Weed Control in Sugarbeet

Red River Valley North

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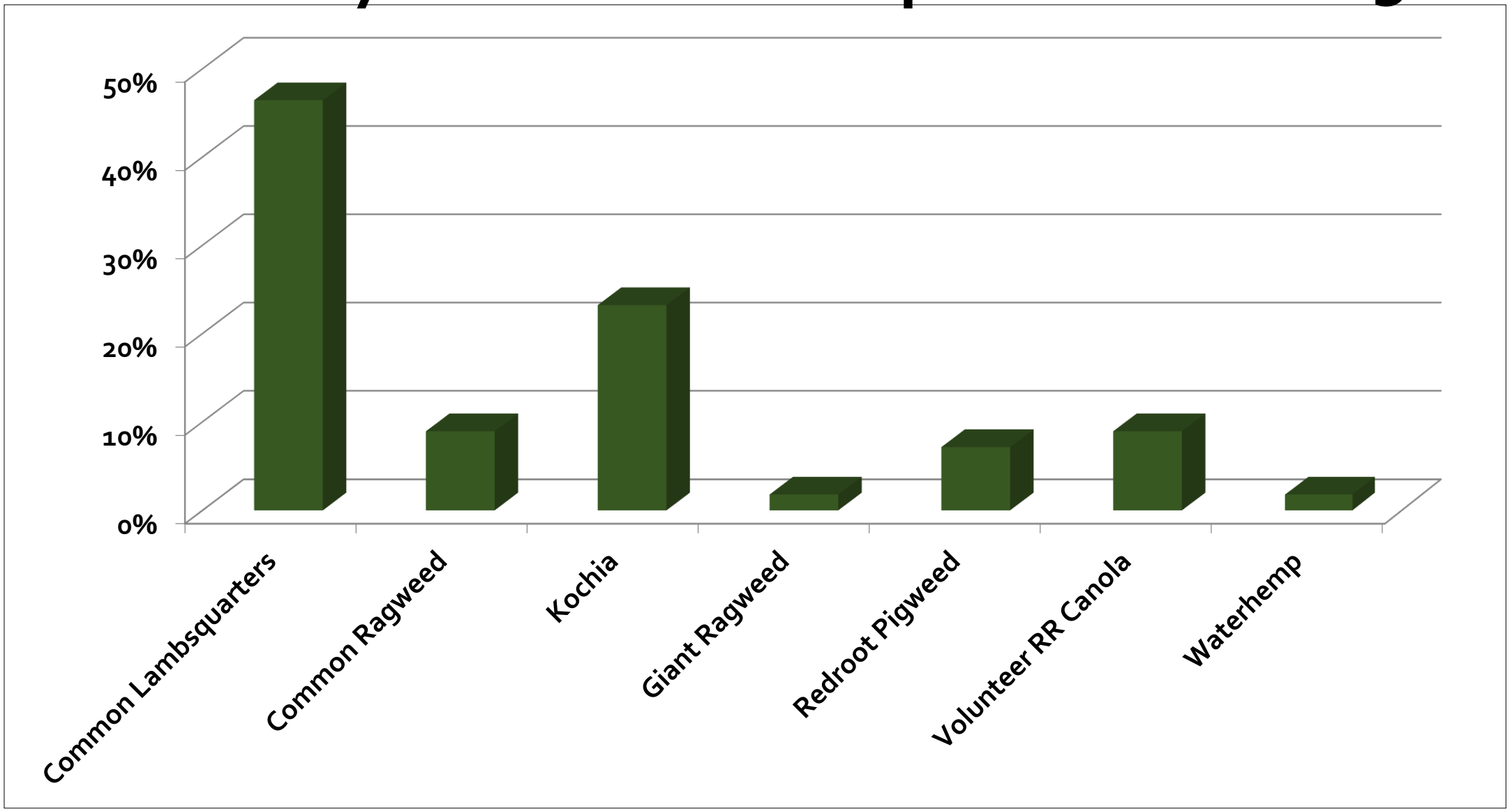
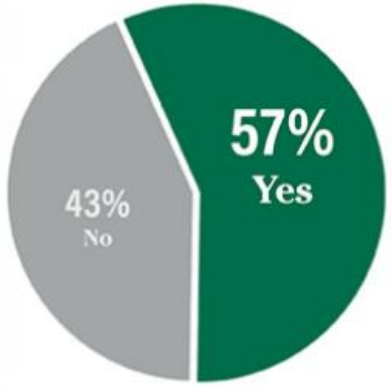
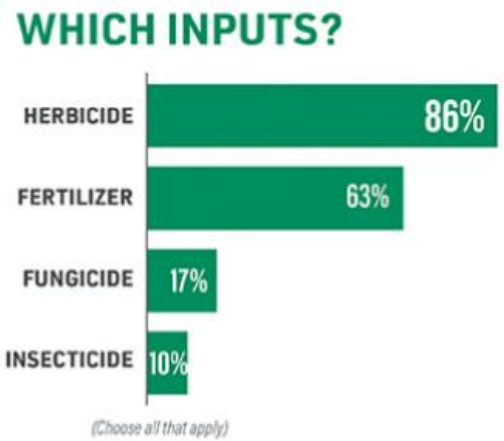
What was your worst weed problem in 2019[1]?

