

Weed Control in Sugarbeet

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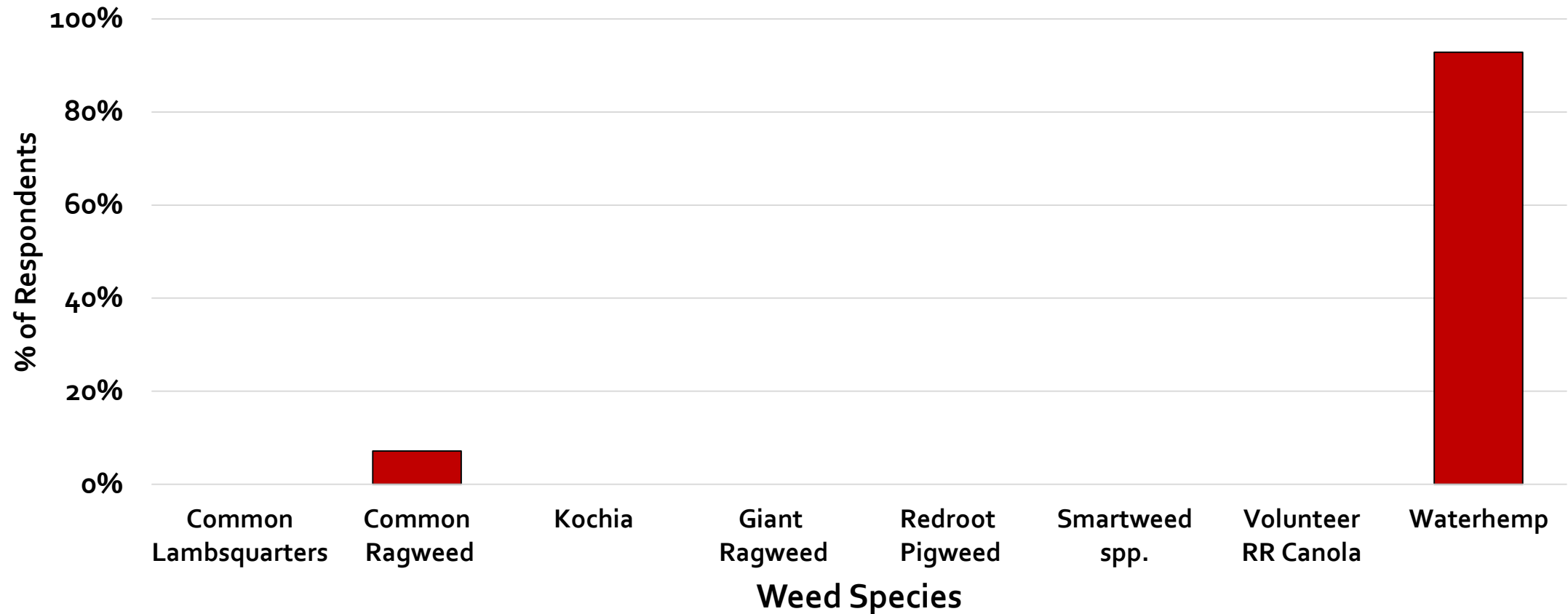


and habitat to



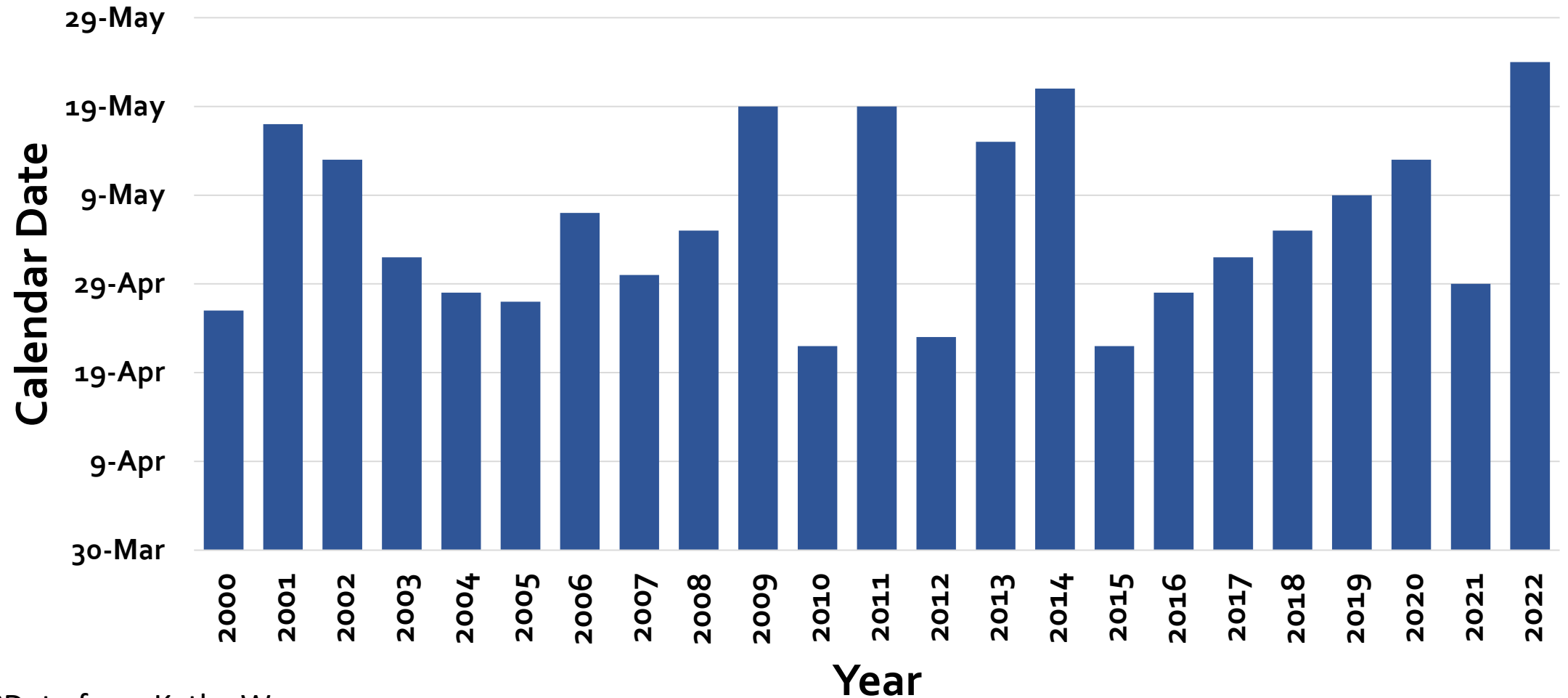
A 155-year-old waterhemp herbarium specimen from the Missouri Botanical Garden Herbarium. Credit: Julia Kreiner, University of British Columbia

