Soybean Weed Management Challenges in 2020 – Lessons from the East

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Soybean Weed Issues

- Overview of Soybean Weed Management
- Wet fall set up issues for 2020
  - Horseweed (marestail)
  - Narrowleaf hawksbeard
- Kochia
- Waterhemp/Palmer

Generaliz Weed

- More chemical option
  - Many POST options
  - Generally “stronger” her
- Many options with soy
  - Conventional (non-GMO
  - Roundup Ready
  - Liberty-Link
  - Roundup Ready Xtend
  - Enlist E3
  - LLGT27
- Slower canopy closure
  - Almost always need 2 he
- Shorter Rotation Restr

CHEMICAL WEED CONTROL FOR FIELD CROPS
Plant-back Interval for Fall, Pre-Plant, and PRE Herbicides

	Rate/A[a]	See paragraph	Alfalfa	Barley	Canola	Chick pea / Lentil	Corn	Dry bean	Field pea	Flax	Oat	Potato	Safflower	Soybean	Sugarbeet	Sunflower	HRS / Durum Wheat
			months before planting (d = days)														
2,4-D[4] amine	0.5 lb ai	B3	1	0	1	1	7d	1	1	1	1	1	1	15d	1	1	0
	1 lb ai	B3	1	0	1	1	14d	1	1	1	1	1	1	1	1	1	0
2,4-D[4] ester	0.5 lb ai	B3	1	0	1	1	7d	1	1	1	1	1	1	7d	1	1	0
	1 lb ai	B3	1	0	1	1	14d	1	1	1	1	1	1	1	1	1	0
E-99 / Weedone 650[4]	1 lb ai	B3	1	0	1	1	14d	1	1	1	1	1	1	15d	1	1	0
Aim[14]	0.5 to 1 fl oz	B4	0	0	0	0	0	0	0	0	0	0	N/R	0	N/R	0	0
Afforia[2,2,14*a]	2.5 - 3.75 oz		3-4	3-4	4-12	4-12	.5-1	3-4	3-4	3-4	4-5	4-12	3-4	1-7d	4-10	45d	1-2
Alluvex[2,2]	1.5 oz		18	9	18	18	0	10	10	10	9	1	18	10	18	10	9
Anthem Flex[14,15]	2.5 - 4.5 fl oz	D6	10	11	18	6	0	11	6	18	11	4	18	0	12	4	1
Autumn Super[2,2]	0.5 oz	B5	Apply post-harvest in fall and plant only corn the next spring.														
Banvel/DMA[4*a]	1 pt	B6	NCS	3d/oz	NCS	NCS	0[a]	NCS	NCS	NCS	3d/oz	NCS	NCS	45 d	NCS	NCS	3d/oz
	1 to 2 pt	B6	NCS	NCS	NCS	NCS	0[a]	NCS	NCS	NCS	NCS	NCS	NCS	90 d	NCS	NCS	3d/oz
Boundary[5,15]	2 - 3.5 pt		4.5	8	12	8	12	12	12	8	12	0	12	0	18	12	8
Clarity/DGA[4*a]	8 fl oz	B6	4	22 d	4	4	0[a]	4	4	4	22 d	4	4	4	4	4	22 d
	16 fl oz	B6	6	44 d	6	6	0[a]	6	6	6	44 d	6	6	6	6	6	44 d
Dual Magnum[15]	1 - 2 pt		4	4.5	12	0	0	0	0	12	4.5	0	0	0	0	0	4.5
Elevore	1 fl oz		9	14d	14d	9/15	14d	9	9	9	14d	15	9	14d	15	14d	14d
Express / tribenuron[2*] Labeled rates			1.5	0	2	1.5	.5-2[a]	1.5	1.5	1.5	1.5	1.5	1.5	7d[ac]	2	0-2[ac]	0
Facet 4L[4,26]	22 fl oz	B10	24b	10	10	24b	10	24b	24b	24b	10	24b	24b	24b	24b	24b	0
Fierce[14,15]	3 oz		10	11	18	11/6[a]	7d-1[a]	11	6	18	11	4	18	0	15	4	1
Glyphosate[9*]	0.75 - 3 lb ae	B2,8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harmony/thifensulfuron[2*] Label rates		E5	1.5	0	1.5	1.5	0	1.5	1.5	1.5	0	1.5	1.5	0	1.5	1.5	0
Liberty[10]	32 - 43 fl oz	B9	6	70d	0	6	0	6	6	6	70d	70d	6	0	0	6[a]	70d
Paraquat[22*] - RUP	Label rates	B11	0	0	N/R	N/R	0	0	0	N/R	N/R	0	0	0	0	0	0
Pre-Pare[2]	0.3 oz	C7	24	9	9	24	11	9	11	9	11	9	9	9	9	9	0/4
Quelex	0.55 - 0.75 oz		9	0	9	9/15	3	9	9	9	3	15	9	3	15	3	0
Select/clethodim[1*]	4 - 16 fl oz	E2	0	1	0	0	6d-1[a]	0	0	0	1	0	0	0	0	0	1
Sequence[9,15]	2.5 - 3.5 pt	A4	4	4.5	NCS	0	0	0	0	0	4.5	0	NCS	0	NCS	0	4.5
Sharpen[14]	1 fl oz	B12	4	0	4	0	0	4	0	4	0	4	4	0[f]	4	4	0
	1.5 fl oz	B12	5	0	5	0/1	0	5	0	5	0	5	5	14d[f]	5	5	0
	2 fl oz	B12	5	0	5	0/1	0	5	0	5	0	5	5	1[f]	5	5	0
	3 fl oz	B12	6	0	6	2/3	0	6	2	6	0	6	6	2[f]	6	6	NR
Spartan Charge[14,14]	3 - 10.2 fl oz	E11	12	4	24	0	4	0	0	12	12	4	12	0	24b	0	4
Valor[14] + tillage	2 oz	E12	4	3	4	3/6	7d-1[a]	3	3	3	4	4	3	0	4	1[a]	14-1d[a]
- tillage	2 oz	E12	8	3	8	3/6	7d-1[a]	3	3	3	8	8	3	0	8	1[a]	14-1d[a]
+ tillage	3 oz	E12	5	4	6	4/7	14d-	4	4	4	5	5	4	0	5	2[a]	2[a]
- tillage	3 oz	E12	10	4	12	4/7	14d-	4	4	4	10	10	4	0	10	2[a]	2[a]
Verdict[14,15]	5-18 fl oz	B12	NCS	NCS	NCS	NCS	0	NCS	NCS	NCS	NCS	NCS	NCS	0-4	NCS	NCS	NCS
Zidua SC[15]	1.75 fl oz	D6	10	11	12	1	0	11	1	2	11	4	1	0	12	1	1
	3.25 fl oz	D6	10	11	12	1	0	11	1	4	11	4	1	0	12	2	1
	5.00 fl oz	D6	10	11	15	1/2	0	11	1	6	11	4	1	0	15	3	4
	6.50 fl oz	D6	10	18	18	2/4	0	11	2	8	18	4	2	4	15	3	6

*= Or generic equivalent.
Herbicide name[number 1-30] = herbicide site of action - see pages 108-109.
[a] = Refer to label for approved rates and restrictions.
[b] = bioassay
[c] = Soybean = 1 day before planting at 0.25 oz SG
= 7 days before planting at 0.3 to 0.5 oz SG
[d] = days before planting
[e] = ExpressSun sunflower = 0 days at 0.25 to 0.5 oz SG
[f] = Soils must be medium to fine texture with >2% OM.
NCS = Next Cropping Season; NR = Not Registered

Actual glyphosate product rates based on acid equivalent (ae) and active ingredient (ai) formulation concentrations - Refer to page 4 for more information.

lb ae	lb ai		0.75 lb ae	1.125 lb ae	1.5 lb ae	2.25 lb ae	3 lb ae
			fl oz/A				
3	= 4	=	32	48	64	96	128
3.75	= 5	=	25.6	38.4	51.2	76.8	102.4
4	= 5.4	=	24	36	48	72	96
4.17	= 5.1	=	23	34.5	46	69	92.1
4.5	= 5.5	=	21.3	32	42.6	64	85
4.72	= 6.3	=	20.3	30.5	40.7	61	81.4
5	= 6.1	=	19.2	28.8	38.4	57.6	76.8