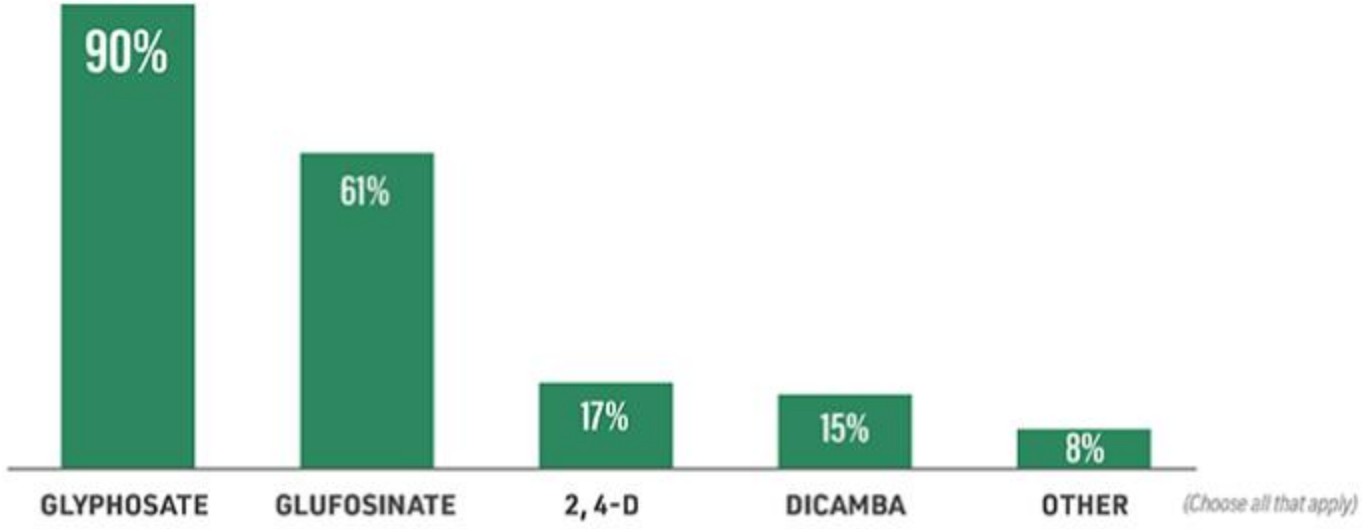


[1]Turning Point Survey of Growers; conducted at the 2020 Sugarbeet Growers Seminar, Grafton

Have you had difficulty sourcing inputs for the 2022 season?
Which herbicides have you had difficulty securing this year?







Source: Farm Journal Supply Chain Survey, February 2022

Presentation Outline

① Kochia control in crops in the sequence; sugarbeet
② Common ragweed control; Stinger HL
③ Waterhemp control; soil residual herbicides
④ Herbicide carryover, when does it occur?
⑤ Palmer amaranth uipdate

Waterhemp emergence, May 2, 2020, Mapleton, ND Greg Krause, Minn-Dak Farmers Coop

Weed control strategy

- Manage weeds in rotational crops
- Use an integrated approach to weed management
  - Use full rates
  - Herbicide mixtures
  - Herbicides temporally across time
  - Cultural, mechanical, and chemical
- Don’t allow weeds to make seed; manage the seedbank
- Practice weed control on field edges

Kochia control in the cropping sequence

corn/wheat>soybean/dry bean>wheat>sugarbeet rotation

Soybean

- Valor/Metribuzin combination, e.g. Valor + Metribuzin, Fierce MTZ, etc.
- POST application of Liberty, Dicamba, or Flexstar (1 or 2 apps as needed/appropriate) depending on the soybean trait.
- Dicamba PRE.

Soybean Postharvest

- Valor 3 oz late fall prior to freeze-up. Advise not to till after Valor application.
- Seed wheat direct in the spring.

Wheat

- 2 oz ai fluroxypyr where possible. 1.5 oz ai is cut rate, less than 4" kochia.
- Kochiavore or Cleansweep D (products with at least 2 modes of action).
- Check the 2022 ND Weed Control Guide for additional products.