Most troublesome weed control challenge, 2021.^a



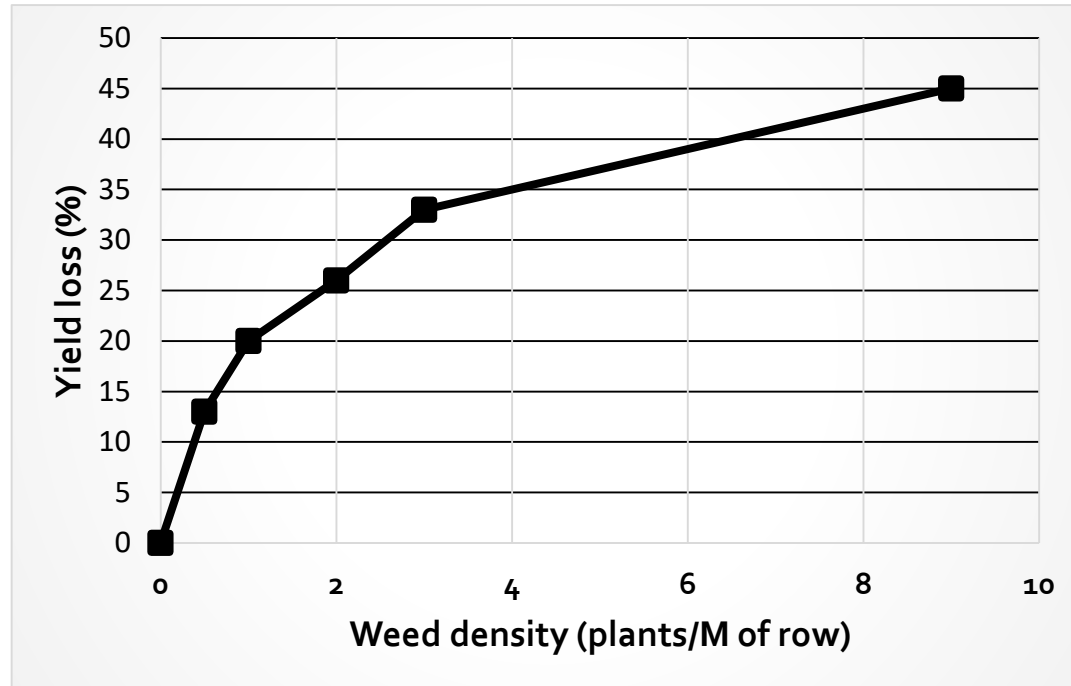
^a2022 Fargo Growers Seminar, February 3, 2022

Average sugarbeet plant date, American Crystal Sugar Coop, 2000 to 2022.^a



^aData from Kathy Wang

Redroot pigweed reduced sugarbeet root yield, Evans and Dexter, 1978.

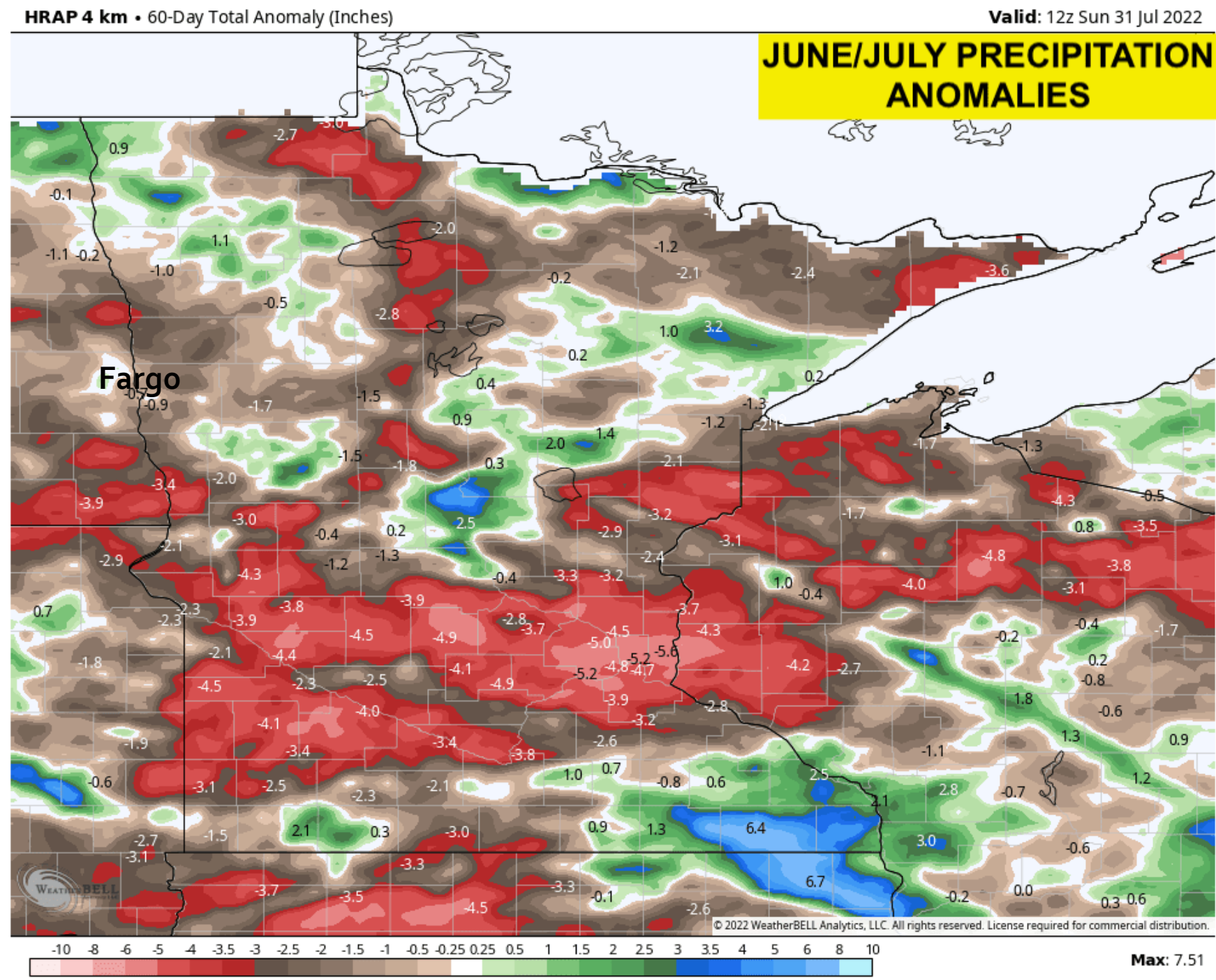


Planting date, environment and weed emergence in sugarbeet (Evans and Dexter, 1978)