Table 4. Soybean herbicide-resistance traits and herbicides that can be used in combination with resistant traits.
A checkmark indicates that soybean herbicide trait packages have resistance to various herbicide products.[a]

Soybean Herbicide Trait	Glyphosate	Glufosinate	2,4-D Choline[b]	Dicamba[c]	HPPD Inhibitors[d]
Conventional					
Glyphosate Tolerant (GT)	✓				
Roundup Ready[e]	✓				
Roundup Ready 2 Yield[e]	✓				
Roundup Ready 2 Yield Xtend[e]	✓			✓	
Roundup Ready 2 Yield Xtendflex[f]	✓	✓		✓	
LibertyLink (LL)		✓			
LLGT27[d]	✓	✓			✓
Enlist	✓		✓		
Enlist E3	✓	✓	✓		
GT27	✓				✓

[a]Always consult herbicide labels for application requirements.
[b]Only approved 2,4-D choline formulations (Enlist Duo, Enlist One) are permitted for over-the top applications to Enlist and Enlist E3 soybeans.
[c]Only approved dicamba formulations (Engenia, FeXapan, Tavium, XtendiMax) are permitted for over-the-top application to Xtend and XtendFlex soybeans.
[d]GT27 and LLGT27 are resistant to isoxaflutole preemergence. No HPPD-inhibiting herbicide is approved for use in soybeans in the U.S. as of January 2020.
[e]Always consult herbicide label to determine if glyphosate formulation is approved for RR soybeans.
[f]Not approved for commercial production in the U.S. as of January 2020.

Strengths and Weaknesses

- Herbicide Resistant Trait
  - Conventional (non-GMO)
    - Strengths: Cheaper seed. Can bin-run many varieties
  - Roundup Ready
    - Strengths: Control many weeds. Application flexibility.
      - Can save seed ONLY from NDSU glyphosate-tolerant varieties
    - Weaknesses: Glyphosate-resistant weeds.
  - Liberty-Link
    - Strengths: broadleaf weeds. Horseweed/marestail
    - Weaknesses: Grasses. Need water, sunshine, heat, and humidity.

Strengths and Weaknesses

- Herbicide Resistant Trait
  - Roundup Ready Xtend
    - Strengths: Broadleaves. Kochia, Horseweed/marestail
    - Weaknesses: Very strict application parameters. Grasses.
  - Enlist E3
    - Strengths: Flexibility of glyphosate, Liberty or 2,4-D. Kochia (Liberty component). Horseweed/marestail
    - Weaknesses: Kochia (2,4-D component)
  - LLGT27
    - Strengths: Flexibility of glyphosate or Liberty
    - Weaknesses: Cannot use the “27” component

Pages 32 – 41 in 2020 ND Weed Guide

W253-20 **This Publication Supercedes All Previous Issues**

2020

North Dakota Weed Control Guide

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SOYBEAN

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks and Paragraphs
Refer to page 6 for Fall or Spring Early Preplant Herbicides. **Refer to page 38-39 for additional herbicides to use in conventional or herbicide-resistant soybean.**				
Soil-Applied Herbicides				
Prowl **Prowl H2O** (pendimethalin[3])	**2.4 to 3.6 pt EC** **2.1 to 3 pt ACS** (1 to 1.5 lb)	Annual grass and some broadleaf weeds.	PPI. Fall or Spring.	Adjust rate for soil type. Do not apply PRE. Poor control of weeds with large seeds, including wild oat and wild mustard. A1-2 B1 B7 E1 E11
Sonalan **Sonalan 10G** (ethalfluralin[3])	**1.5 to 3 pt EC** **5.5 to 11.5 10G** (0.55 to 1.15 lb)			
Treflan / generic trifluralin[3]	**1 to 2 pt EC** (0.5 to 1 lb)			
Valor SX **Valor EZ** (flumioxazin[14])	**2 to 3 oz WDG** **2 to 3 fl oz EZ/SC** (1.02 to 1.53 oz)	Small-seeded broadleaf weeds.	EPP, Shallow PPI, or PRE.	PRE requires precipitation for herbicide activation. Refer to label for tank-mix options, application information, and restriction. Commercial mixtures available (See page 30): **Afforia** = flumioxazin + thifensulfuron + tribenuron **Authority Assist** = sulfentrazone + imazethapyr **Authority Edge** = sulfentrazone + pyroxasulfone **Authority Elite** = sulfentrazone + S-metolachlor **Authority First** = sulfentrazone + cloransulam **Authority MTZ** = sulfentrazone + metribuzin **Authority Supreme** = sulfentrazone + pyroxasulfone **BroadAxe XC** = sulfentrazone + S-metolachlor **Fierce** = flumioxazin + pyroxasulfone **Fierce MTZ** = flumioxazin+pyroxasulfone+metribuzin **Sonic** = sulfentrazone + cloransulam **Surveil** = flumioxazin + cloransulam A1-2 B1-2 E1 E12-13
Spartan (sulfentrazone[14])	**4.5 to 12 fl oz F** (2.25 to 6 oz)			
Metribuzin[5]	Soil pH >7.5 = **0.33 lb DF** Soil pH <7.5 = **0.33 to 0.5 lb DF**			May injure certain soybean varieties. Commercial mixtures available: **Boundary** = metribuzin + S-metolachlor A1-2 E1 E7
Sharpen (saflufenacil[14])	**1 to 1.5 fl oz SC** (0.36 to 0.54 oz)	Broadleaf weeds including winter annuals.		PRE requires precipitation for herbicide activation. Apply with MSO adjuvant at 1 to 1.5 pt/A for burndown control of emerged broadleaf weeds. Planting interval is dependent on soil texture and OM. Sharpen at 1.5 fl oz and Verdict at 7.5 fl oz require a 14 day plantback interval. Refer to label for tank-mix options. A1-2 B1-2 B12
Verdict (saflufenacil[14] & dimethenamid[15])	**5 to 7.5 fl oz EC** (1.3 to 0.53 oz & 0.9 to 1.34 lb)			
Dual/II/Magnum (S/metolachlor[15])	**1 to 2 pt EC** (0.95 to 1.9 lb)	Annual grasses and some broadleaf weeds.	EPP, Shallow PPI, PRE and EPOST. POST PHI: Dual = 90 days.	Requires precipitation for soil activation. Multiple rain events increase activation of pyroxsulfone. Provides 3 to 4 weeks residual weed control after activation. Adjust rate for soil type. Shallow PPI gives more consistent weed control than PRE. Use highest rates for greater and more consistent weed control. Warrant: Do not PPI. Application with other PRE or EPOST herbicides and stressful environment after application may increase risk of soybean injury. Refer to labels for tank-mix options. Commercial mixtures available (See page 30): **Authority Elite** = S-metolachlor + sulfentrazone **Boundary** = S-metolachlor + metribuzin **BroadAxe XC** = S-metolachlor + sulfentrazone **Fierce** = pyroxasulfone + flumioxazin **Zidua Pro**= pyroxasulfone + saflufenacil + imazethapyr A1-2 B1-2 D5 E1
Outlook / generic dimethenamid[15]	**10 to 24 fl oz EC** (0.47 to 1.125 lb)			
Warrant (acetochlor[15] - microencapsulated)	**1.25 to 2 qt ME** (0.94 to 1.5 lb)			
Anthem Maxx (pyroxasulfone[15] & fluthiacet[14])	**2 to 5.5 fl oz SC** (1 to 2.87 oz & 0.03 to 0.087 oz)			
Zidua SC (pyroxasulfone[15])	**2.5 to 5.75 oz SC** (1.3 to 3 oz)			

