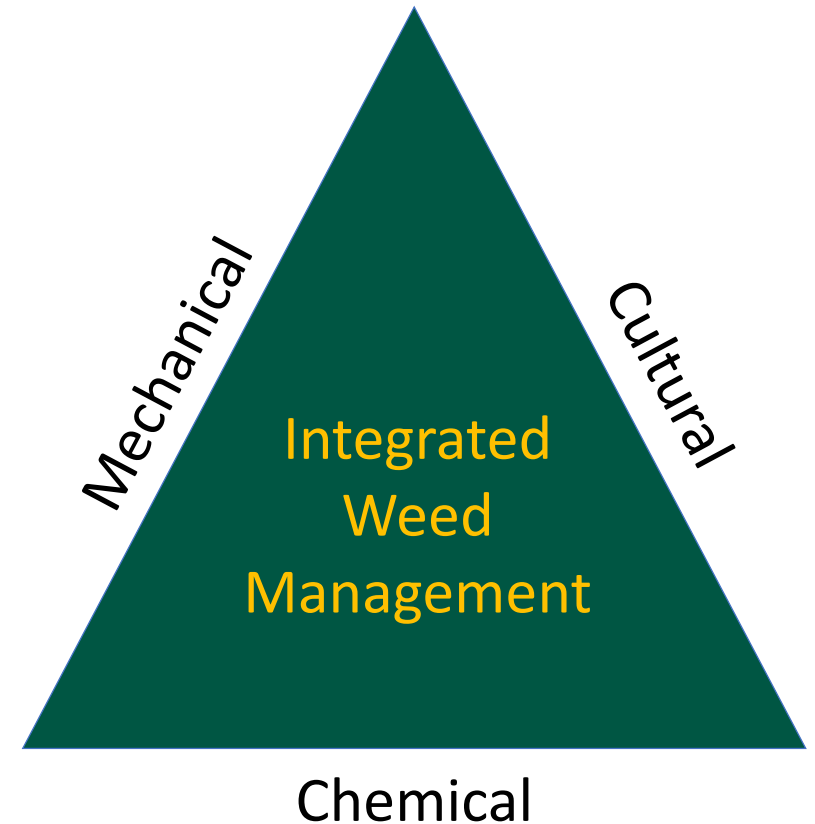
ANOVA	Cultivation	Herbicide	C X H Interaction
P-value	0.018	< 0.001	NS

Cultivation timing had no effect on sugarbeet yield across all environments in 2018

Cultivation timing	Yield Components		
	Root yield	Sucrose content	RSA
	Tons/acre	%	Lbs/acre
Control	24.3	15.0	6,817
June 21	24.1	14.8	6,773
July 5	24.7	14.9	6,934
July 19	23.5	14.9	6,563
August 2	25.4	14.7	6,899
August 16	24.4	14.5	6,529
June 21 + July 19	24.3	14.5	6,679
July 5 + Aug 2	24.7	14.6	6,698
July 19 + Aug 16	23.5	14.8	6,472
June 21 + July 19 + Aug 16	23.5	14.8	6,540
ANOVA	-----p value-----		
Treatment	0.944	0.062	0.947

The Future of Cultivation: 2019 and Beyond

- Valuable tool to removal weeds that herbicide did not/will not control
- Timing is key: cultivate near crop canopy closure
 - No effects on weed emergence if shade is present
- No effect on yield in 2018, but repeats in future years are needed



These steps are general for all sprayers, but...

- Know your sprayer
 - Where can residues hide? Where are my valves? Screens? Hoses?
 - Consult your operators manual
- Develop a checklist
- Know the physical properties of the chemical you're applying
 - Dry vs. EC vs. solution
 - Jar mix to test incompatibility

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



Cleanout process focuses on three objectives:

- Remove as much of the remnant mixture as possible
- Dilute the remainder as much as possible and use it to clean the boom plumbing.
- Ensure anything that came in contact with spray mix has been cleaned.