Postharvest wheat

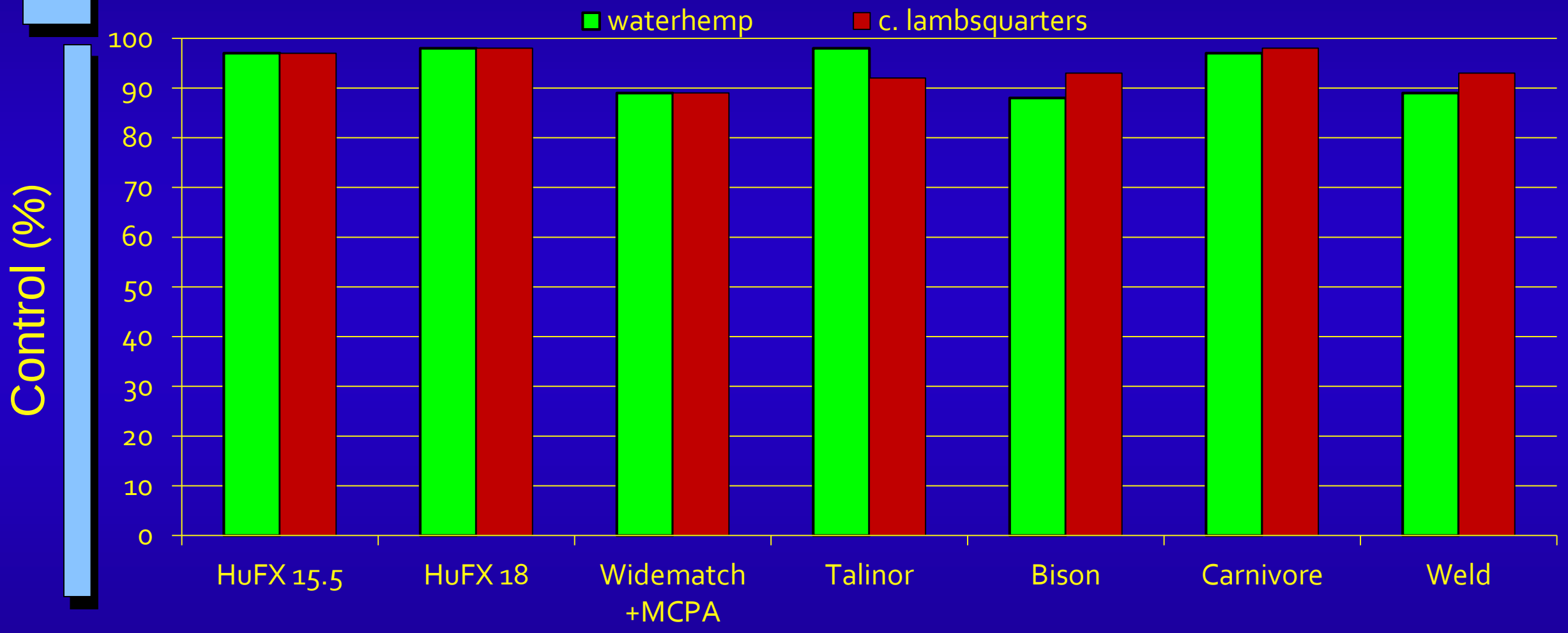
- Tillage or Gramoxone to control kochia escapes.

Kochia control in herbicide tolerant soybean, Carrington and Minot, 2020.[a]

Treatment	Rate	7 DAT	7 DAT	14 DAT	28 DAT
	oz/A	< 2-inch	> 2-inch	all	all
Liberty	32	**97**	**98**	**90**	85
Roundup PM	28	79	78	74	60
Liberty + Roundup PM	32 + 28	**97**	**99**	**92**	89
Liberty + Enlist Duo	32 + 4.75 pt	**96**	**99**	**91**	88
Liberty + Enlist One	32 + 2 pt	**91**	**99**	85	78
Enlist Duo	4.75 pt	70	60	68	61
Enlist One	2 pt	16	3	0	0
LSD (0.05)		6	4	6	10

[a]all treatments contain AMS at 3 lb/A

Broadleaf Weed Control



Slide courtesy of Dr. Kirk Howatt

Kochia was NOT a focus of the 2021 Emergency Exemption and control from UB has been inconsistent across experiments

- Producers, especially in Sidney Sugars Coop, are interested in kochia control from UB
- Control has been inconsistent in experiments in 2020 and 2021, mostly because of kochia size
- Kochia must be less than 3-inch tall
- Prefer application with glyphosate and adjuvants

Treatment	Horace, 2020	Manvel, 2020	Horace, 2021	Manvel, 2021
	%	%	%	%
Etho (6-7.5 pt) / PowerMax	75 a	85 a	98 a	82 a
Ultra Blazer	25 c	83 a	45 b	33 b
UB + PowerMax	86 a	96 a	97 a	66 a

[a] Ultra Blazer with non-ionic surfactant at 0.125%; Ultra Blazer + PowerMax with NIS and Amsol liquid AMS at 0.125% and 2.5% v/v

Common ragweed control

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	1.2 – 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

We have observed some ragweed biotypes more difficult to control

- Common ragweed seed collected from sugarbeet fields with escapes
- Control, PowerMax at 32 and 64 fl oz and Stinger at 3 and 6 fl oz/A
- Visual control weekly
- Table is visual control 50 DAT

Stinger Rate	Control	ACS-1	ACS-2	ACS-3	Minn-Dak
fl oz/A	%	%	%	%	%
3	85	60	50	90	70
6	90	70	60	95	85

Control is a 'university standard', likely susceptible

Common lambsquarters control

Advantage weeds when applying herbicides under hot and dry conditions

Herbicides are influenced by environmental conditions.

- Herbicides generally are most effective when applied to actively growing plants at 70 to 85F.
- Drought or heat stress can reduce POST herbicides efficacy by physically changing plant architecture.
- Plants with thicker cuticle and greater proportion of waxy constituents. The plant cuticle functions to reduce losses to vaporation; a barrier for spray droplets applied to the leaf surfaces.

Common lambsquarters control in response to treatment, Benson, MN, 2021.[a]

Treatment	Rate	Count per plot[b]	Control[b]
	fl oz/A	Num	%
glyphosate	28	3.5 a	80
glyphosate	32	3.0 ab	80
glyphosate + NIS + AMS	28 + 0.25% + 2.5%	0.5 b	90
glyphosate + NIS + AMS	32 + 0.25% + 2.5%	2.3 ab	89
glyphosate + ethofumesate + NIS + AMS	28 + 6 + 0.25% + 2.5%	0.8 b	96
P-Value		0.1408	NS

[a] 95F air temperature and 42% RM on June 10, 2021 at 10:00AM

b Count on June 25 (15 DAT) and visible control on October 11 (113 DAT)