Pages 32 – 41 in 2020 ND Weed Guide

SOYBEAN

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Soil-Applied Herbicides				
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Sonalan **Sonalan 10G** (ethalfluralin[3])	**1.5 to 3 pt EC** **5.5 to 11.5 10G** (0.55 to 1.15 lb)			
Treflan / generic trifluralin[3]	**1 to 2 pt EC** (0.5 to 1 lb)			
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Spartan (sulfentrazone[14])	**4.5 to 12 fl oz F** (2.25 to 6 oz)			
Metribuzin[5]	Soil pH >7.5 = **0.33 lb DF** Soil pH <7.5 = **0.33 to 0.5 lb DF**			May injure certain soybean varieties. Commercial mixtures available: **Boundary** = metribuzin + S-metolachlor A1-2 E1 E7
Sharpen (saflufenacil[14])	**1 to 1.5 fl oz SC** (0.36 to 0.54 oz)	Broadleaf weeds including winter annuals.		PRE requires precipitation for herbicide activation. Apply with MSO adjuvant at 1 to 1.5 pt/A for burndown control of emerged broadleaf weeds. Planting interval is dependent on soil texture and OM. Sharpen at 1.5 fl oz and Verdict at 7.5 fl oz require a 14 day plantback interval. Refer to label for tank-mix options. A1-2 B1-2 B12
Verdict (saflufenacil[14] & dimethenamid[15])	**5 to 7.5 fl oz EC** (1.3 to 0.53 oz & 0.9 to 1.34 lb)			
Dual/II/Magnum (S/metolachlor[15])	**1 to 2 pt EC** (0.95 to 1.9 lb)	Annual grasses and some broadleaf weeds.	EPP, Shallow PPI, PRE and EPOST. POST PHI: Dual = 90 days.	Requires precipitation for soil activation. Multiple rain events increase activation of pyroxsulfone. Provides 3 to 4 weeks residual weed control after activation. Adjust rate for soil type. Shallow PPI gives more consistent weed control than PRE. Use highest rates for greater and more consistent weed control. Warrant: Do not PPI. Application with other PRE or EPOST herbicides and stressful environment after application may increase risk of soybean injury. Refer to labels for tank-mix options. Commercial mixtures available (See page 30): **Authority Elite** = S-metolachlor + sulfentrazone **Boundary** = S-metolachlor + metribuzin **BroadAxe XC** = S-metolachlor + sulfentrazone **Fierce** = pyroxasulfone + flumioxazin **Zidua Pro**= pyroxasulfone + saflufenacil + imazethapyr A1-2 B1-2 D5 E1
Outlook / generic dimethenamid[15]	**10 to 24 fl oz EC** (0.47 to 1.125 lb)			
Warrant (acetochlor[15] - microencapsulated)	**1.25 to 2 qt ME** (0.94 to 1.5 lb)			
Anthem Maxx (pyroxasulfone[15] & fluthiacet[14])	**2 to 5.5 fl oz SC** (1 to 2.87 oz & 0.03 to 0.087 oz)			
Zidua SC (pyroxasulfone[15])	**2.5 to 5.75 oz SC** (1.3 to 3 oz)			

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks and Paragraphs
Refer to page 38-39 for additional herbicides to use in conventional or herbicide-resistant soybean.				
POST-Applied Herbicides				
Warrant (acetochlor[15] - microencapsulated)	**1.25 to 2 qt ME** (0.94 to 1.5 lb)	PRE control of grass and broadleaf weeds.	POST. Soybean: After emergence until R2.	Rainfall required for PRE activation. Does not control emerged weeds. Provides residual weed control after activation. No adjuvant required. A1-2 E1 D5
Basagran 5L / generic bentazon[6] + MSO adjuvant	**0.4 to 1.6 pt SL** / **0.5 to 2 pt applied 1 to 4 times.** (0.25 to 1 lb)	Some broadleaf weeds.	POST. Soybean: After emergence. Broadleaf weeds: **Small.**	Non-residual, contact herbicide requiring >15 gpa and full sunlight. Add MSO adjuvant at 1 to 1.5 pt/A. Maximum bentazon amount per season is 2 lb/A. Refer to E3 for additional information. A3 A5-6 E1 E3
Cadet (fluthiacet[14])	**0.4 to 0.9 fl oz EC** (0.045 to 0.1 oz)	Some small broadleaf weeds including pigweed species.	POST. Soybean: 1 to 2 trifoliates. Weeds: Small.	Contact herbicides requiring small weed size, >15 gpa, NIS or oil adjuvant at 1 to 2 pt/A, and full sunlight. May cause speckling on soybean leaves. Cadet may improve lambsquarters control. Apply Cobra with oil adjuvant at 1 to 2 pt/A. Refer to label for crop response, adjuvant type and rate, and tank-mix options. A3 E1
Cobra (lactofen[14])	**8 to 12.5 fl oz EC** (2 to 3.2 oz)			
Resource (flumiclorac[14])	**2 to 8 fl oz EC** (0.215 to 1.72 oz)			
Ultra Blazer (acifluorfen[14])	**0.5 to 1.5 pt EC** (0.125 to 0.375 lb)			
Flexstar / generic fomesafen[14] + oil adjuvant	**0.75 pt EC** (0.176 lb)	Many small broadleaf weeds. Poor buckwheat, lambsquarters and hairy nightshade control.	POST Soybean: Prior to flowering. Weeds: Small. Do not use as a rescue treatment. Contact herbicide requiring small weed size.	Apply at >15 gpa, oil adjuvant at 1 to 2 pt/A, and full sunlight. MSO at 1 to 2 pt/A + AMS at 8.5 lbs/100 gal water will increase weed control and risk of crop injury. Apply at 1 pt/A in ND east of I-29 and south of I-94. Apply at 0.75 pt/A in ND east of Hwy 281 and in the following counties west of Hwy 281: Benson, Bottineau, Burleigh, Dickey, Eddy, Emmons, Foster, Grant, Kidder, LaMoure, Logan, McHenry, McIntosh, McLean, Mercer, Morton, Oliver, Pierce, Renville, Rolette, Sheridan, Sioux, Stutsman, Towner, Ward, and Wells. West of Hwy 281: - Do not apply to soil with OM >4%. - Do not apply after June 20. Refer to product label and ND SLN label for crop rotation restrictions and other restrictions. Refer to E4 for improved broadleaf weed control. A3 E1 E5
FirstRate (cloransulam[2])	**0.3 oz WDG or 10 A/pack** (0.25 oz)	Large-seeded broadleaf weeds.	POST. Soybean: Up to full flower stage (R2). Weeds: Small.	Add oil adjuvant at 1 to 2 pt/A + 28% UAN at 2.5% v/v. Refer to label for weed size, and tank-mix options. A3 E1
Harmony / generic thifensulfuron[2]	**0.083 (1/12) oz DF** **0.125 (1/8) oz SG** (0.062 oz)	Mustard, pigweed, and lambsquarters.	POST. Soybean: 1st trifoliate until 60 days PHI.	Add oil additive at 1 to 2 pt/A + 28% UAN or AMS. Refer to label for tank-mix options. A3 A5-8 E1 E6
Pursuit (imazethapyr[2])	**2 to 3 fl oz SL** (0.5 to 0.75 oz)	Annual broadleaf weeds. Poor lambsquarters, ragweed, buckwheat and b. wormwood control.	POST. Soybean: **Prior to flowering.** Weeds: Small and actively growing. Allow a 30 day PHI.	Add oil adjuvant at 1 to 2 pt/A + 28% UAN at 2.5% v/v. MSO adjuvants enhance weed control more than petroleum oil or NIS adjuvants. Refer to label for weed size and application information. Raptor has less soil residual carryover than Pursuit. A3 A5-8 E1 E8 E10
Raptor (imazamox[2])	**4 to 5 fl oz SL** (0.5 to 0.625 oz)			
Varisto (bentazon[6] & imazamox[2])	**11 to 27 fl oz SL** (0.34 to 0.84 lb + 0.26 to 0.64 oz)	Small annual grass and broadleaf weeds and suppression of Canada thistle.		Add MSO adjuvants at 1.25 to 1.5 pt/A. Apply 11 fl oz to pre-bolt canola. Refer to E3 for additional information. A3 A5-8 E1 E3 E10

Pages 32 – 41 in 2020 ND Weed Guide

HERBICIDE-RESISTANT SOYBEAN

Refer to Herbicide Resistant Weeds section (X1) for weed management strategies to delay herbicide resistant weeds.

Rule #1 - Control weeds BEFORE 2 to 4 inches tall to avoid yield loss.
Remove weeds early especially when grass weed populations are high.