Ammonia, bleach, detergents and tank-cleaners

- Ammonia - increases the pH of the solution which increases the herbicide solubility, ex. SU and weak acid herbicides
 - is effective at penetrating and loosening deposits and residues
 - 1 gallon ammonia in 100G water
- Bleach - lowers the pH of the solution which speeds the degradation of some herbicides.
- Detergents – cleaners, designed to remove oil-soluble herbicides
- Commercial tank cleaners – usually contain ammonia and a detergent
 - Commercial tank cleaners usually perform better than household detergents







Palmer amaranth (left) and waterhemp (right) 35 days after planting



Current Status in Minnesota

• STATEWIDE SUMMARY

- 18 landowners in Six Counties With Confirmed Palmer plants since 2016

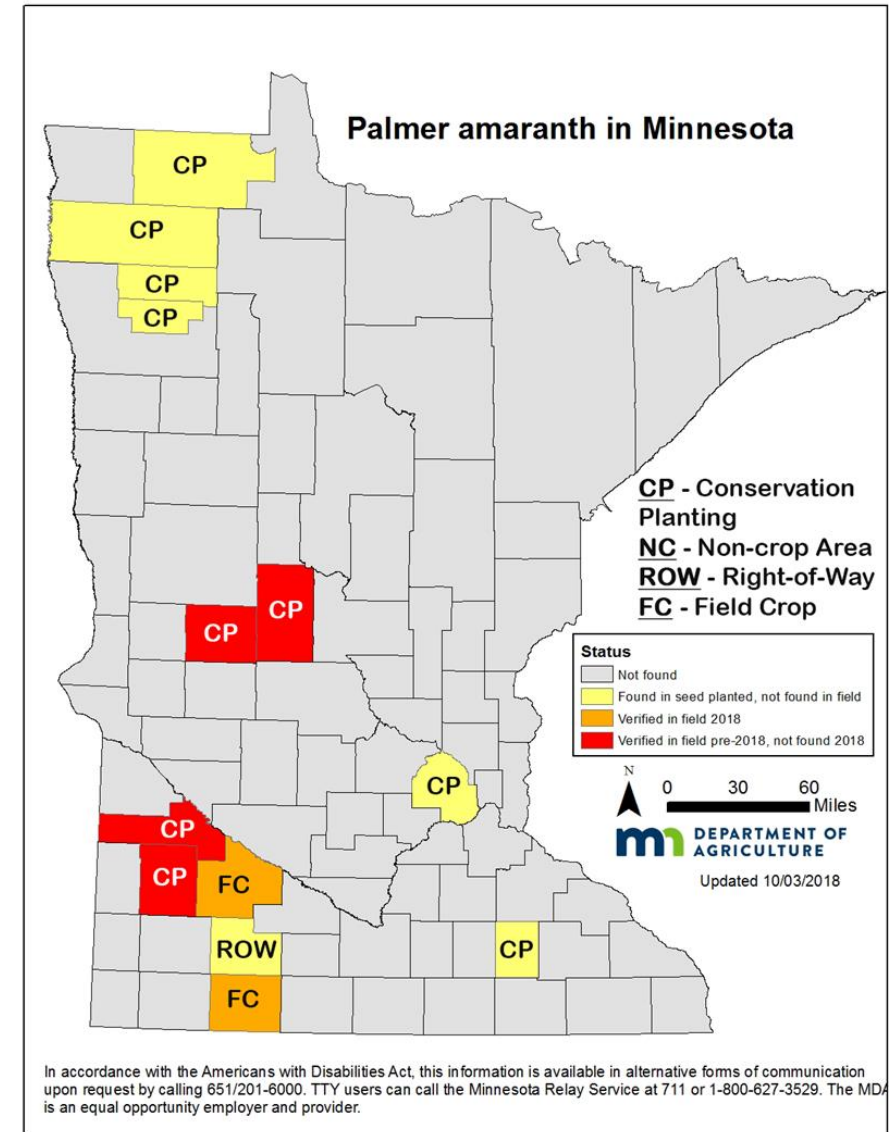
- 42 CRP plantings in 4 Counties (2016 – 2017)
 - NO PALMER discovered in Lyon, Yellow Medicine, Todd or Douglas counties in Fall 2018 on these plantings
- 2 Soybean fields - 1 Jackson & 1 Redwood County – Fall 2018
 - Plants hand-pulled and destroyed; no seed produced
 - No other Palmer plants found within a 5-mile radius MDA field survey

