



2021 Palmer Amaranth Research
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Palmer Amaranth Trials in 2021

- Barnes County population tested
 - Collected and cleaned from screenings pile in September 2020
 - Field trials on escapes in cattle-feed area
- Greenhouse
 - Resistance screening
 - Some tank-mixes
- Field
 - 22 different trials
 - Some resistance screening
 - Mainly herbicide programs in corn, soybean, dry bean

Herbicide Screen – Materials and Methods

- Randomized Complete Block Design
 - 6 herbicides
 - 1× and 3× field rate in ND
 - 11 replications

- Weed Control at 7, 14, and 21 days after treatment
 - Visual rating, 0 to 100 scale
 - Biomass at 21 days after treatment

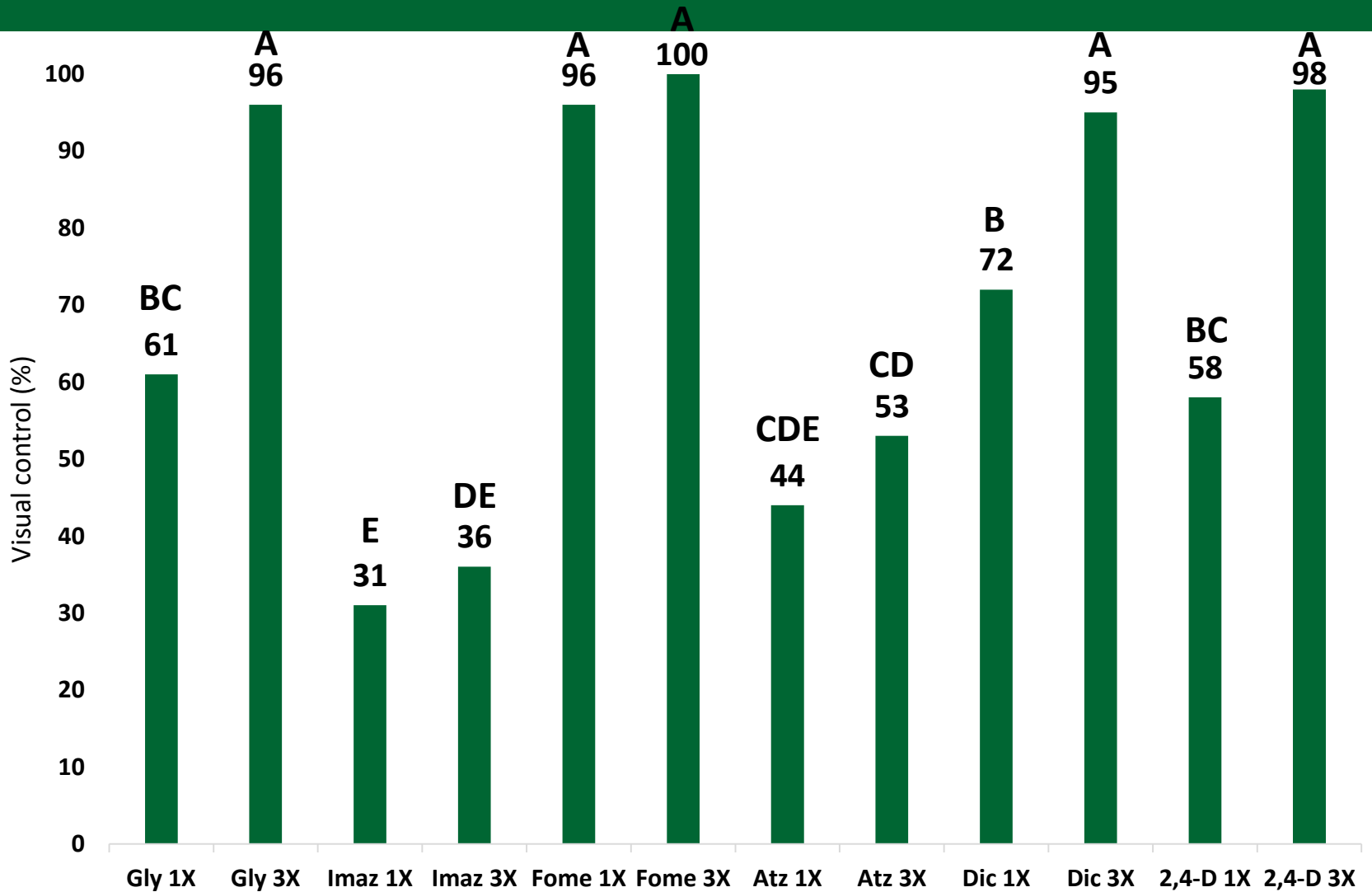
- Data analysis
 - Pooled across experiments
 - Fisher's LSD (0.05) in PROC GLIMMIX, SAS 9.4