	Extractable sucrose per acre		
Weed	Glyndon	Fargo	Crookston
	-----% loss-----		
3 pigweed plants / M row	44	6	1
Plant	May 10	May 4	April 28
Sugarbeet emergence	May 23	May 16	May 11
Pigweed emergence	May 18	May 19	May 18

- Root yield loss even when redroot pigweed were spaced 6.7 feet
- Planting date influences weed interference

Bring Me the News
Meteorologist Sven
Sundgaard
<https://bringmethenews.com/minnesota-weather/july-2022-in-minnesota-was-hotter-windier-and-drier-than-normal>



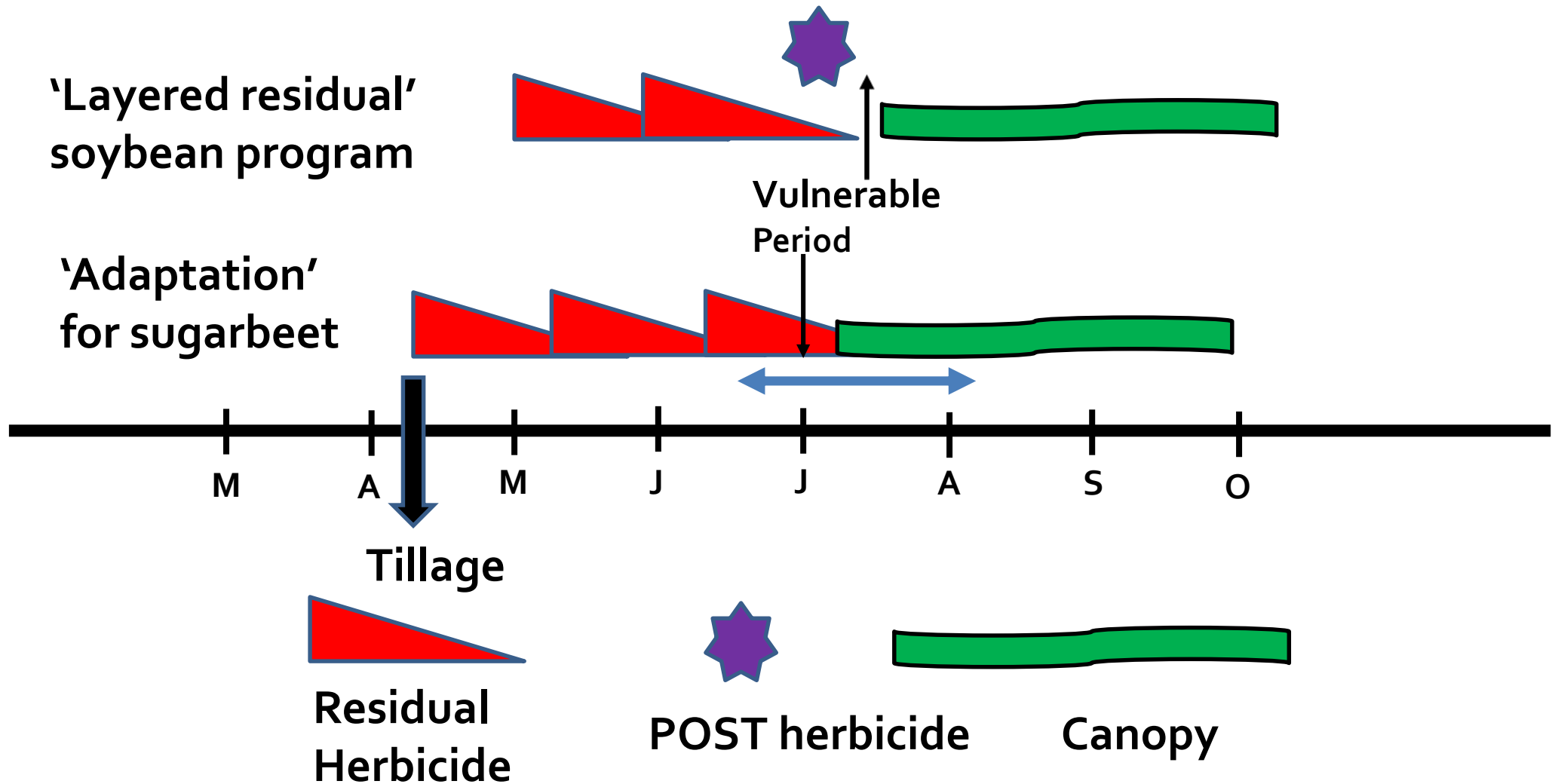


Waterhemp Control Program in Sugarbeet

Planting Date	Recommendation
Sugarbeet plant in April or May	PRE. Dual Magnum at 0.5 to 0.75 pt/A, ethofumesate at 2 to 6 pt/A or Dual Magnum at 0.5 pt/A plus ethofumesate at 2 pt/A
	Split lay-by application (early postemergence / postemergence). Chloroacetamide herbicides applied at 2-lf sugarbeet fb 6- to 8-lf sugarbeet
June	Continue to scout fields for waterhemp. Control escapes with Ultra Blazer (Section 18ee), Liberty with the Redball™ 915 hooded sprayer (24c), or inter-row cultivation
July	Electric Discharge Systems (WeedZapper™)
August / September	Hand remove waterhemp

Layered Residual Herbicides

Objective: Prolong PRE activity until canopy fills



Adapted from a slide created by B Hartzler, ISU

Waterhemp control. All treatments contained ethofumesate at 3 pt/A PRE, Moorhead, 2019.