Advantage weeds when applying herbicides under hot and dry conditions

- **Actively growing weeds** are easier to kill with POST herbicides because all biosynthetic processes (photosynthesis, synthesis of amino acids, proteins, and other cellular components, and meristematic growth) are operating at full strength.
- Now contrast a **weed growing very slowly** due to drought or heat stress. The same physiological processes are occurring but at a very slow rate
- Systemic herbicides like Roundup, Liberty, growth regulator herbicides, POST grass herbicides are affected the most by environmental conditions
- Addition of adjuvants (spray additives), when recommended, may improve weed control from herbicides under adverse growing conditions

Roundup PowerMax 3 Herbicide

Nonselective foliar control of both grass and broadleaf weeds

Active Ingredient and Site of action

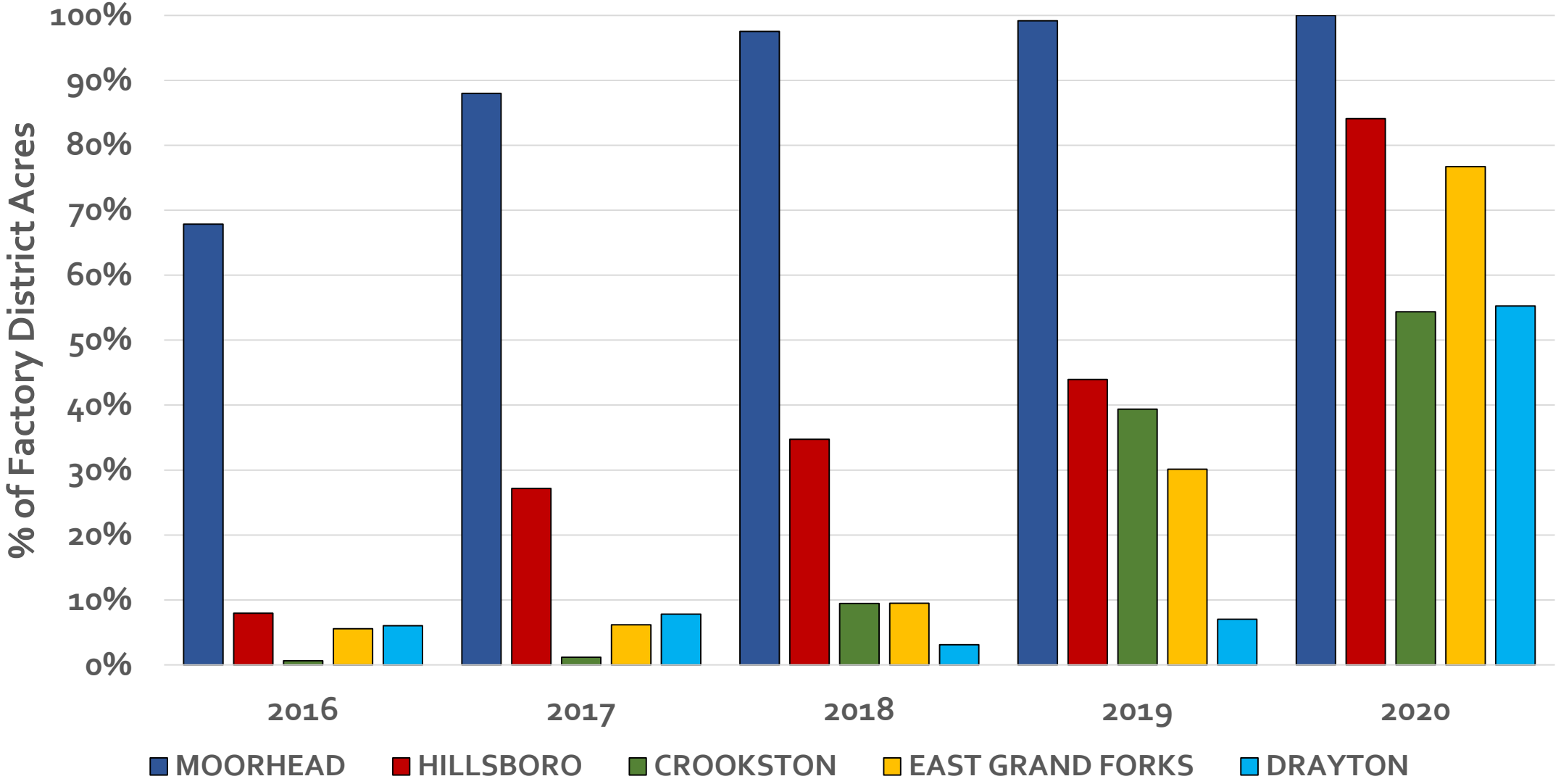
- Glyphosate in the form of the Potassium (K) salt
  - 4.80 lb ae/gal
  - 5.88 lb ai/gal

Equivalent Application Rates (fl oz/A)

lb ae/A	Roundup PowerMax 3 Herbicide	Roundup PowerMax Herbicide
0.75	20	22
1.125	30	32
1.5	40	44
2.25	60	64

Waterhemp control

Percent factory district acres reporting waterhemp, 2016 to 2020



Why were *Pigweed* Spp. frequently named most important weed?