ND soybean yield loss from weeds removed at different intervals.

Weed height when weeds were removed.	Soybean stage	Soybean yield* (bu/A)
Weed free	-	44.3
2 to 4 inches	VC (cotyledon) to V1	42.1
6 to 8 inches	V2 to V4	40.8
>10 inches	V3 to R2	36.4
Weedy check	-	22.7

*Source: Greg Endres, Carrington R&E Center. 8-site years (2011-2014). Carrington, Doyon, Langdon, and Minot.

Soybean yield loss from weeds may be greater in dry North Dakota environments than other areas of the Midwest that receive greater precipitation.

LibertyLink Soybean

Herbicide	Product/A (ai/A)	Weeds	When to Apply	Remarks and Paragraphs
Liberty 280, Interline (glufosinate[10])	**32 to 43 fl oz SL** (0.58 to 0.72 lb) **Maximum total** = 87 fl oz	Annual grass and broadleaf weeds including ALS and glyphosate resistant weeds.	POST. Soybean: Emergence to pre-bloom. Weeds: Up to 3 inches tall.	**Apply only to LibertyLink soybean varieties.** Non-selective, contact, non-residual herbicide requiring thorough coverage. Apply a PRE foundation treatment prior to Liberty POST. Add AMS at 3 lb/A - do not use AMS replacement or water conditioner adjuvants. Can be applied with a registered grass herbicide. Refer to label for tank-mix options and restrictions. Most active in hot and sunny conditions. Controls weeds resistant to other herbicides. A3 A6 B9 D7
Cheetah, Scout (glufosinate[10])	**29 to 43 fl oz SL** (0.53 to 0.72 lb) **Maximum total** = 87 fl oz			

STS (sulfonylurea-tolerant) Soybean

Herbicide	Product/A (ae/A)	Weeds	When to Apply	Remarks and Paragraphs
Harmony/generic thifensulfuron[2]	**0.33 oz DF 0.5 oz SG** (0.25 oz)	Annual broadleaf weeds including wild buckwheat, lambsquarters, mustard species, and vol. RR canola.	POST. RR/STS soybean: 1st fully expanded trifoliate to 60 days PHI.	**Apply only to RR/STS soybean varieties.** Apply with glyphosate at 0.38 to 1.125 lb ae/A. Add NIS at 1 qt/100 gal water. Apply with AMS fertilizer at 8.5 lb/100 gal. Refer to label for weeds controlled and application information. A4-7 B8 D8 E6

Roundup Ready and Roundup Ready 2 Yield Soybean

Herbicide	Product/A (ae/A)	Weeds	When to Apply	Remarks and Paragraphs
Glyphosate[9]	**Maximum single application** = 1.5 lb ae **Maximum in-crop** = 2.25 lb ae **See Remarks.**	Annual and perennial grass and broadleaf weeds.	POST. Soybean: Emergence through R2 or full flowering. Allow a 14 day PHI.	**Apply only to RR / RR 2 Yield soybean varieties. Cannot plant harvested patented soybean seed.** Add AMS fertilizer at 8.5 lb/100 gal. Multiple applications may be necessary for weed flushes. Refer to label for weeds controlled, application information, and tank-mix options with residual herbicides and restrictions. A4-7 B8 D8

Roundup Xtend Soybean

Herbicide	Product/A (ae/A)	Weeds	When to Apply	Remarks and Paragraphs
Engenia 5 SL FeXapan 2.9SL XtendiMax 2.9SL (dicamba[4]) **RUP** Only certified applicators may purchase and apply.	**Single application rate in-crop: 12.8 5SL 22 fl oz 2.9SL** (0.5 lb ae) **Maximum total in-crop:** 1 lb ae **Maximum total/yr:** 2 lb ae **Do not apply less than 0.5 lb ae/A for any application.**	Annual and perennial broadleaf weeds.	EPP, At Planting, PRE and POST. Soybean: Emergence to pre-bloom or no more than 45 days after planting, whichever comes first. Weeds: Less than 4 inches tall.	**Apply only to RU Xtend soybean varieties.** Drift and off-site movement may cause injury or death to susceptible plants and crops. For all application information and restrictions refer to: www.xtendimaxapplicationrequirements.com www.engeniatankmix.com / www.fexapan web site • Do not deviate in use from label or web sites (above). • Dicamba or auxin-specific training is required. • Apply with approved nozzles and adjuvants. • Do not add any product containing ammonium. • Do not apply before/during temperature inversion. • Do not apply when wind speed is <3 or >10 mph. • Maintain a 110 or 220 foot buffer depending on rate. A3-8 B6 B8 D1 D3 D8 E1 E4
Tavium 3.38 SL (dicamba[4] & *S*-metolachlor[15])	**56.5 fl oz CS** (0.5 lb & 1 lb)	Annual and perennial broadleaf weeds. Residual control of grass and small-seeded broadleaf weeds	EPP, At Planting, PRE and POST. Soybean: Emergence to V4 or no more than 45 days after planting, whichever comes first. Weeds: Less than 4 inches tall.	

Dicamba Applications to DT Soybeans in 2020

ND implemented a State and Local Need (SLN), 24c label with restrictions beyond the Federal Section 3 Label in 2019. At the time of this writing, ND Department of Agriculture is CONSIDERING implementing similar restrictions for 2020. However, this is a multistep process requiring support of registrants and EPA. NDSU has established the following link to apprise applicators of developments. A link to the ND Department of Agriculture website will be provided if a SLN is implemented. Use the following link for the latest information: https://tinyurl.com/ND-Dicamba2019SLN

Some reasons why off-site movement of dicamba can occur:

1. Soybean can show phytotoxic symptoms from dicamba at rates as low as 0.0004 oz ae/A (0.028 g/ha). Very small amounts of dicamba from contaminated sprayers, particle drift, and volatility can cause injury symptoms on soybean. Extremely high soybean sensitivity to dicamba influences all other discussion points.
2. Dicamba rate used in DT soybean is 8 oz ae/A compared to 0.5 to 2 oz ae/A used in wheat and corn. The higher dicamba rate applied in DT soybean applied during late June and early July can result in very high release of dicamba into the environment, which could be a source for particle drift and volatility.
3. Higher temperatures occur in late June and early July. The vapor pressure of dicamba significantly increases as temperature increases.
4. Dicamba is normally applied in May and early June in wheat and corn. Dicamba in DT soybean allows application prior to R1 stage. Later applications are more prone to dicamba drift because temperatures are higher, which allows greater dicamba volatility while soybeans are more advanced in growth to intercept dicamba, express injury symptoms, and possibly reduce yield.
5. Dicamba drift is more likely to cause yield loss the closer to and including reproductive stage. Summer solstice (June 21) is the reproductive trigger in soybean.
6. Precipitation normally decreases after late June. Dicamba is highly water soluble and rain events after application can "wash" dicamba off plant leaves into the soil to trap dicamba and reduce off-target movement.

NDSU Weed Science recommends no dicamba applications after June 20 - See #3-6 above.

- This allows for PRE and Early POST applications.
- This supports the residual PRE concept for effective weed management and encourages timely applications.
- Soybeans are photoperiod sensitive: the reproductive phase begins after the longest day of the year (June 21). Off-target drift of dicamba is more likely to injure non-tolerant soybean yield when it enters the reproductive phase.
- Most off-target dicamba drift complaints result from postemergence applications. Postemergence applications have the greatest potential to contact and injure susceptible vegetation. Spraying conditions may be favorable after June 20 but average temperatures are higher, which exponentially increase the potential for dicamba volatilization. Soybean plants will be larger to intercept more herbicide.