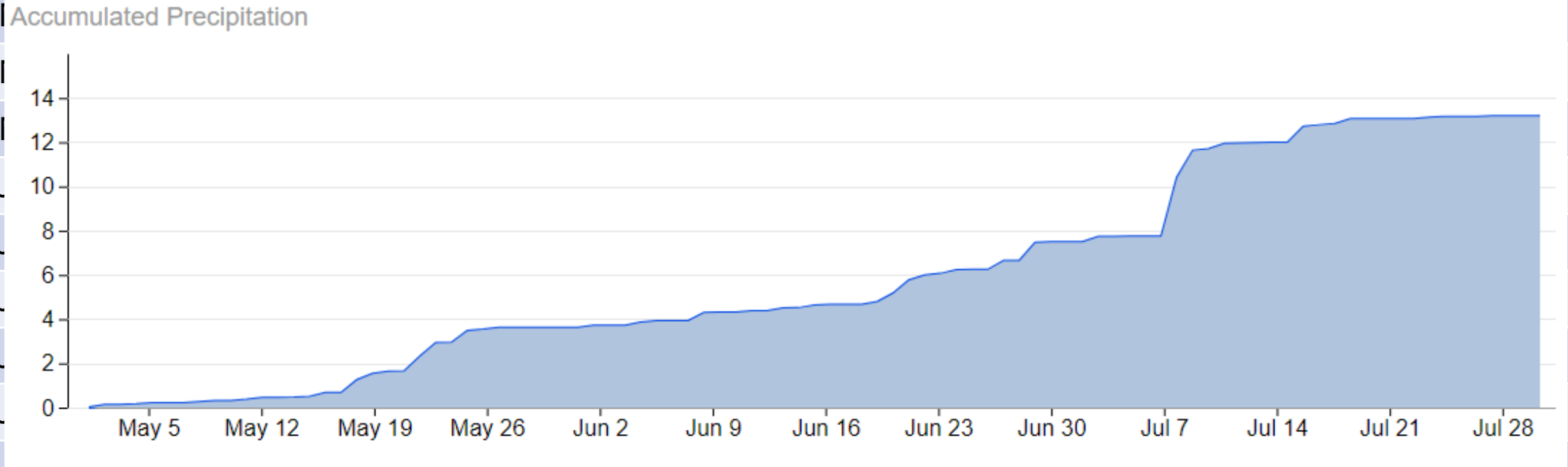
Treatment ^a	Rate	Timing	Jul 12	Aug 3
	fl oz/A		%	%
PM + eth / PM + etho	28 + 4 / 28 + 4	PRE	96 b	79 b
Warrant + PM + etho / PM + etho	48 + 28 + 4 / 28 + 4	PRE / V2	100 a	98 a
PM + etho / Warrant + PM + etho	28 + 4 / 48 + 28 + 4	PRE / V6	96 b	98 a
Warrant + PM + etho / Warrant + PM + etho	48 + 28 + 4 / 48 + 28 + 4	PRE/V2/V6	100 a	98 a
Etho + PM / PM + etho	48 + 28 / 28 + 4	PRE / V2	100 a	98 a
PM + etho / Etho + PM	28 + 4 / 48 + 28	PRE / V6	98 ab	98 a
Etho + PM / Etho + PM	32 + 28 / 32 + 28	PRE/V2/V6	100 a	99 a
LSD (0.05)			3	6

^aTreatments contained Destiny HC and N-Pak Liquid AMS at 1.5 pt / A + 2.5% v/v

Waterhemp control in response to PRE/EPOST/POST treatments, Moorhead MN 2019



Planted May 9, 2019

Date	Rainfall (inch)	Cumulative Totals (Inch)
May 17	0.6	0.6
May 18	0.3	0.9
<div><div>Accumulated Precipitation</div></div> <div></div>		
July 6	2.7	7.9
July 9	1.2	9.1
July 16	0.7	9.7

Comparison of PPI and PRE ethofumesate at 3.75 to 4.0 lb/A, 1973-1986

Nortron application	4 of 7 locations	3 of 7 locations
	Rrpw cntl	Rrpw cntl
	%	%
PPI	97	91
PRE	79	93
LSD (0.05)	11	NS

From Dr. Dexter's presentation for PLSC 350, 2012

Weed control in response to herbicide treatment and incorporation depth, Dexter (1979) Depth of Incorporation, Sgbt. Res. Ext. Repts., 9:81.

Herbicide Treatment	Incorporation depth	Redroot pigweed	Common Lambsquarters	Mean
	inch	%	%	%
Nortron + Ro-Neet	1	83	91	87
Nortron + Ro-Neet	2	100	100	100
Nortron + Ro-Neet	4	100	100	100
Nortron + TCA	1	93	87	90
Nortron + TCA	2	93	89	91
Nortron + TCA	4	83	73	78

Ethofumesate at 6 pt/A PRE, Blomkest, MN,

- Evaluation, 19 DAP, June 15, 2022



Ethofumesate at 6 pt/A PRE, Blomkest MN, 2022

- No POST soil residual herbicides applied in experiment

Trt 12, rep 2, July 15



Trt 12, rep 3, July 25

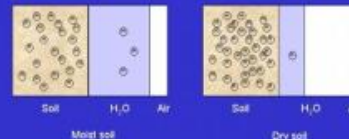


Chloroacteamide herbicides have different chemical properties.

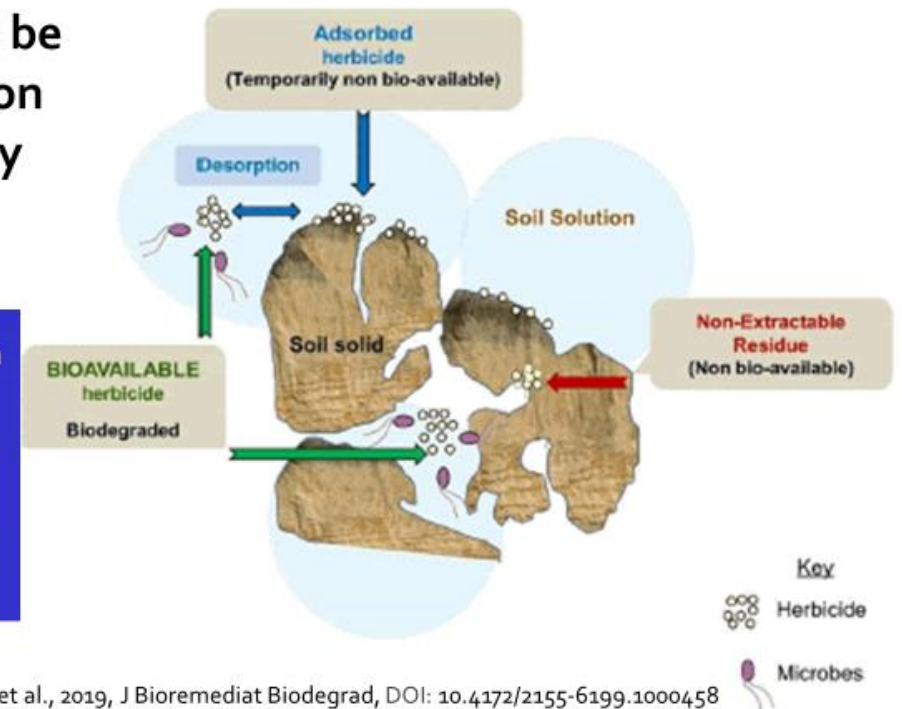
Herbicide	Absorp-tivity	Water Solubility
	^a K _{OC}	ppm ^b
Acetochlor	200	233
Outlook	155	1,174
S-metolachlor	200	488
Ethofumesate	340	110
Treflan	7,000	0.3
Dicamba	2	4,500

Herbicides must be in the soil solution to be taken up by seeds, roots, or shoots

Figure 2. Soil moisture effect on herbicide availability.