* 2017 – Summer – seed lot tested positive for Palmer

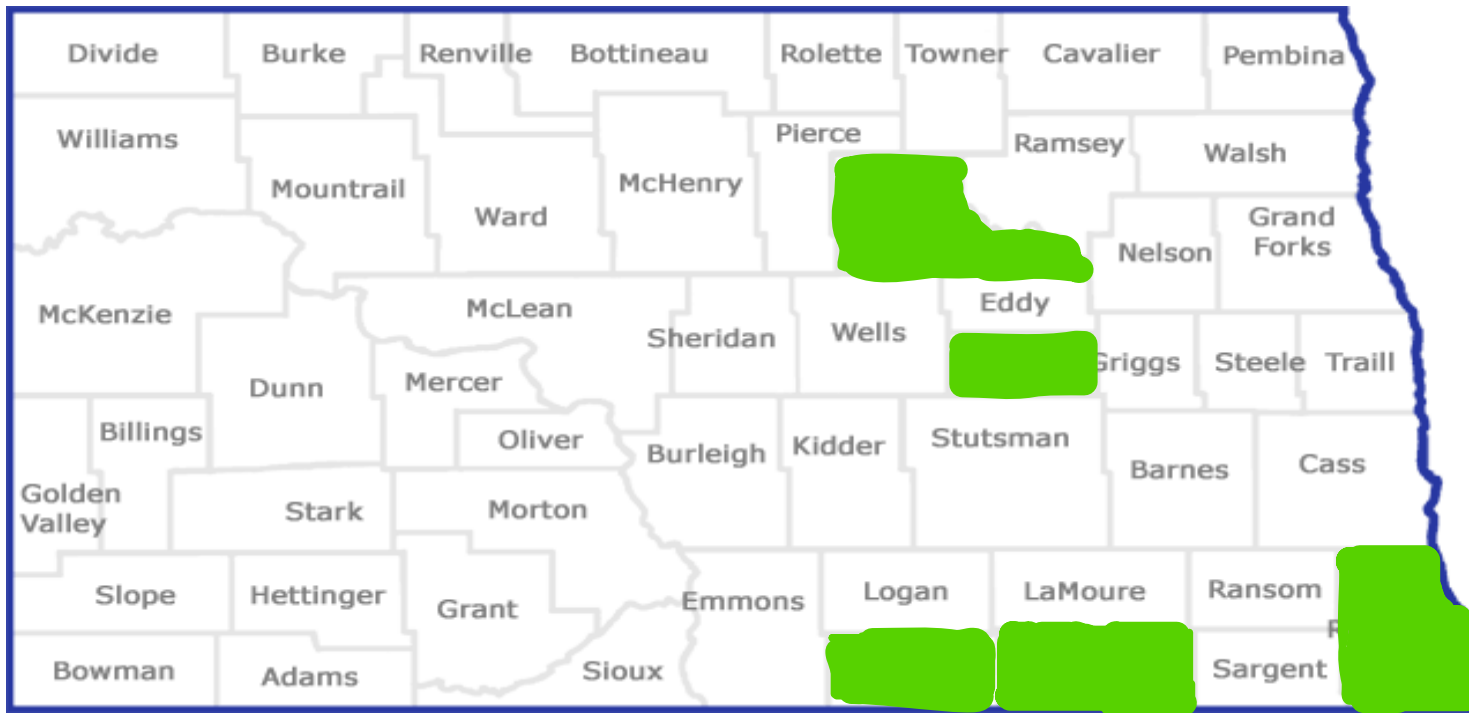
- Sold to MNDOT for seeding a ROW in SW MN
- **MDA Found No Palmer On This Site In 2017 or 2018**

** 2018 – Spring - seed lot tested positive for Palmer

- Sold to 8 Landowners, planted at 14 locations in 4 counties potentially impacting 1,400 acres
- **MDA Found No Palmer On These Acres In 2018**



Palmer amaranth was confirmed in five North Dakota Counties in August and September



County	Possible source
McIntosh	Migratory birds
Dickey	Purchase of used combine out-of-state
Foster	Custom combining
Benson	Railroad car cleanout
Richland	Alternative sources for cattle feed