More POST Options ≠ Skip a PRE

HERBICIDE-RESISTANT SOYBEAN

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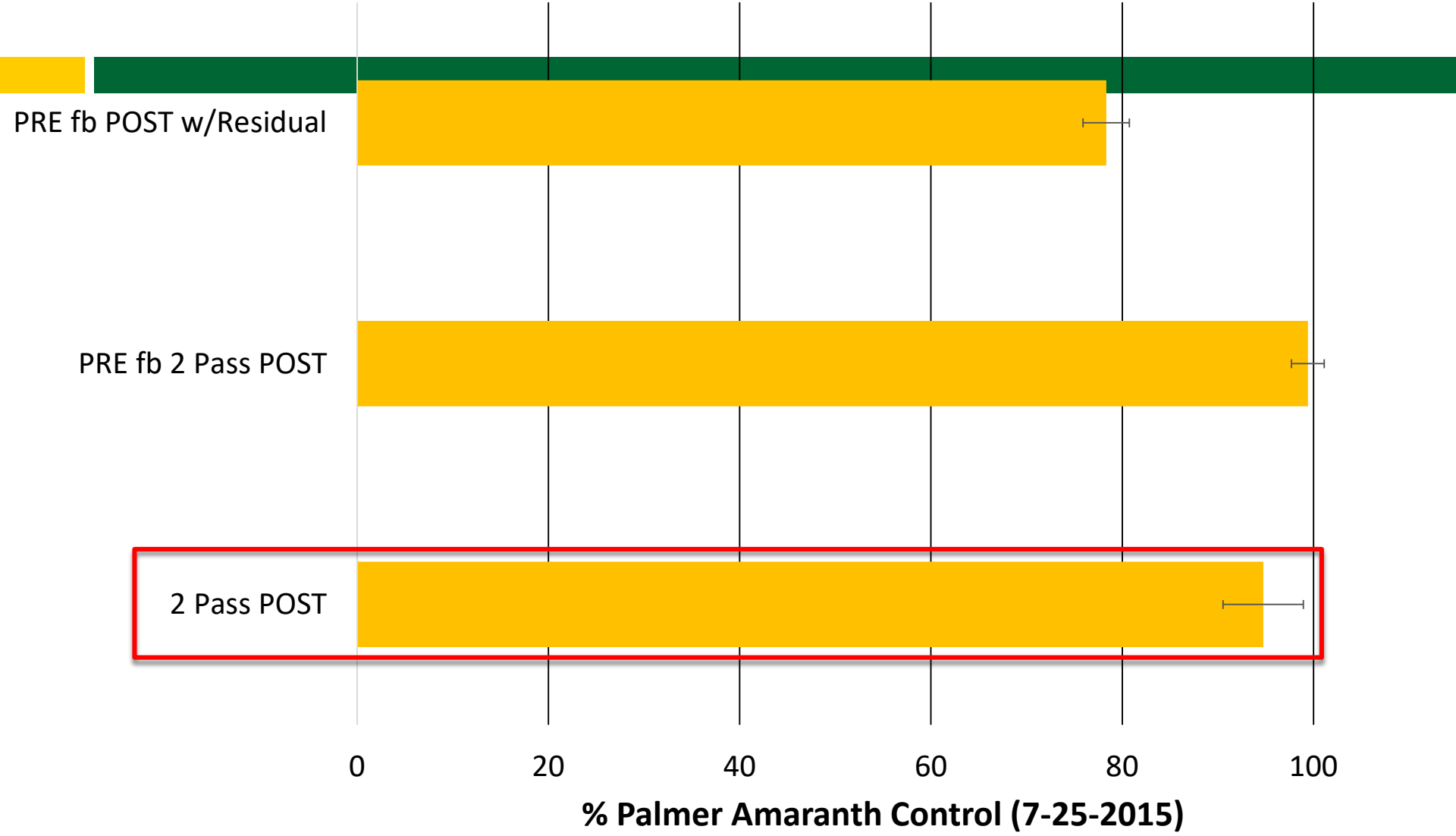
Xtend Program Approaches on Glyphosate-Resistant Palmer



Roundup Ready Stewardship Plan in the late 1990's

No Reason For Residuals In Roundup Ready® Soybeans

Roundup Ready® SOYBEANS

Extensive research has shown that the best weed control and value is achieved when Roundup Ultra™ herbicide is used alone in Roundup Ready® soybeans. Soil residual herbicides add costs, offer no significant weed control benefit, and *create the potential for greater crop injury, delayed canopy closure and carryover.*

Weed Control Comparisons

All across the major soybean growing areas of the Midwest, the consolidated data from 1993 through 1997 confirms the outstanding weed control provided by Roundup Ultra alone in Roundup Ready soybeans.

Narrow Rows (Less than 20")

Weed Species	% Weed Control Roundup Ultra	% Weed Control Prowl®/Pursuit®	% Weed Control Roundup Ultra	% Weed Control DNA/Roundup Ultra
Giant Foxtail	95	92	96	96
Crabgrass	96	89	95	94
Fall Panicum	93	70	92	92
Velvetleaf	92	89	96	95
Lambsquarters	94	76	91	93
Pigweed	92	86	94	92
Waterhemp	95	77	95	94
Cocklebur	94	90	95	93
Giant Ragweed	87	72	91	89
Morningglory	85	77	83	81
Penn. Smartweed	92	90	93	89

Notes: 1) Clean start with Roundup Ultra at labeled rates – or tillage
2) Rates: Roundup Ultra – 32 oz/A; Commercial Standards – Labeled Rates
3) All tillages combined

Wide Rows (Greater than 20")

Weed Species	% Weed Control Roundup Ultra	% Weed Control Prowl®/Pursuit®	% Weed Control Roundup Ultra	% Weed Control DNA/Roundup Ultra
Giant Foxtail	93	94	95	97
Crabgrass	90	79	94	95
Fall Panicum	94	71	90	91
Velvetleaf	93	90	95	91
Lambsquarters	93	75	94	92
Pigweed	94	89	94	96
Waterhemp	94	72	95	97
Cocklebur	92	90	95	93
Giant Ragweed	86	82	89	88
Morningglory	84	72	80	81
Penn. Smartweed	95	82	93	89

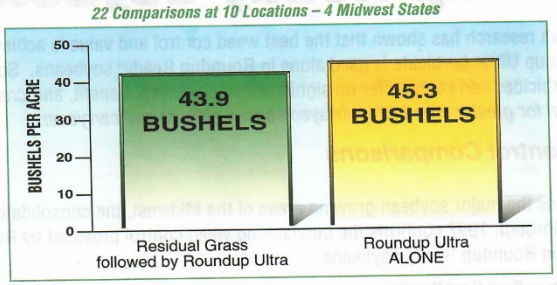
Notes: 1) Clean start with Roundup Ultra at labeled rates – or tillage
2) Rates: Roundup Ultra @ 32 oz/A or Roundup Ultra @ 32 oz/A followed by 16-24 oz/A sequential treatment; Commercial Standards – Labeled Rates
3) All tillages combined

Source: Monsanto Product Development and Academic Data 1993-1997

Yield Comparisons

Field studies were conducted in 1996 comparing Roundup Ultra as a stand-alone treatment versus a residual grass herbicide followed by Roundup Ultra. These studies show that a stand-alone treatment of *Roundup Ultra performed better than or equal to* a residual followed by Roundup Ultra.

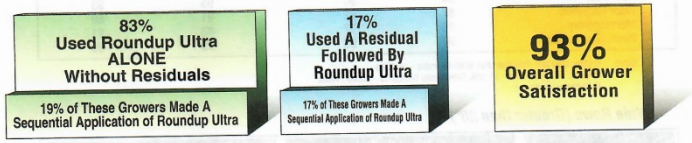
22 Comparisons at 10 Locations – 4 Midwest States



Residual Grass = Treflan®/ Prowl®/ Dual®/ Lasso® Source: Academic and Monsanto Product Development

High Grower Satisfaction with Roundup Ultra Alone

Growers from the major soybean growing regions of the Midwest were surveyed and here's what they reported.



Growers surveyed = 656 Source: Marketing Horizons 11/96

Roundup ULTRA

The unmatched weed control of Roundup Ultra combined with outstanding crop safety provides strong yields and a high level of grower satisfaction.