Hartzler, Professor Emeritus, ISU



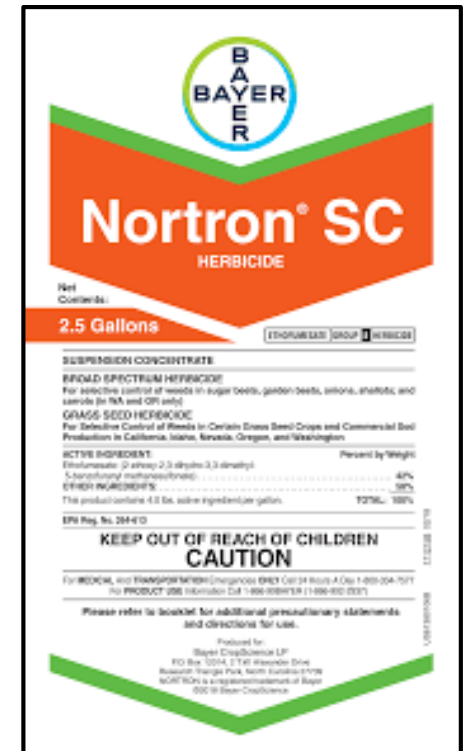
Kanissery, et al., 2019, J Bioremediat Biodegrad, DOI: 10.4172/2155-6199.1000458

^a The K value represents the ratio of herbicide bound to soil collides versus what is free in the water. Thus, the higher the K value the greater the adsorption to soil colloids.

^bWater solubility is a measure of the amount of chemical substance that can dissolve in water at a specific temperature. For example, milligrams per liter.

What do we know about ethofumesate?

- Excellent sugarbeet safety in MN/ND soils across rates and application method.
- Ethofumesate likes rain for weed control, rainfall and rainfall intensity.
- Ethofumesate likes to attach to soil.
- Begins to degrade after 14 days.
- Needs to be in the soil solution, even when incorporated into soil.
- Can make mixture partners more active, i.e. Warrant.
- 45 to 50 days waterhemp control.



BMPs for waterhemp control in sugarbeet

1. Plant sugarbeet into fields with documented field history.
2. Categorize sugarbeet fields as either low, moderate, or heavy for waterhemp pressure.
 - Apply ethofumesate at 5 to 7.5 pt/A PRE / EPOST / POST on heavy waterhemp pressure fields and fields with heavy previous crop residue.
 - Consider incorporating ethofumesate.
 - Apply ethofumesate + Dual Magnum / EPOST / POST on low and medium pressure fields.
3. Use a weed control program in the crop sequences that compliments your program in sugarbeet.
4. Use your inter-row cultivator.

More risk

Less risk

INCORPORATING SOIL RESIDUAL HERBICIDES



Results from incorporation demonstration conducted September 1979, Comparison of herbicide incorporation tools (1982), AG Dexter et al., SBREB, 12:49-56.

Tool	Tillage Depth	Speed	Incorporate Depth	Dye left on surface	Uniformity ^a
	inch	MPH	inch	%	0-10
Tandem disk	4	5	3.5	15	2
Field cultivator	4	5	3	30	4
Melroe cultivator	3	8	1.5	20	6
Alloway seedbetter	4	7	1.5	15	9
Koehn field cultivator with crumblers	5	8	2	10	9
Triple K soil condition with crumblers	3	8	2.5	20	7
Spring-tine harrow	2	7	1.5	60	2

^a 0 = poor, 10 = excellent



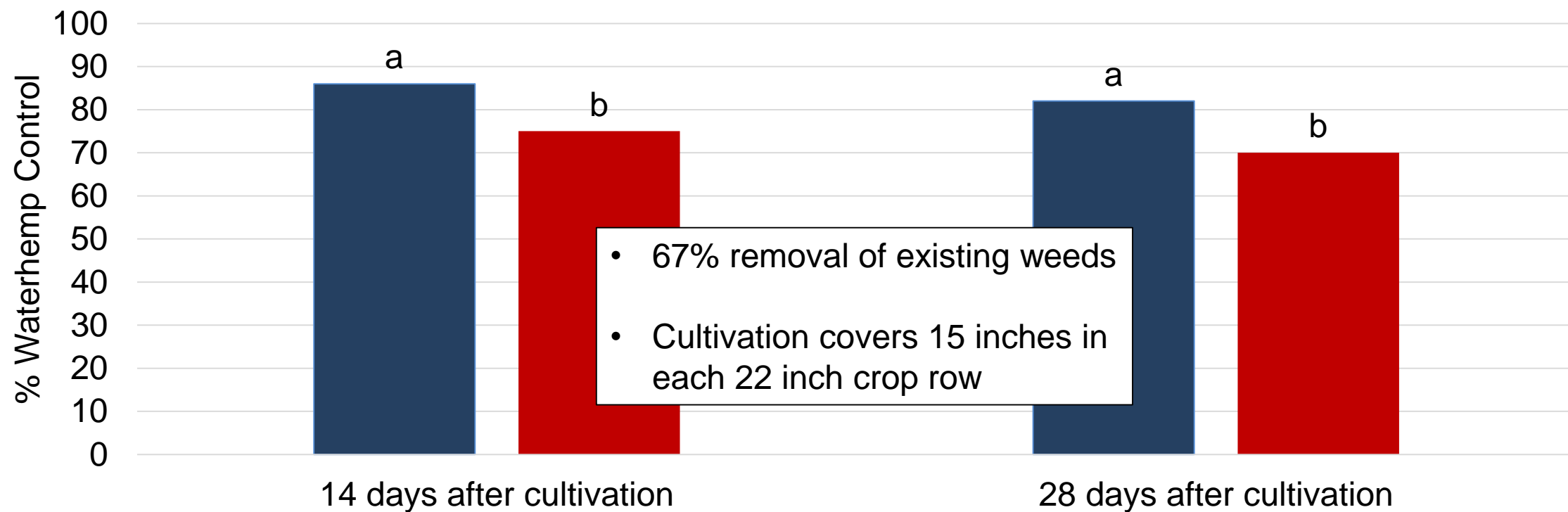
Schmoll Farms
Lake Lillian, MN

When should I cultivate?