Herbicide Screen – Materials and Methods

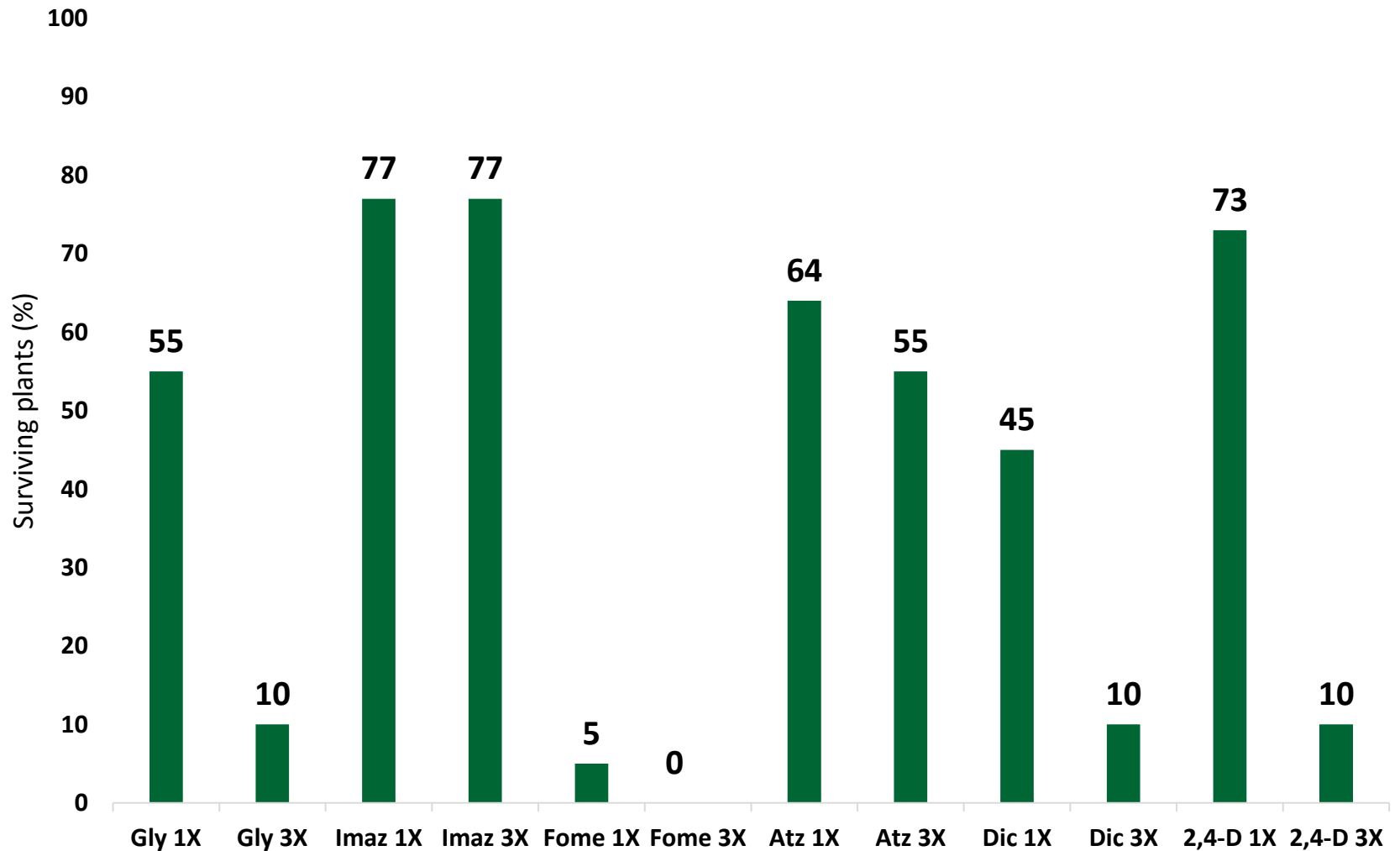
- Herbicides applied to 3” tall Palmer amaranth
- 15 GPA carrier volume