Horseweed (Marestail)

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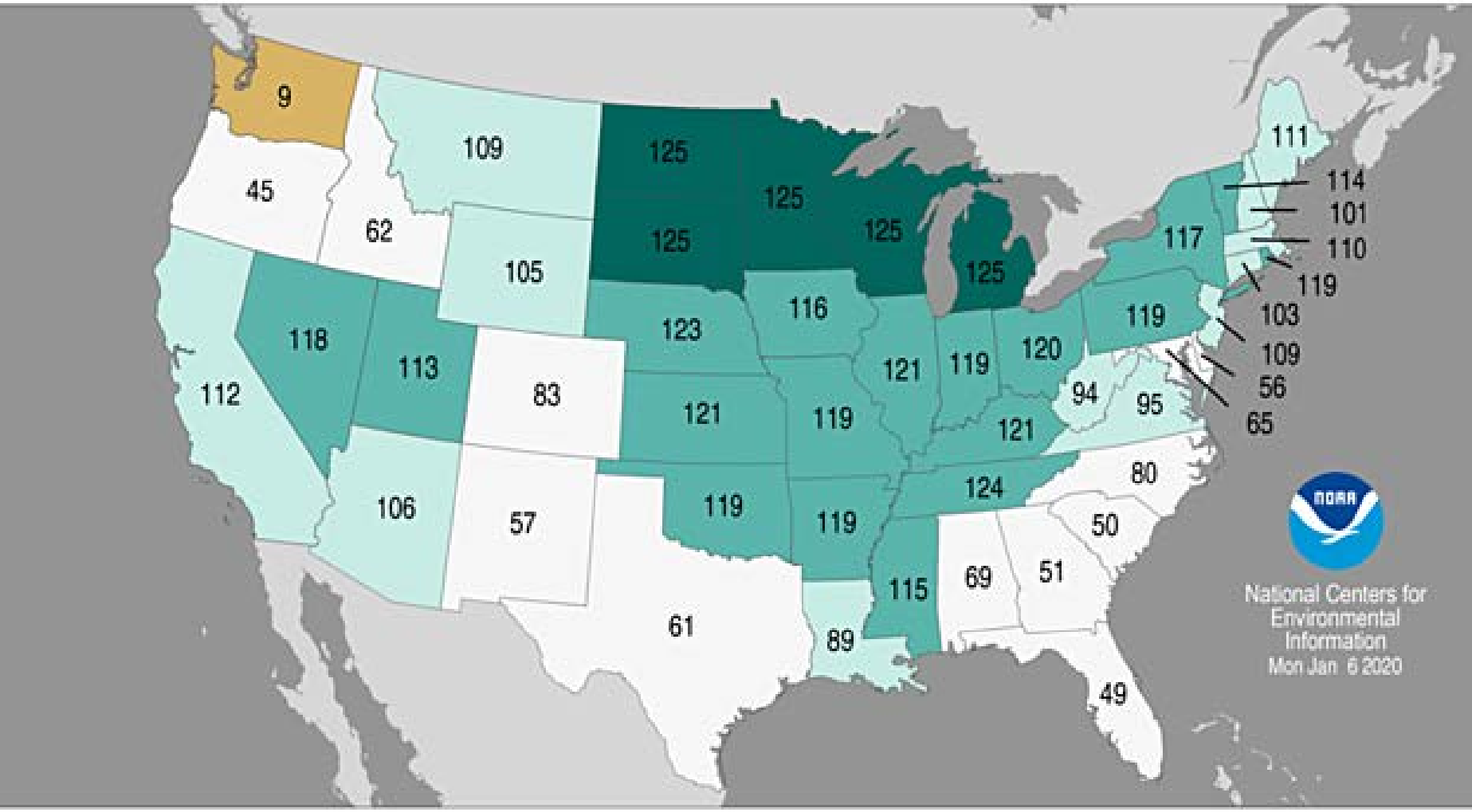
Statewide Precipitation Ranks