- Sugarbeet is a member of the Betoidae subfamily within amaranthaceae and includes approximately 2,500 species
- *Amaranthus* Spp. are both common and troublesome weeds in MN and ND
- Germinate and emerge in response to moisture and light (cultivation)
- Germination and emergence from May through August
- Prolific seed producers
- Seed is viable up to six years

Waterhemp

Image credit: Cody Walstrom, Minn-Dak Farms Coop

Redroot pigweed

Image credit: Bruce Ackley, The Ohio State University, Bugwood.org

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 5 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 18), Liberty with the Redball™ 915 hooded sprayer (24c), or inter-row cultivation
July	Electric Discharge Systems (WeedZapper™)
August / September	Hand remove waterhemp

S-metolachlor mixed with glyphosate and ethofumesate reduced sugarbeet stature, 7 and 14 but not 21 DAT, average of four locations, 2021.[a]

Factor A PRE Treatment	Factor B POST Treatment	% Sugarbeet Injury		
		7 DAT[b]	14 DAT	21 DAT
No	PowerMax + etho / PowerMax + etho[c]	3 a	2 a	3
No	*S*-metolachlor + PowerMax + etho / *S*-metolachlor + PowerMax + etho	11 b	9 b	6
Etho + Dual Magnum	PowerMax + etho / PowerMax + etho	4 a	1 a	2
Etho + Dual Magnum	*S*-metolachlor + PowerMax + etho / *S*-metolachlor + PowerMax + etho	13 b	8 b	7
	LSD (0.05)	6	5	NS

[a]Means within a main effect not sharing any letter are significantly different by the LSD at the 5% level of significance.
[b]DAT = days after treatment.
[C]etho = ethofumesate.

S-metolachlor mixed with glyphosate and ethofumesate did not reduce sugarbeet yield or quality.[a]

Factor A PRE Treatment	Factor B POST Treatment	Root Yield	% Sucrose	Recov Sucrose
		--Ton/A--	--%--	--lb/A--
No	PowerMax + etho / PowerMax + etho[b]	37.9	15.9	10,415
No	*S*-metolachlor + PowerMax + etho / *S*-metolachlor + PowerMax + etho	36.0	15.8	10,033
Etho + Dual Magnum	PowerMax + etho / PowerMax + etho	37.9	15.7	10,215
Etho + Dual Magnum	*S*-metolachlor + PowerMax + etho / *S*-metolachlor + PowerMax + etho	36.9	15.7	10,133
	LSD (0.05)	NS	NS	NS

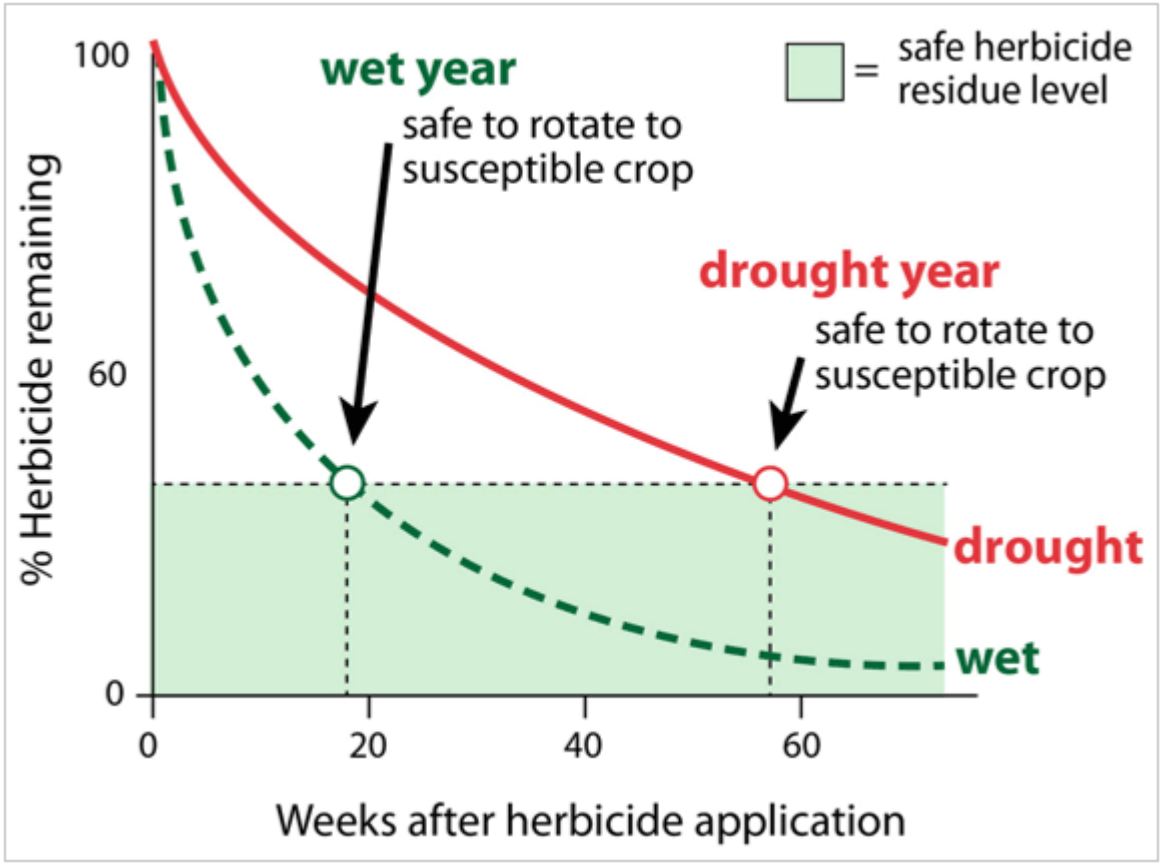
[a]Means within a main effect not sharing any letter are significantly different by the LSD at the 5% level of significance.
[b]etho = ethofumesate

Herbicide carryover, when does it occur?