Herbicide	1X Rate	Site of Action
Glyphosate	1.125 lb/A	9
Imazamox (Raptor)	4 fl oz/A	2
Fomesafen (Flexstar)	0.75 pt/A	14
Atrazine	0.5 lb/A	5
Dicamba	0.5 lb/A	4
2,4-D	0.5 lb/A	4

Palmer amaranth Control 21 DAT



Surviving Palmer amaranth Plants



UNTRT

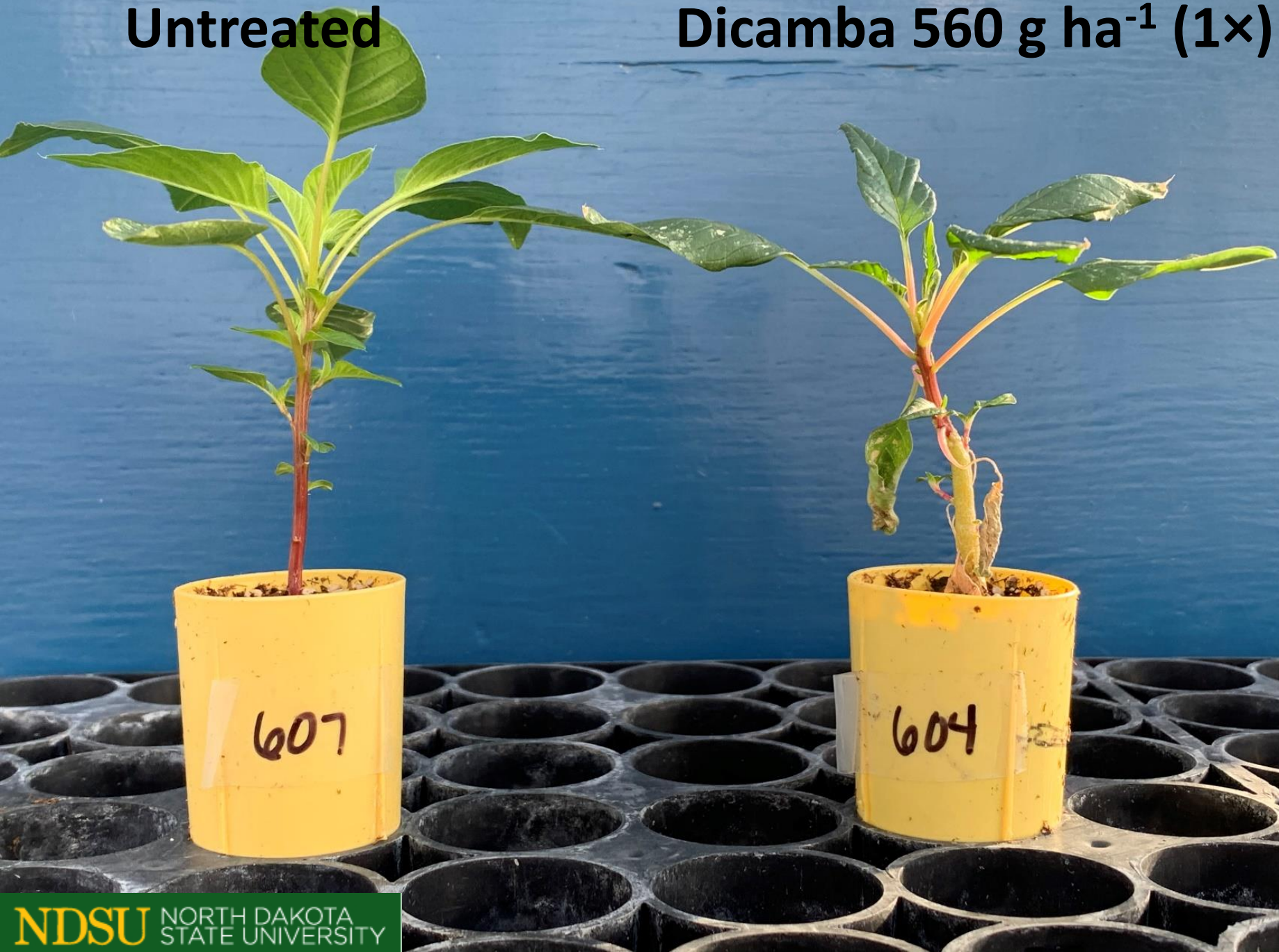
Raptor 1x

Raptor 3x



Untreated

Dicamba 560 g ha⁻¹ (1×)



Untreated

2,4-D 560 g ha⁻¹ (1×)



Glyphosate Resistance Screen

- 112 Palmer amaranth plants treated with 1260 g ha⁻¹ (1.125 lb/A) glyphosate
- Plant tissue tested for amplification of EPSPS
- 41% of plants survived 21 DAT
 - 89% of survivors overexpressed EPSPS



ALS Resistance Screen

- 112 Palmer amaranth plants treated with 35 g ha⁻¹ imazamox (4 oz/A Raptor)
- 81% of plants survived 21 DAT
 - 74% of survivors exhibited little symptomology



Herbicide Screen 2 – Materials and Methods

- Randomized Complete Block Design
 - 5 herbicides
 - 1× and 3× field rate in ND
 - 10 replications

- Weed Control at 7, 14, and 21 days after treatment
 - Visual rating, 0 to 100 scale
 - Biomass at 21 days after treatment