January–December 2019

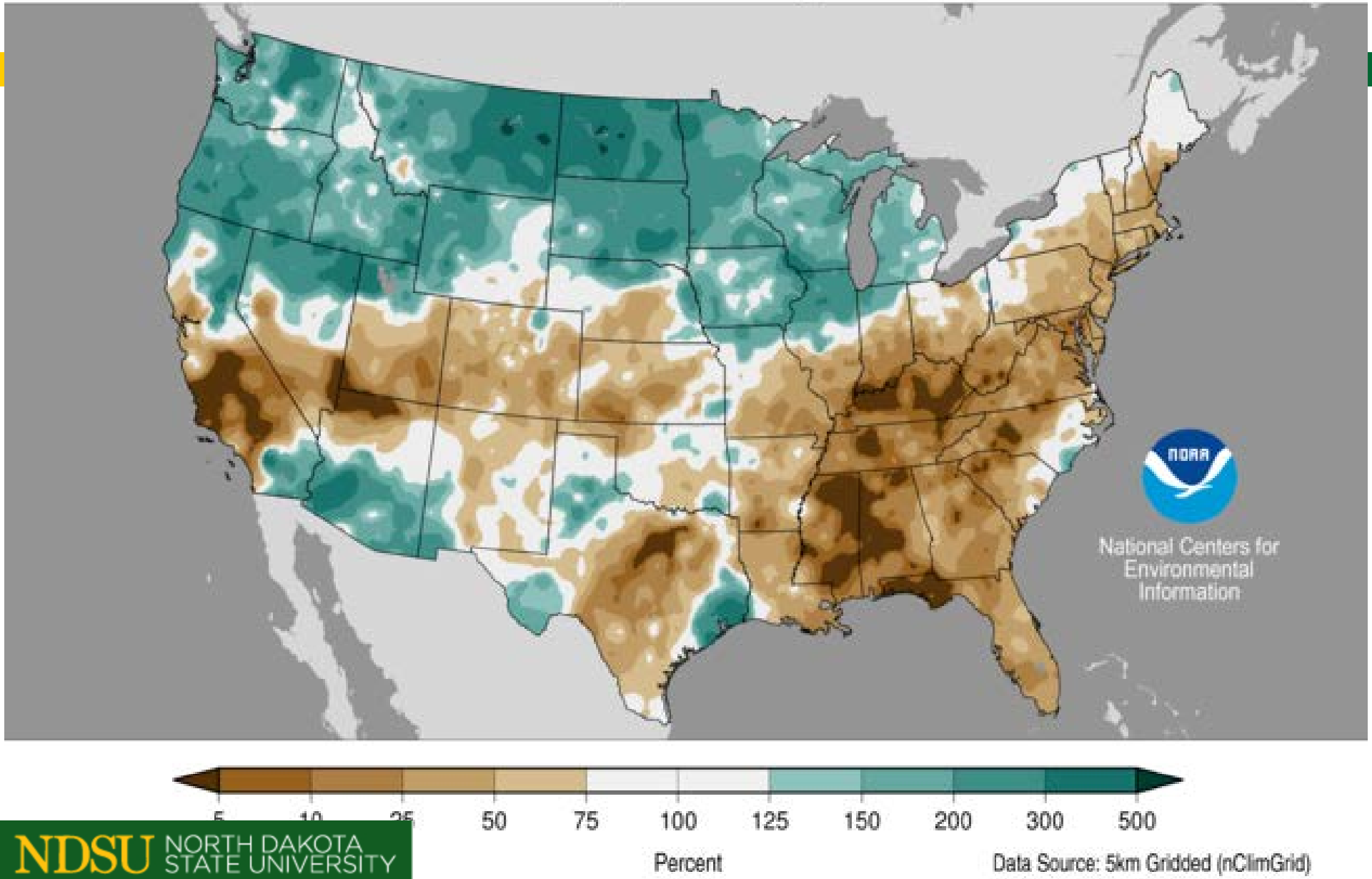
Period: 1895–2019



Precipitation Percent of Average

September 2019

Average Period: 20th Century



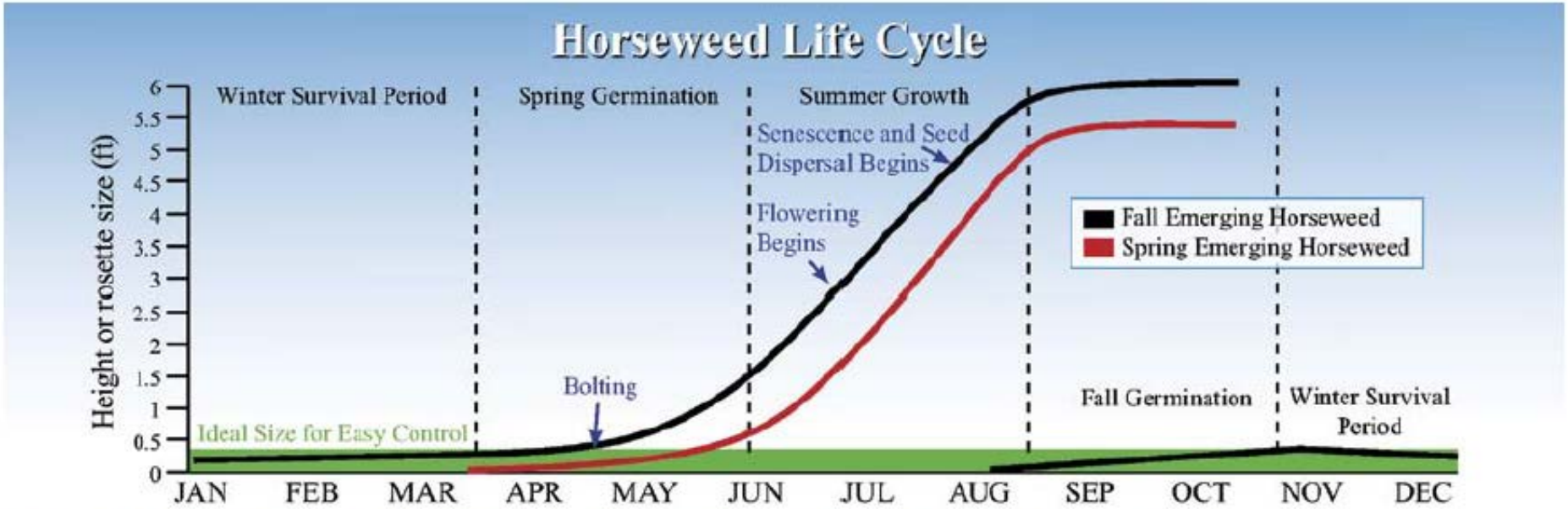


Figure 4. *This graph shows the relative life cycles of horseweed throughout the year for plants that emerge in the spring and fall.*

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Marestail Management Principles

- Field must be free of marestail at time of planting
  - Burndown control tougher in the spring
    - Paraquat + metribuzin + group 4, Sharpen products
  - Do not rely on glyphosate or 2,4-D alone
    - Dicamba and Elevore slightly better than 2,4-D

- Need residual marestail control for 6 to 8 weeks after planting
  - Apply residual (PRE) herbicides in spring
  - Broad-spectrum products that contain full rate of metribuzin (5 oz or more), Valor, Authority

- If you have “multiple resistant” glyphosate and ALS resistant marestail
  - Grow corn or wheat
  - Only POST options are Liberty, Dicamba, and Enlist HR crops

Narrowleaf Hawksbeard Control

Photo: Ed Davis
Montana State University

Narrowleaf hawksbeard control

Fall:

1. Glyphosate + Express (or Panoflex) + (2,4-D)
2. Glyphosate + Sharpen + (2,4-D)
3. Glyphosate + (2,4-D)
4. Glyphosate + dicamba (be aware of rotation restrictions)
5. Glyphosate + Valor + (2,4-D)

Spring:

1. Glyphosate + Sharpen (rosette stage)
2. Glyphosate
3. In-crop wheat: Affinity BS + 2,4-D, GoldSky, Starane Flex + 2,4-D
   - WideMatch + 2,4-D not sufficient

Kochia Control in Soybeans
(Assuming ALS and glyphosate-resistant)

- Start clean and use residuals at planting
  - Sulfentrazone (Authority), metribuzin (Sencor), flumioxazin (Valor), pyroxasulfone (Zidua)

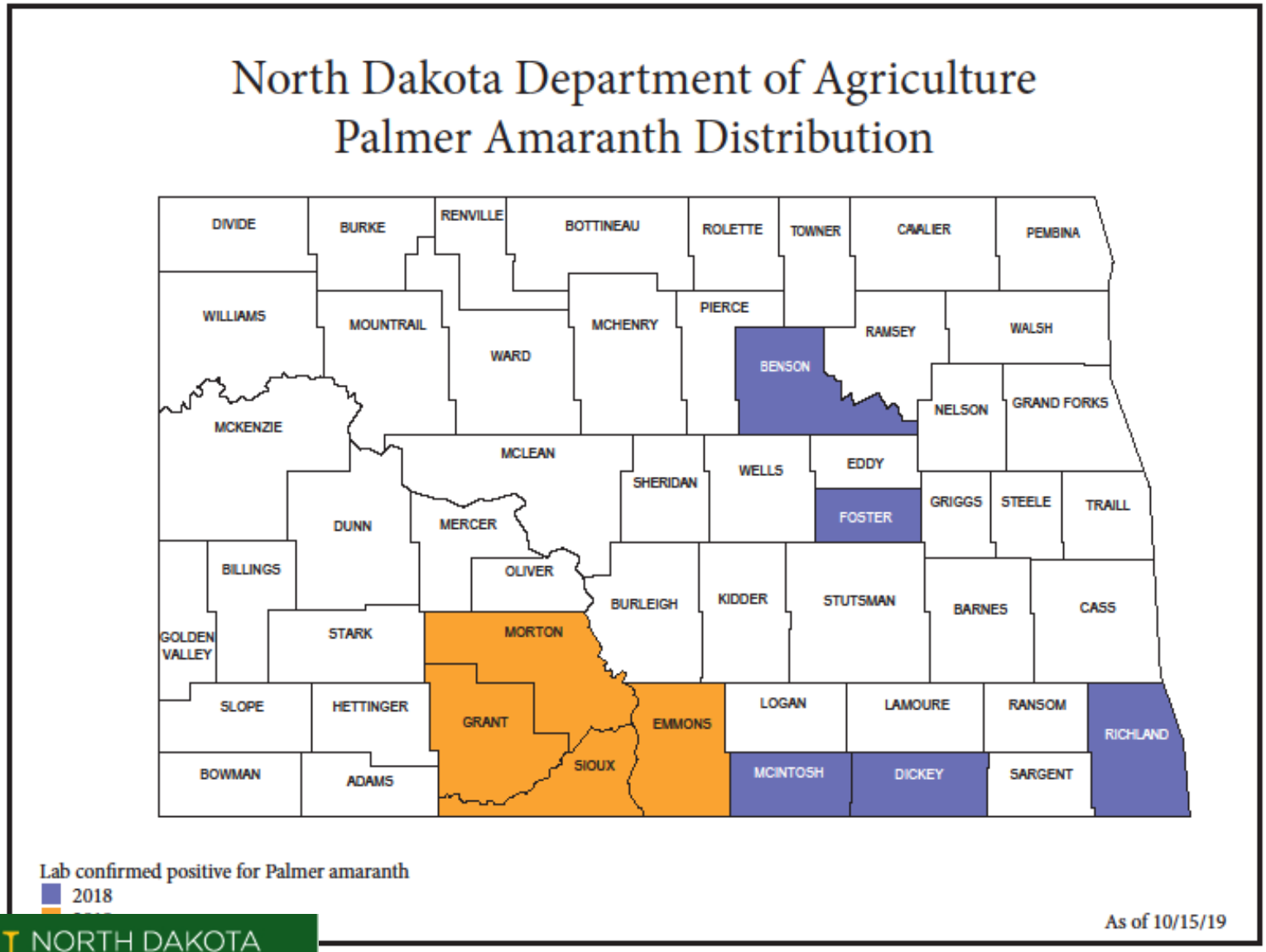
- **TIMELY** post treatments + another layer of residual
  - Flexstar – NOT all counties. 9 months to small grains. 12 to 18 months for most other crops
  - Or
  - Liberty
  - Or
  - Xtendimax/Engenia