- Consider weed size, target waterhemp less than 4-inch, 4 to 6-inch maximum size
- Cultivate before second lay-by application
 - Be proactive and cultivate to remove GR weed escapes
 - Apply second lay-by after cultivation



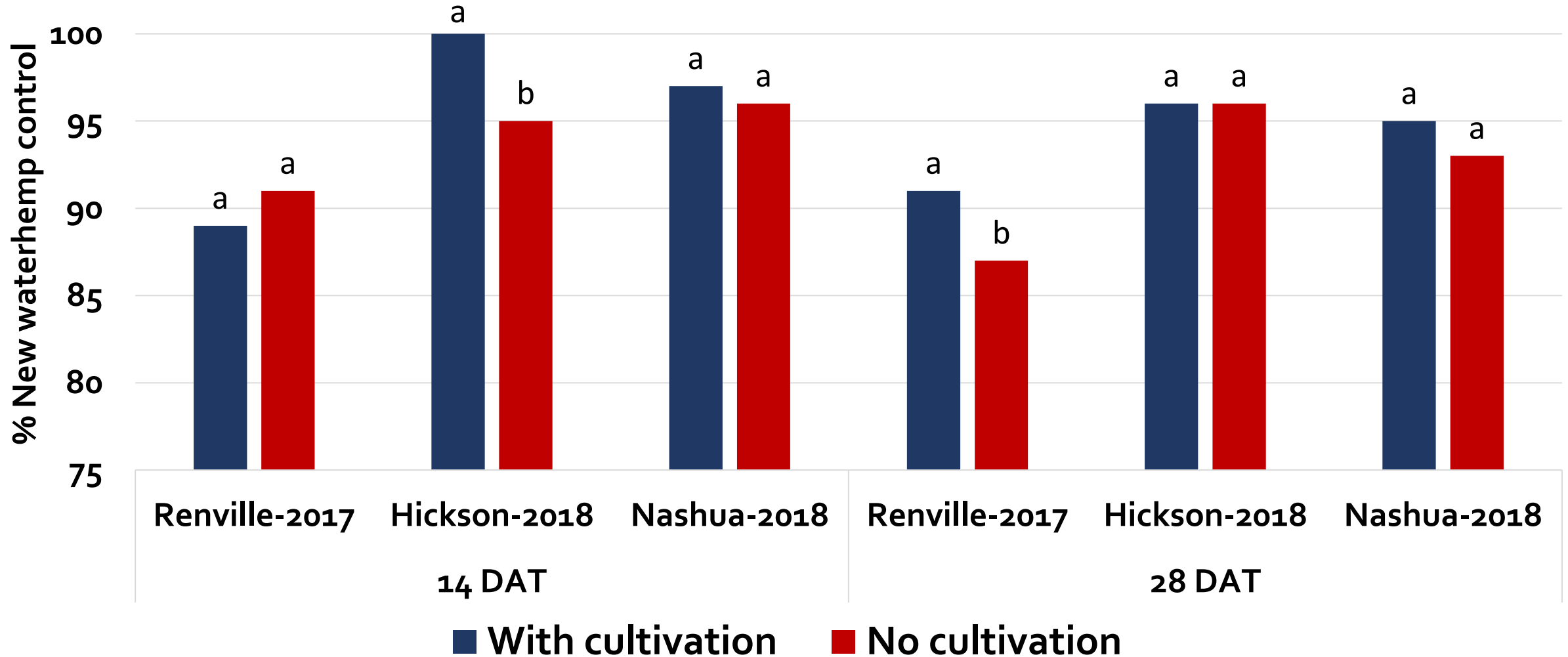
Cultivation two weeks after POST spray improved waterhemp control 11-12% across four environments