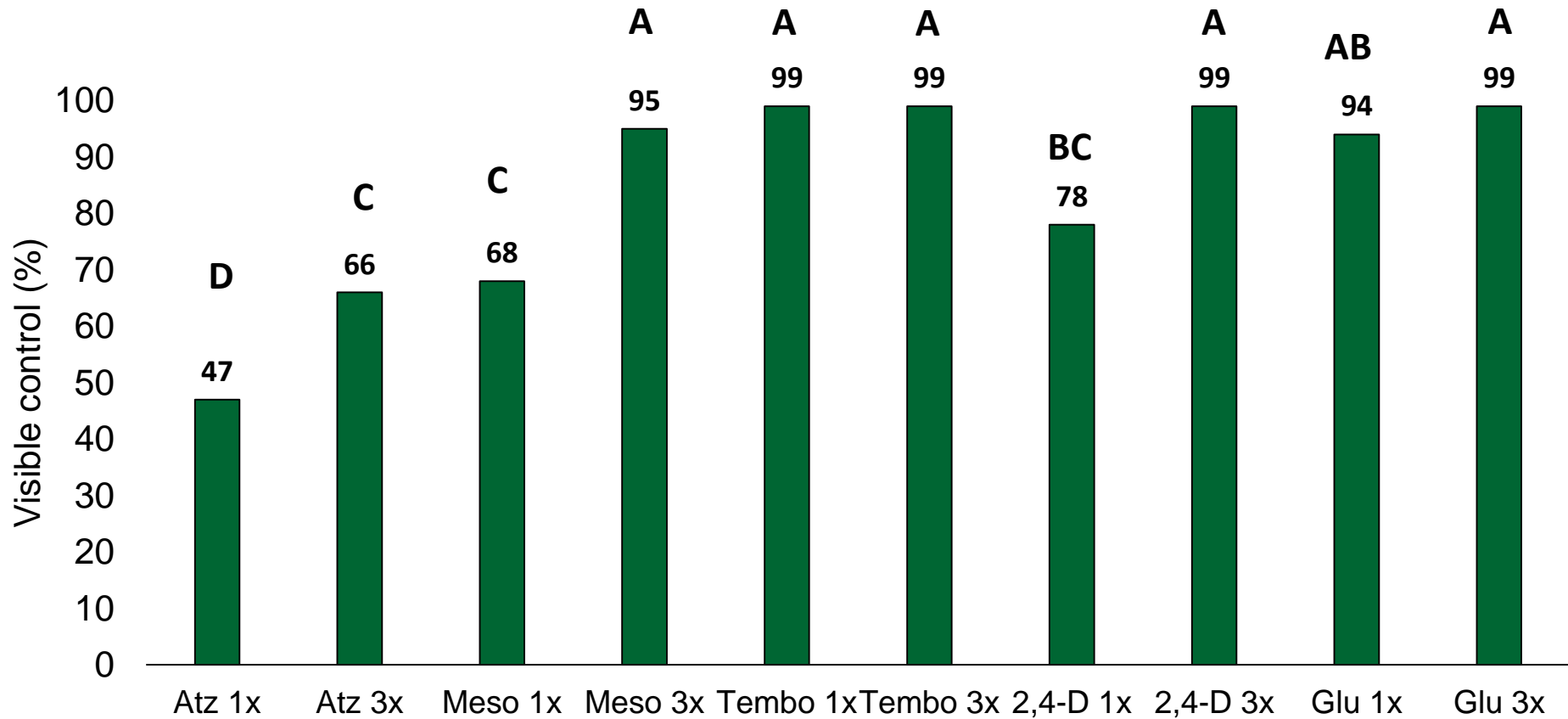
- Data analysis
 - Pooled across experiments
 - Fisher's LSD (0.05) in PROC GLIMMIX, SAS 9.4