How do herbicides degrade in soil?

- Degradation is the conversion of active herbicide molecules to products that no longer have herbicidal activity.
- Degradation rate is frequently described as half-life, the time required for half of the herbicide molecules to degrade from the soil.
- Herbicides with longer half-lives tend to be more persistent and have higher potential for carryover to crops in sequence.
- Both PRE and POST herbicides may persist in soils.

Herbicides may persist longer in dry vs. wet soils



- Pesticide labels provide guidance for crop rotation restrictions
- Environmental conditions, especially rainfall will ultimately determine persistence of herbicides

Colquhoun, J. 2006. Herbicide persistence and carryover. University of Wisconsin Extension publication A3819.

There are several ways herbicides are degraded /deactivated in soil.

- Breakdown / degradation by soil microbes – most common.
- Breakdown by chemical hydrolysis (water breaks herbicide molecules into less active pieces).
- Herbicide escaping to the atmosphere as a gas (volatilization).
- Breakdown by light (photo degradation).
- Herbicides tightly bound to soil colloids.

Degradation: Microbial

- Important means for destroying pesticide in soils
- Some soil microorganisms use pesticides as food
  - bacteria and fungi

Factors affecting herbicide carryover

- **Herbicide itself**
  - The chemical structure of a herbicide affects absorptivity (binding to soil) and water solubility.
  - Herbicides highly bound to soil particles are often less likely to be available for microbial degradation.
- **Moisture**
  - Moisture enables herbicide to be in the soil solution
  - Soil microbes are most active under moist but not saturated condition
  - Herbicide adsorption (binding) is greater under dry conditions
- **Temperature**
  - Optimum soil microbial activity occurs in June, July and August when temperatures range from 70F to 85F.
  - Less breakdown before June or after August or when soil temps are less than 50F
- **Soils**
  - CEC, especially organic matter
  - Soil pH