Palmer Amaranth control in greenhouse, 2017

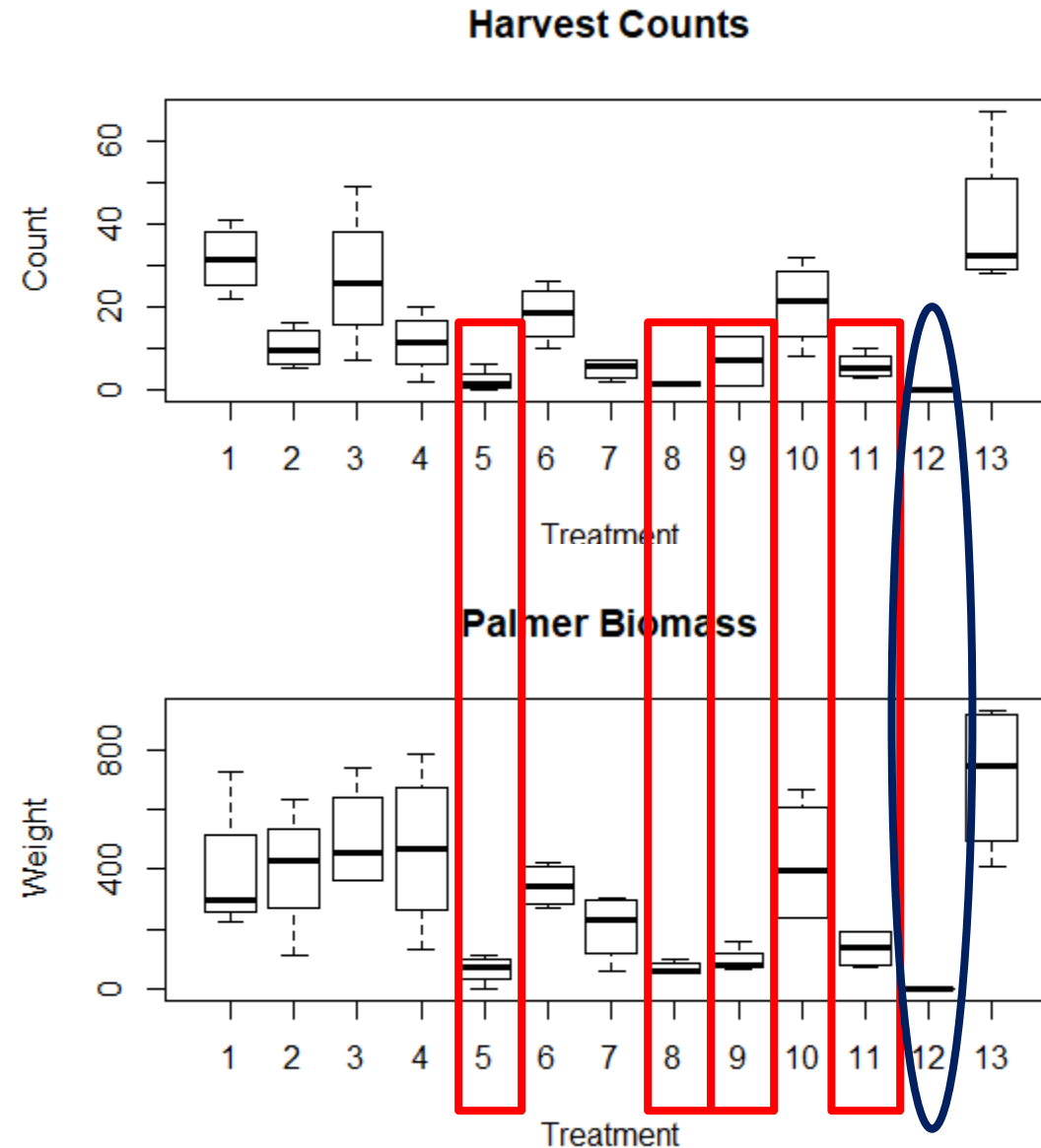
Herbicide treatment	Height (inch)	Control 5 DAT	Control 24 DAT
		------(%)-----	
Betamix+ethofumesate+UpBeet (3 pt + 12 fl oz + 1 oz)	2	99 a	99 a
Betamix+ethofumesate+UpBeet (3 pt + 12 fl oz + 1 oz)	4	56 b	57 b
Betamix+ethofumesate+UpBeet (3 pt + 12 fl oz + 1 oz)	8	34 c	24 c

Herbicide treatment	Height (inch)	Control 20 DAT	Control 28 DAT
		------(%)-----	
Betamix+ethofumesate+UpBeet (3 pt + 12 fl oz + 1 oz)	2	70 a	23
Betamix+ethofumesate+UpBeet (3 pt + 12 fl oz + 1 oz)	4	43 b	17
Betamix+ethofumesate+UpBeet (3 pt + 12 fl oz + 1 oz)	8	38 b	13



Palmer amaranth number and weight m⁻², Scottsbluff NE in 2018

Num	Treatment
1	Etho/PM/PM, PRE/2/6 TL
2	+ Warrant, 2TL
3	+ Etho, 2TL
4	+ Warr+etho, 2TL
5	+ Warrant, 6TL
6	+ Etho, 6TL
7	+ Warr+Etho, 6TL
8	+ Warr/Warr, 2/6 TL
9	+ Etho/Warr, 2/6 TL
10	+ Etho, 2 TL
11	+ Warr+Etho/Warr+ Etho
12	Weed Free Check
13	Weedy Check



Waterhemp control and sugarbeet tolerance, Moorhead and Lake Lillian MN and Amenia ND, 2018