Herbicide Screen – Materials and Methods

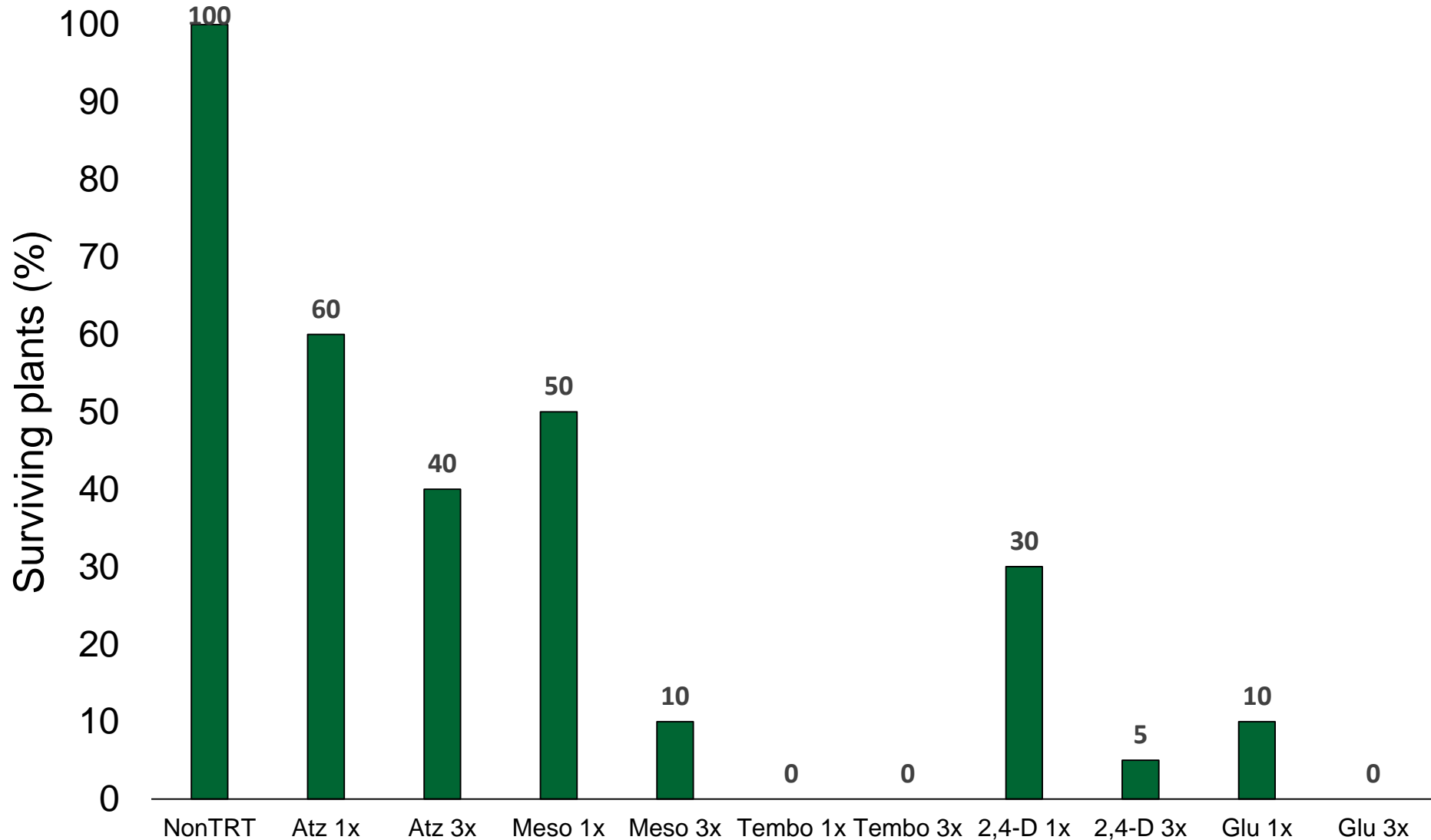
- Herbicides applied to 3” tall Palmer amaranth
- 15 GPA carrier volume

Herbicide	1× Rate	Site of Action
Atrazine	0.5 lb/A	5
Mesotrione (Callisto)	3 fl oz/A	27
Tembotrione (Laudis)	3 fl oz/A	27
Glufosinate (Liberty)	32 fl oz/A	10
2,4-D	1 lb/A	4

Palmer amaranth Control 21 DAT



Surviving Palmer amaranth Plants



Atrazine



Untreated

1.5 lb/A

Atrazine



Mesotrione



Untreated

3 fl oz/A



Untreated



3 fl oz/A

2,4-D



Untreated

3 lb/A

Additional Greenhouse Treatments

- Tank-mixes evaluated for control at same time as second set of resistance testing
- All tank-mixes provided 100% control on both Palmer populations
- Callisto + atrazine (3 fl oz + 0.5 lb/A)
 - COC + AMS
- Laudis + atrazine (3 fl oz + 0.5 lb/A)
 - MSO + AMS
- 2,4-D + Liberty (1 lb + 32 fl oz/A)
 - AMS
- 2,4-D + Liberty + glyphosate (1 lb + 32 fl oz + 1.125 lb/A)
 - AMS