Palmer amaranth update

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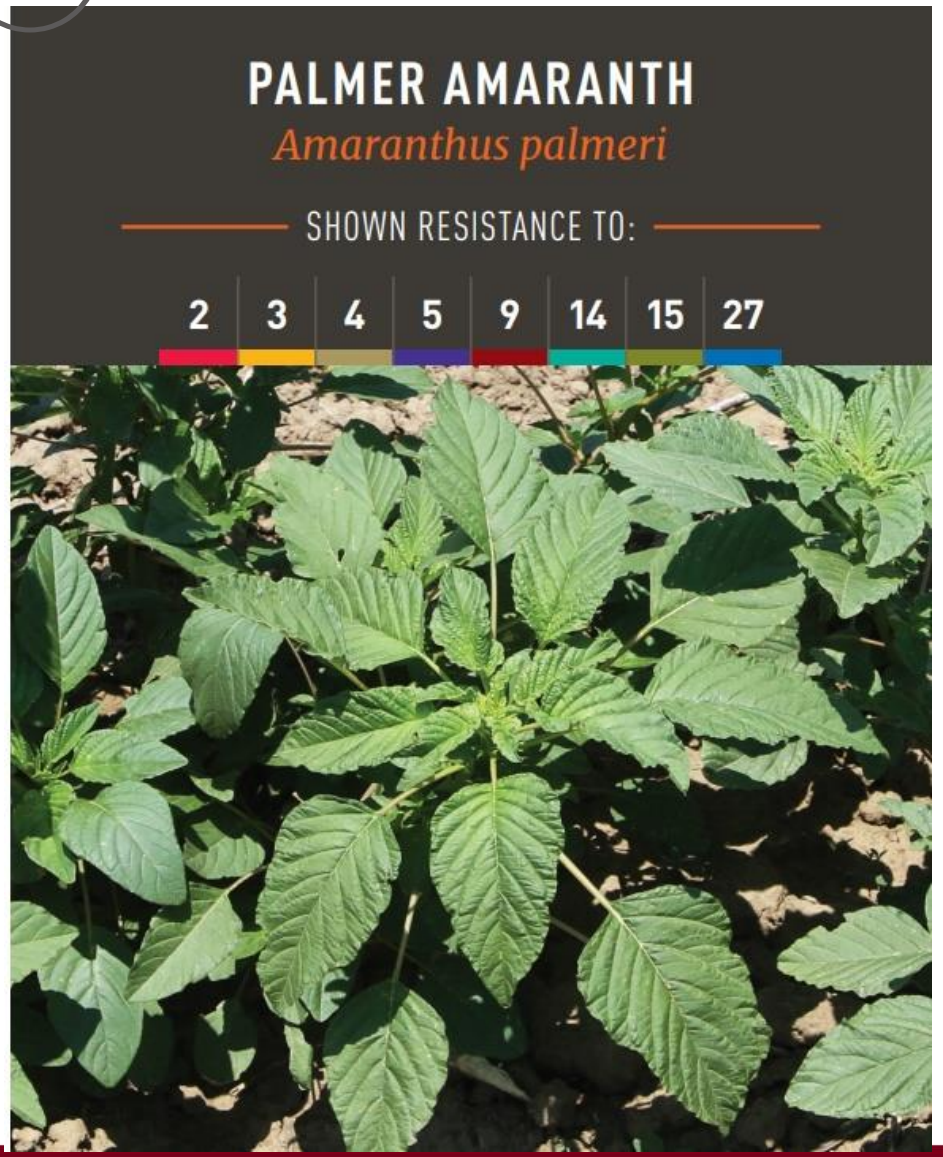
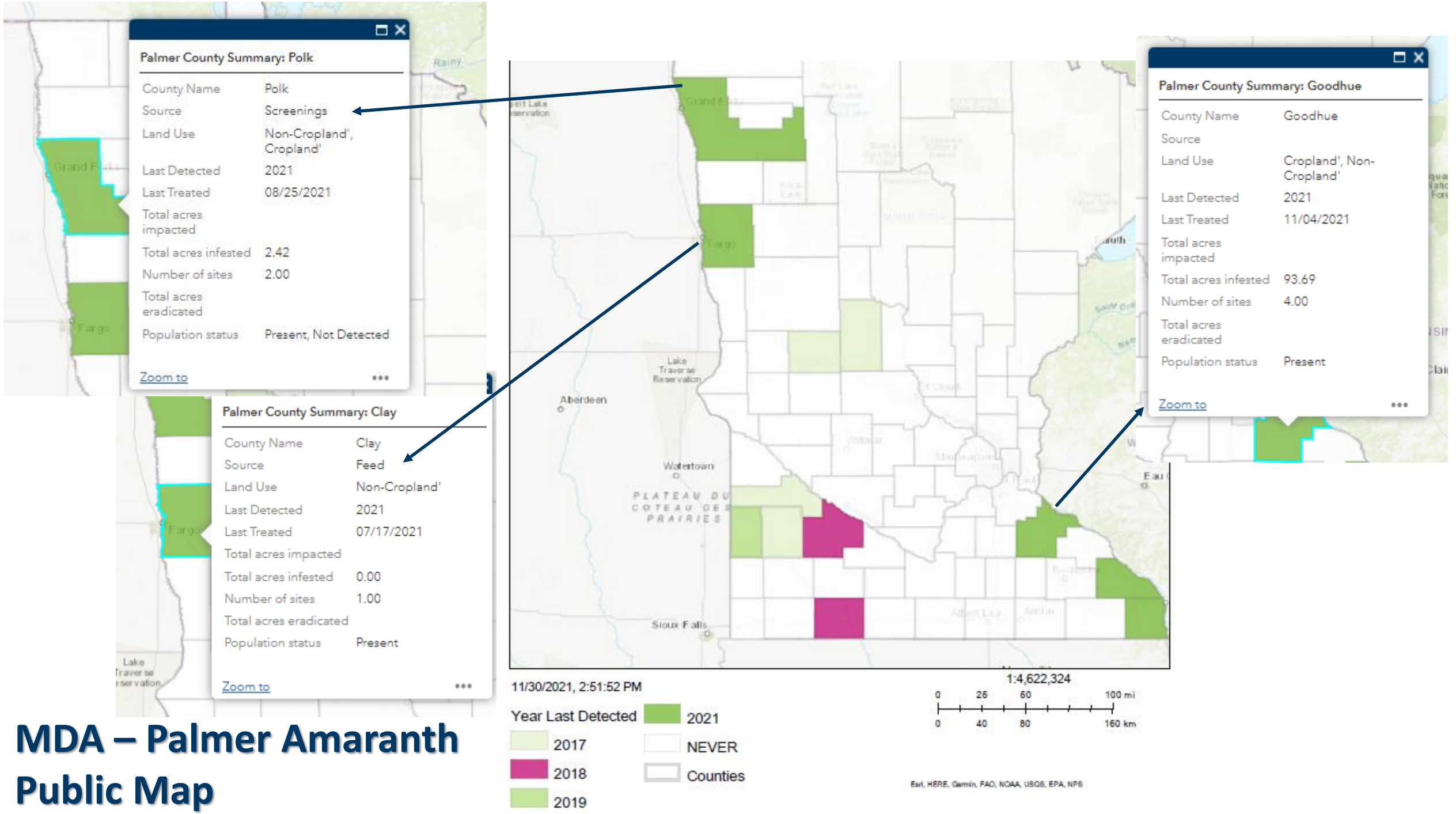


Why the big deal?

- Fast growing (up to 2-3 inches/day)
- Prolific seed producer
  - Potential 500,000+ seeds/plant
- Can cause severe yield losses
  - Up to 91% in corn & 79% in soybean
- Herbicide resistance concerns
  - R to multiple SOAs common