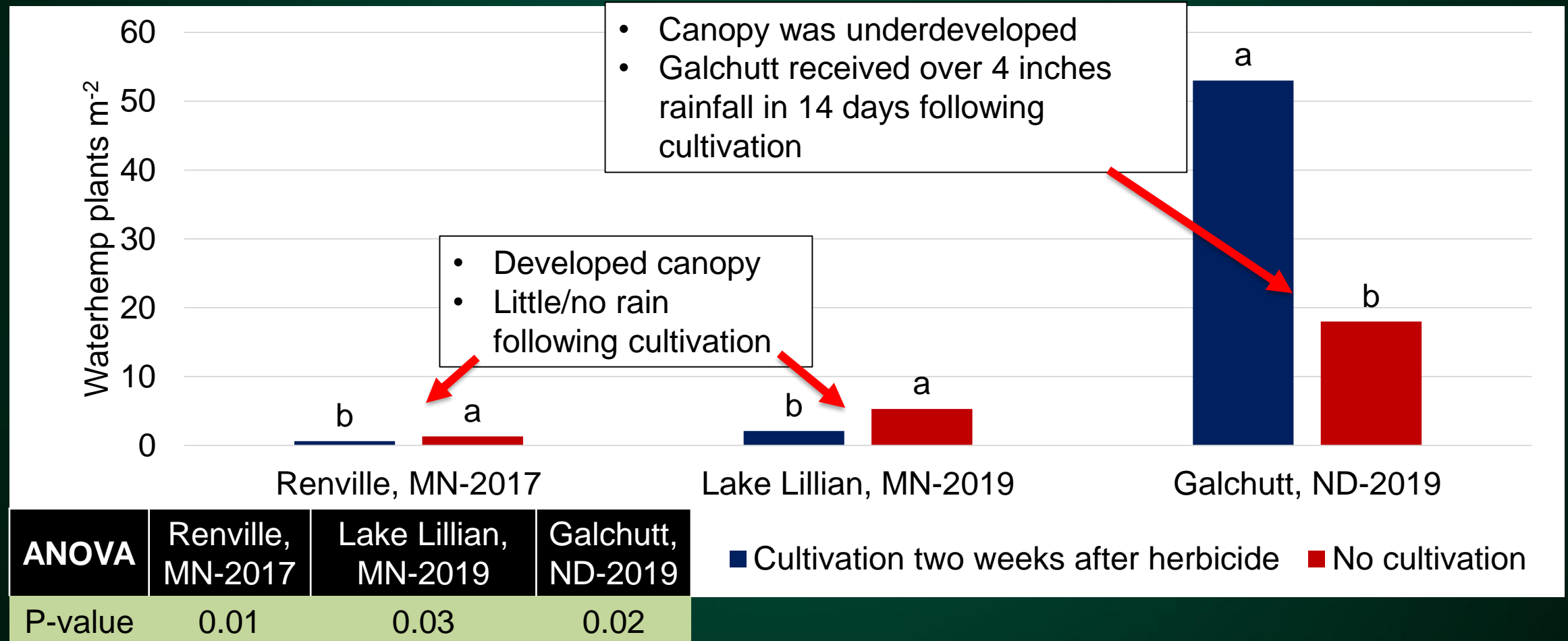
ANOVA	14 DAT	28 DAT
P-value	0.038	0.030

■ Cultivation two weeks after herbicide ■ No cultivation

Early cultivation generally had no effect on new waterhemp emergence control in a dense canopy



Delayed cultivation significantly increased waterhemp density 28 DAT in Galchutt, ND-2019



Ultra Blazer

Acifluorfen was applied on over 65,000 acres following Environmental Protection Agency (EPA) approval of a Section 18 emergency exemption in 2021 and 2022.

- A single Ultra Blazer application at 16 fl oz/A alone or with NIS on greater than 6-leaf sugarbeet stage.
- Ultra Blazer alone or in mixtures with PowerMax(3) and AMS.
- Target waterhemp up to 4-inch.
- Apply Ultra Blazer in afternoon hours on days with maximum day-time air temperatures greater than 85F.
- Application before 6 leaf sugar beet will result in crop injury and potential yield loss.
- 95% of survey respondents (2021) indicated the emergency exemption was beneficial and contributed to overall weed management.



2022 (and 2023) Ultra Blazer program objectives

Improve sugarbeet safety; increase waterhemp control.

- Revisit repeat applications (Ultra Blazer fb Ultra Blazer at 12 fb 12 fl oz/A).
- Evaluate crop oil concentrate with Ultra Blazer.
- Nozzles and spray volume to improve coverage and waterhemp control.



Ultra Blazer + NIS



Ultra Blazer + PowerMax3

Hendrum, MN
4 DAT



Ultra Blazer + COC



PowerMax3 / PowerMax3



Ultra Blazer + NIS, 14 DAT

Murdock, MN



Ultra Blazer + NIS, 23 DAT



Ultra Blazer + PowerMax3, 14 DAT



Ultra Blazer + PowerMax3, 23 DAT

Injury and yield in response to treatment, across locations, 2022

Treatment	Rate	Necrosis	Growth Reduction	Root Yield	Sucrose	Recoverable Sucrose
	fl oz/A	%	%	TPA	%	lb/A
Ultra Blazer + NIS ^a	16 + 0.25%	12 b	11 cd	31.0 b	16.0	8,504 abc
Ultra Blazer + NIS / Ultra Blazer + NIS	12 + 0.125% / 12 + 0.125 %	53 a	18 ab	31.7 ab	16.1	8,770 a
Ultra Blazer + crop oil concentrate ^b	16 + 0.25%	16 b	15 bc	31.4 ab	16.0	8,606 ab
PowerMax3 + Ultra Blazer + AMS ^c	25 + 16 + 2.5% v/v	22 b	24 a	30.0 c	16.0	8,167 bc
PowerMax3 + Ultra Blazer+ NIS + AMS	25 + 16 + 0.25% + 2.5% v/v	22 b	22 ab	29.4 c	16.0	7,974 c
PowerMax3 + NIS / PowerMax3 + NIS ^d	25 / 25	0 c	5 d	32.8 a	16.1	8,963 a
P-value (0.05)		<0.0001	<0.0001	0.0040	NS	0.0123

^a Prefer 90 non-ionic surfactant

^b Prime Oil, Winfield United, St. Paul, MN.

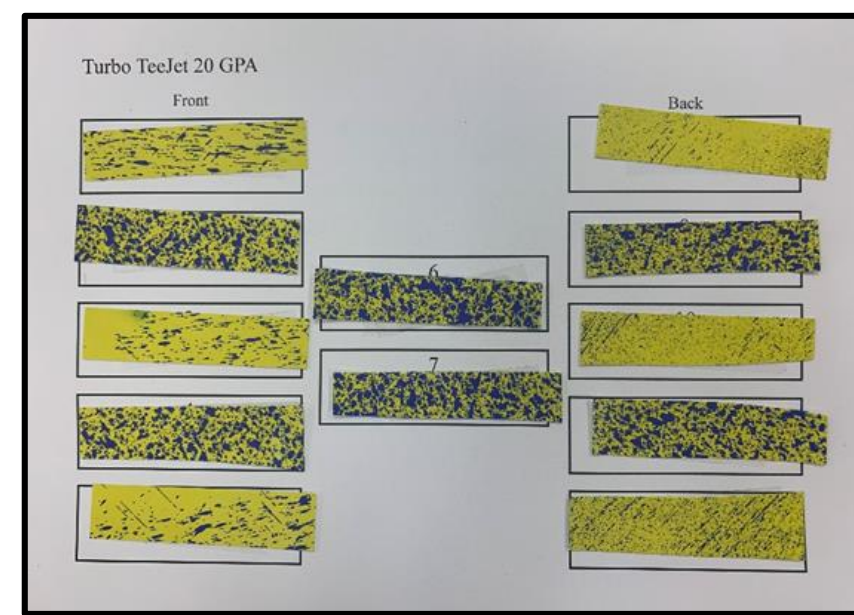
^c PowerMax3 and Amsol Liquid AMS, Winfield United, St. Paul, MN.

^d Prefer 90 NIS at 0.25%v/v.