Dicamb

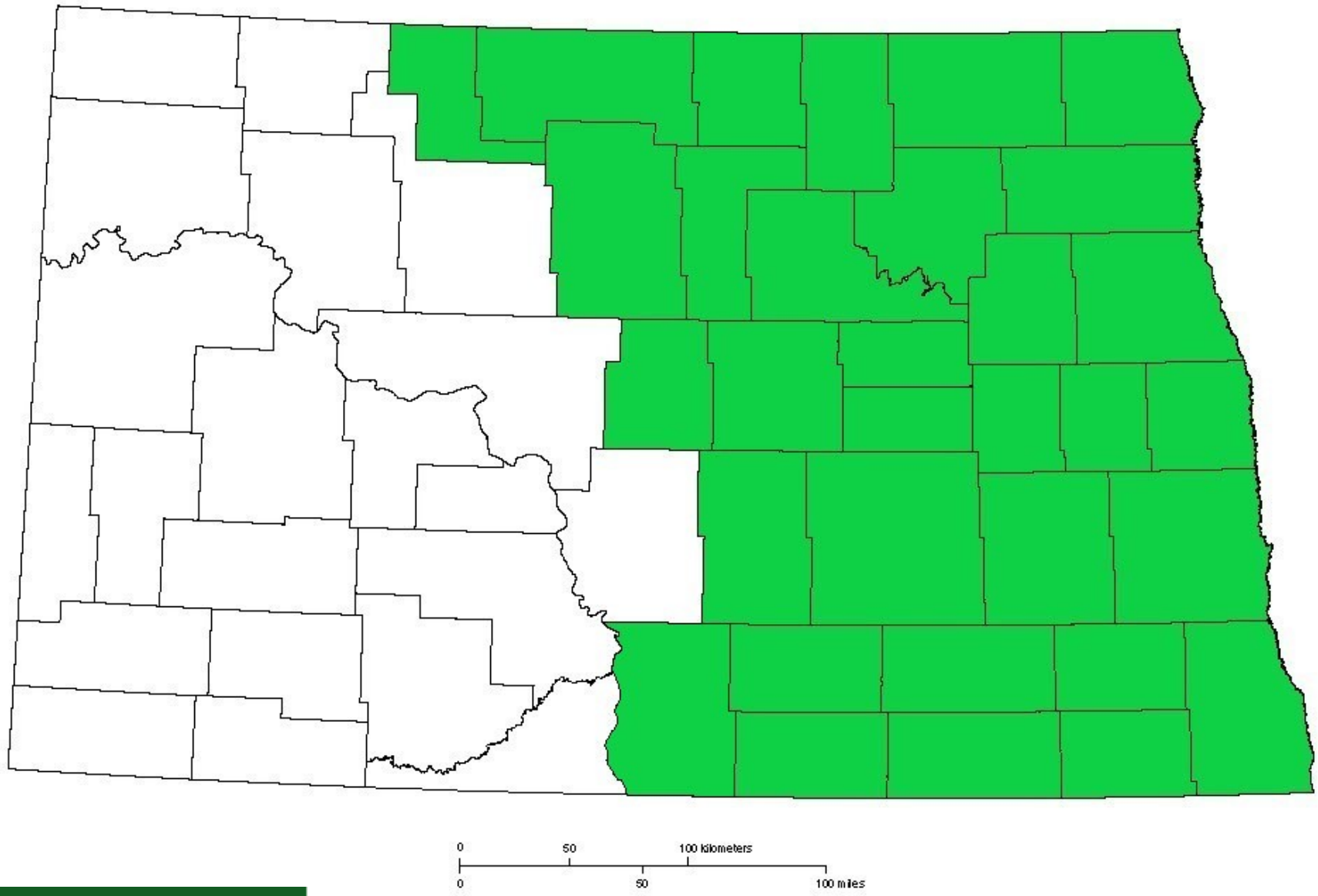
Palmer Amaranth

Waterhemp

Palmer 2019 Update



NORTH DAKOTA



Waterhemp/Palmer Control in Soybeans

(assuming it is glyphosate and ALS resistant but not PPO resistant)

- Start clean and use residuals at planting
  - Sulfentrazone (Authority), flumioxazin (Valor), pyroxasulfone (Zidua)
  - Metribuzin (at least 6 oz), metolachlor (Dual), acetochlor (Warrant), dimethenamid (Outlook), anything yellow
- **TIMELY** post treatments + another layer of residual
  - Flexstar/Cobra/Blazer + metolachlor, acetochlor, dimethenamid, or pyroxasulfone
  - Or
  - Liberty + metolachlor, acetochlor, dimethenamid, or pyroxasulfone in LL soybean
  - Or
  - Xtendimax/Engenia + approved group 15 in RR2Xtend soybean
  - Or
  - Enlist (tank-mix with Liberty) + approved group 15 in Enlist soybean

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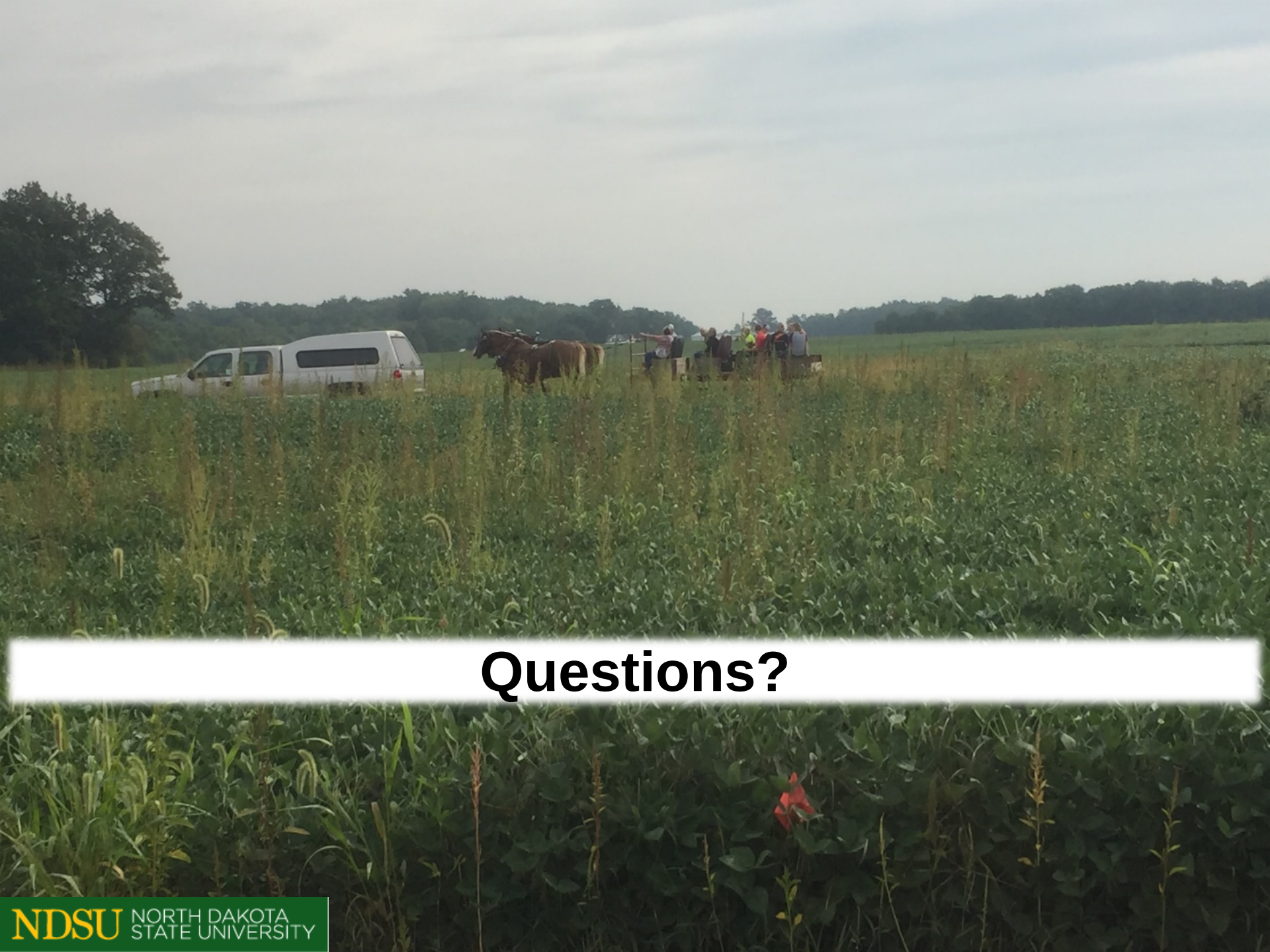

Questions?

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