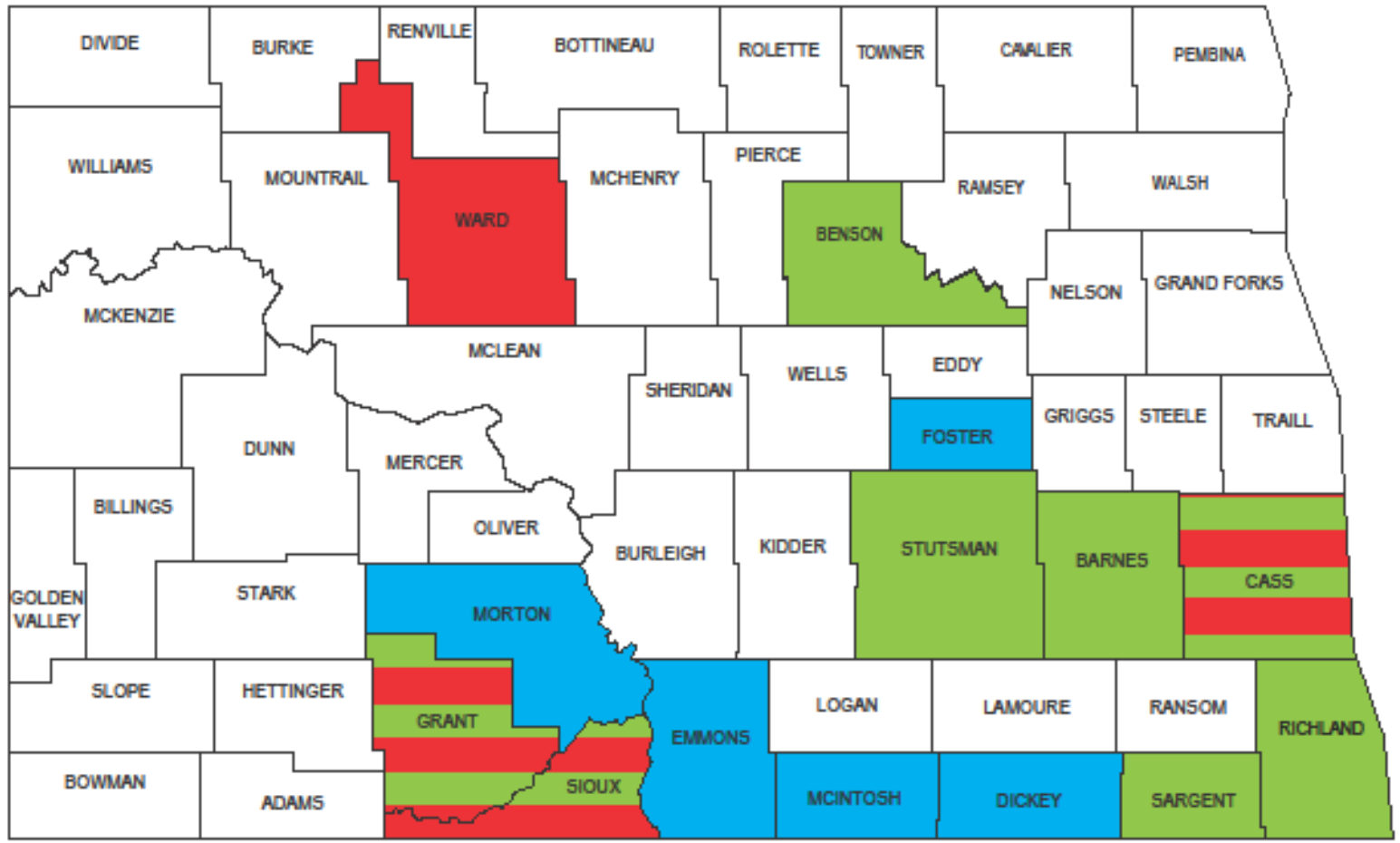
2	3	4	5	9	14	15	27
ALS INHIBITORS	MICROTUBULE INHIBITORS	SYNTHETIC AUXINS	PHOTOSYSTEM II INHIBITORS	EPSP SYNTHASE INHIBITOR	PPO INHIBITORS	LONG-CHAIN FATTY ACID INHIBITORS	HPPD INHIBITORS
Classic®, Pursuit®	*Prowl® H2O, Treflan®*	*2,4-D, Clarity®, quinclorac*	*atrazine. metribuzin, Linex®*	*Roundup® (glyphosate)*	*Flexstar®, Cobra®*	*Dual®, Harness®*	*Callisto®, Laudis®*

TakeACTION Herbicide-Resistance Management



MDA – Palmer Amaranth Public Map

North Dakota Department of Agriculture
Palmer Amaranth Distribution



Previously found but no longer detected
Previously found and still detected, under management
Population found in current year (2021)

As of 11/2/2021

If you suspect Palmer amaranth…..

1) Take Photos and record location

ARREST THE PEST
Contact to report sightings
arrest.the.pest@state.mn.us
888-545-6684

2) Immediately call

- TOM PETERS, local U of M Extension Educator or IPM Specialist, crop consultant, county agricultural inspector and/or MDA's **Arrest the Pest at 888-545-6684** to report locations

3) SAVE the plant(s) for positive ID!

- Leave in the field if you can until the MDA can verify the plant and collect sample for genetic confirmation
- If hand-pulled, collect at least 5 leaves from each plant, place in Ziploc bag and refrigerate until you contact the MDA
- Dead and dry plant material should be placed in a paper bag and stored at room temperature.

DEPARTMENT OF AGRICULTURE

Machine Shop Meetings -2022

- Week of February 21 in East Grand Forks Factory District
- Locations, dates and time TBD
- Small group meetings
- No PowerPoint; plenty of donuts and coffee…and sometimes…..in the afternoon
- Weed Identification; weed control in sugarbeet
- Ultra Blazer in sugarbeet
- Strip Tillage; herbicide carryover

We appreciate your trust

- The Sugarbeet Research and Education Committee for supporting our field research program.
- To Darryl Collette (St. Thomas), Scott Johnson (Manvel), and Pinta Brothers (Minto) for providing us with the opportunity to conduct our experiments on their fields.
- Strip Tillage project cooperators in Walsh and Polk Counties
- The University of Minnesota NW Research and Outreach Center, Crookston; especially Mr. Jeff Nielsen
- Shop Meeting Hosts

Thank you for your continued support

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