Ultra Blazer in 2023

Using our acquired knowledge of spray quality for Cercospora leaf spot control on weed control

- Spray nozzles
- Spray volume



	Necrosis ¹		G Reduction		WH Control ²	
Nozzle	15 gpa	20 gpa	15 gpa	20 gpa	15 gpa	20 gpa
XR TeeJet	33 abc	38 ab	19 a	20 a	60 c	80 a
AIXR	23 c	23 c	8 c	8 c	64 c	68 c
Turbo TeeJet	28 bc	30 bc	15 ab	13 bc	69 bc	78 ab
Turbo TwinJet	26 c	43a	10 bc	19 a	83 a	81 a

¹Necrosis and growth reduction 13 DAT

²Waterhemp control 41 DAT

Moorhead MN, 2022



A few more points

Cover Crops, Nurse Crops and soil residual herbicides

- Winter rye or winter wheat at less than 15 lb broadcast, 3 to 5 lb in rows.
- No concerns with ethofumesate in the spring following cover crops, any rate.
- Incorporation?
- Spring barley is the most common nurse crop in our area.
- 15 lb (1/3 bushel).
- Etho and Dual Magnum will damage spring barley.
- Give the nurse crops a head start.



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

Corn rotate to Sugarbeet

^a& = premix; + = tank-mix

Products with crop rotation restrictions preventing sugarbeet planting the following year

Premergence	months	Postemergence ^a	months
Verdict (dimethenamid-P & saflufenacil (15&14))	NCS	Acuron GT (meto&meso&bicycle&glyph (15, 27, 27, 9))	18
Anthem Maxx (pyroxasulfone & fluthiacet) (15 & 14)	15	Armezon Pro (topramezone & dimethenamid-P) (27 & 15)	18
Corvus (isoxaflutole, thienencarbazone & safener) (27&2)	17	Halex GT (glyphosate & S-metolachlor & mesiotrione) (9 & 15 & 27)	18
Acuron Flexi (S-metolachlor, mesiotrione, bicyclopyrone & safener) (15 & 27 & 27)	18	Harness Max (acetochlor & mesotrione) (15&27)	18
Balance Flexx (isoxaflutole & safener) (27)	18	Realm Q (rimsulfurone & mesotrione & safener) (2 & 27)	18
Resicore / Resicore XL (acetoachlor, mesotrione & clopyralid) (15 & 27 & 4)	18	Maverick (mesotrione, clopyralid & pyroxasulfone) (27,4,15)	18
Atrazine (5)	2 CS	Sinate (topramezone & glufosinate (27 & 10) + atrazine (need LL Corn))	18
Surestart II (acetochlor, flumetsulam & clopyralid) (15 & 2 & 4)	26		



Soybean rotate to Sugarbeet

Products with crop rotation restrictions

^a& = premix; + = tank-mix
^bwith soil testing



Preemergence	months	Postemergence ^a	months
XtendiMax / Engenia (dicamba) (need XtendiMax soybean	NCS	Flexstar GT fomesafen & glyphosate) (14 & 9)	18
Fierce *pyroxasulfone & flumioxazin) (15 & 14)	12		
Boundary (S-metolachlor & metribuzin) (15 & 5)	18		
Fierce MTZ (pyroxasulfone & flumioxazin & metribuzin	18		
Authority Edge (sulfentrazone & pyroxasulfone) (14 & 15)	24		
Authority First / Sonic (sulfentrazone & chloransulam) (14 & 2)	30		
Sonic (sulfentrazone & chloransulam (14 & 2)	30 ^b		
Surveil (flumioxazin & chloransulam) (14 & 2)	30 ^b		
Authority MTZ (sulfentrazone & metribuzin) (14, 15 & 5)	36/24 ^b		
BroadAxe XC (S-metolachlor & sulfentrazone) (15& 14)	36		
Zidua Pro (pyroxasulfone, saflufenacil & imazethapyr) (15 & 14 & 2)	40		



Common ragweed control from Stinger, 51 DAT, greenhouse biotype, Minn-Dak and ACS.



Stinger HL 'Higher Load' is approved for corn, cereals, canola, and sugarbeet in MN and ND.

Product	Loading	Labeled rate	Sugarbeet rate
Stinger	3 lb/gal	4 – 10.7 fl oz/A	2 – 6 fl oz/A
Stinger HL	5 lb/gal	2.4 – 6.4 fl oz/A	1.8 – 3.6 fl oz/A

	Converting Stinger rate to Stinger HL rate			
	fl oz/A	fl oz/A	fl oz/A	fl oz/A
Stinger	2	3	4	6
Stinger HL	1.2	1.8	2.4	3.6

Common ragweed control, Ada, MN, 2022

			Common ragweed control		
Treatment	Rate	Common Ragweed	July 8	July 16	July 26
	fl oz/A	inch	%	%	%
Stinger HL + PowerMax3	1.2 + 25	<2	75 b	61 cd	60 cd
Stinger HL + PowerMax3	1.8 + 25	<2	91 a	83 b	80 b
Stinger HL + PowerMax3	2.4 + 25	<2	91 a	87 ab	88 a
Stinger HL + PM ₃ / Stinger HL + PM ₃	1.5 + 25 / 1.5 + 25	<2 / 10 day	91 a	91 ab	89 a
Stinger HL + PM ₃ / Stinger HL + PM ₃	1.8 + 25 / 1.8 + 25	<2 / 10 day	95 a	92 a	94 a
LSD (0.05)			6	8	6

Common ragweed control, Ada, MN, 2022

			Common ragweed control		
Treatment	Rate	Common Ragweed	July 8	July 16	July 26
	fl oz/A	inch	%	%	%
Stinger HL + PowerMax3	1.2 + 25	2-4	65 c	59 d	54 d
Stinger HL + PowerMax3	1.8 + 25	2-4	68 c	61 cd	63 c
Stinger HL + PowerMax3	2.4 + 25	2-4	71 bc	67 cd	65 c
Stinger HL + PM ₃ / Stinger HL + PM ₃	1.5 + 25 / 1.5 + 25	2-4 / 10 day	69 c	69 c	77 b
Stinger HL + PM ₃ / Stinger HL + PM ₃	1.8 + 25 / 1.8 + 25	2-4 / 10 day	70 bc	69 c	79 b
LSD (0.05)			6	8	6

Best Management Practices for Stinger HL application and ragweed control

- Stinger HL at 1.8 fl oz/A must be our lowest rate; 2.4 fl oz is preferred.
- Stinger at 1.8 fl oz/A fb Stinger HL at 1.8 fl oz/A for repeat applications.
- Time Stinger HL application to ragweed size rather than sugarbeet stage.
- May need to separate glyphosate and Stinger HL application if using nurse crops and want to delay termination to 4-lf sugarbeet.
- Tank-mix Stinger HL with glyphosate, ethofumesate, and a chloroacetamide.
- Complex mixtures? Adding Mustang Max, Asana or Betamix?
- Carryover.

Thank you for your attention and your continued support

Tom Peters

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