Trt	Treatment	Rate (pt or fl oz/A)	Sugarbeet stage (Num leaves)	AMATA Mrhd Jun 27	AMATA L Lilli Jul 22	Visible Gro Red Amenia	Recov sugar Amenia
				%	%	%	lb/A
1	Etho/PM + Etho/ PM + Etho	3p / 28 + 4 / 28 + 4	PRE / 2-4 / 6-8	88 a	89 a	2 a	11,015
5	Etho / PM + Etho / Warrant + PM + Etho	3p / 28 + 4 / 3p + 28 + 4 /	PRE / 2-4 / 6-8	96 a	98 a	7 a	11,037
8	Etho / Warrant + PM + Etho / Warrant + PM + Etho	3p / 3p + 28 + 4 / 3p + 28 + 4	PRE / 2-4 / 6-8	100 a	100 a	26 b	10,845
9	Etho / Etho + PM / Warrant + PM + Etho	3p / 3p + 28 / 3p + 28 + 4	PRE / 2-4 / 6-8	93 a	95 a	30 bc	11,851
11	Etho / Etho + Warrant + PM / Etho + Warrant + PM	3p / 2p + 1.5p + 28 / 2p + 1.5p + 28	PRE / 2-4 / 6-8	94 a	100 a	35 c	10,497

- Treatments provided greater than 90% waterhemp control at Moorhead and Lake Lillian in 2018
- Growth reduction was observed with repeat applications of Warrant or Warrant + Ethofumesate
- No differences in root yield, sucrose content or recoverable sucrose per acre at Amenia, ND

Online Resources

DEPARTMENT OF AGRICULTURE

Noxious and Invasive Weed Program

Leafy spurge infests this pasture and reduces forage for cattle.

Noxious Weed Law | Noxious Weed List | County Ag Inspectors | Advisory Committee

The Noxious and Invasive Weed Team works with local governments and landowners to protect the environment, public health, public roads, crops, livestock, or other property in Minnesota from the injurious impacts of noxious and invasive weeds. The Noxious Weed Advisory Committee represents a wide range of agencies and organizations. This committee advises the Commissioner of Agriculture about plant species regulation, weed management and implementation of Minnesota's Noxious Weed Law. Enforcement of the Noxious Weed Law is a shared responsibility with local governments.

Weed of the Month Series

Leafy spurge is one of the weeds featured in this series.

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www.mda.state.mn.us/weedcontrol

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Weed management

Herbicides
Herbicide information, calculating herbicide rates and calibrating sprayers

Resistance management
Strategies for diversifying weed control to manage herbicide resistance

Weed identification
Photos and descriptions of weeds and weed seedlings common in Minnesota crop production

Research reports
Weed control research conducted by University of Minnesota scientists and found on the [Applied weed science research](#) website.

Applied weed science research
University of Minnesota website

Herbicide management videos
Diversify weed control to fight herbicide resistance

Minnesota Crop News

12/2 Aghd-resistant soybean varieties available for Minnesota

11/20 2016 University of Minnesota's field crop trial results available now

11/20 Nov. 17, 2016 South Central Hay Auction Summary

11/22 Farmers - Get Nitrogen Smart!

11/21 Corn grain trial results and criteria to advance hybrid selection

[More Minnesota Crop News](#)

Upcoming events

Today Wednesday, December 7

Wednesday, December 7
CPM Short Course and MCPR Trade E

Thursday, December 8
CPM Short Course and MCPR Trade E

Rice County Soil Health

Monday, December 12
1:00pm Nitrogen SmartSlayton

Tuesday, December 13
Conservation Tillage Conference

Events shown in time zone: Central Time

<http://z.umn.edu/palmerID>

NDSU EXTENSION EXTENDING KNOWLEDGE >> CHANGING LIVES

How to Identify Palmer Amaranth

Palmer amaranth	Waterhemp	Redroot pigweed
No hair	No hair	Very short, dense hairs
Petioles longer than leaf	Petioles shorter than leaf	Petioles shorter than leaf
Separate male and female plants	Separate male and female plants	Male and female parts on same plant
Spiny bracts on female plants	No spiny bracts	No spiny bracts
Female head prickly, male head soft	Female and male head soft	Heads are soft
Leaves diamond or oval-shaped	Leaves long, narrow, shiny	Leaves round to oval-shaped

Palmer amaranth plants. (B. Jenks, NDSU)

Female Palmer amaranth with spiny bracts (B. Jenks, NDSU)

Palmer amaranth (right), waterhemp (left). (G. Endres, NDSU)

Palmer amaranth petioles are longer than the leaf blade (B. Jenks, NDSU)

Waterhemp has long, narrow leaves. (T. Peters, NDSU)

For the latest information, visit www.ag.ndsu.edu/palmeramaranth

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Thank you for your Support

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