Greenhouse Screening Conclusions

- Resistance to 5 Sites of Action
 - Groups 2, 4, 5, 9, 27
 - Imazamox, 2,4-D, atrazine, glyphosate, mesotrione
- Putative metabolic (non-target site) resistance
 - Atrazine, 2,4-D, mesotrione
 - Tank-mixes effective for control
- Target site resistance
 - Glyphosate, ALS-inhibitors
- Susceptible individuals within population

Field Observations

- Palmer germination first noted around Memorial Day
 - Later than monoecious pigweeds
 - Similar to waterhemp
 - Germination continued through September in bare areas
- When other weeds left uncontrolled
 - Palmer present, but did not outcompete
 - Palmer generally the tallest plant at the end of the year
- When other weeds controlled
 - Palmer plants produced abundant leaves
 - Very bushy, high biomass

Corn PRE fb POST

Herbicide (Rate/A) PRE @ planting; POST @ 11" corn (~28 days after planting)	Palmer Control 28 days after POST
Acuron (1.25 qt) PRE Acuron + Powermax (1.25 qt + 1 qt) POST	99
Lumax EZ (1.5 qt) PRE Halex GT (2.6 pt) POST	99
Acuron Flexi (1.125 qt) PRE Acuron Flexi + Powermax (1.125 qt + 1 qt) POST	97
Surestart II (2 pt) PRE Resicore + Aatrex + Durango (1.25 pt + 1 pt + 1.5 pt) POST	99
Keystone LA NXT (1.5 pt) PRE Realm Q + Durango (4 oz + 1.5 pt) POST	99
Balance Flexx (4 fl oz) PRE Capreno + Harness + Powermax + Aatrex (3 fl oz + 2 pt + 1 qt + 1 pt) POST	99
Harness Max (40 fl oz) PRE Harness Max (40 fl oz) POST	99
Harness Xtra (3.2 pt) PRE Sinate + Aatrex (28 fl oz + 1 pt) POST	99
Verdict (1 pt) PRE Status + Aatrex + Powermax (5 oz + 1 pt + 1 qt) POST	99
Verdict (10 fl oz) PRE Armezon PRO + Aatrex + Powermax (18 fl oz + 0.75 pt + 1 qt) POST	99

Corn EPOST

Herbicide (Rate/A) POST @ V2 corn	Palmer Control 42 days after POST
Acuron GT (3.75 pt)	97
Acuron GT + Aatrex (3.75 pt + 1 pt)	98
Resicore + Powermax (1.25 qt + 26.6 fl oz)	97
Resicore + Aatrex + Powermax (1.25 qt + 1 pt + 26.6 fl oz)	96
Realm Q + Aatrex + Durango (4 oz + 1 pt + 24 fl oz)	97
Capreno + Harness + Powermax + Aatrex (3 fl oz + 2 pt + 1 qt + 1 pt)	98
Anthem Maxx + Callisto + Aatrex + Weathermax (4 fl oz + 3 fl oz + 1 pt + 22 fl oz)	96
Harness + Impact + Aatrex (1.75 pt + 1 fl oz + 1 pt)	99
Harness + Sinate + Aatrex (1.75 pt + 28 fl oz + 1 pt)	98
Armezon PRO + Aatrex + Powermax (18 fl oz + 1 pt + 1 qt)	98
Status + Outlook + Aatrex + Powermax (5 oz + 1 pt + 1 pt + 1 qt)	97

Xtend Soybean PRE fb POST

Herbicide (Rate/A) PRE @ Planting; POST @ 28 Days After Planting	Palmer Control 42 days after POST
Zidua PRO (4.5 fl oz) PRE Engenia + Zidua SC + Powermax (12.8 fl oz + 3.25 fl oz + 1 qt) POST	98
Zidua PRO (4.5 fl oz) PRE Liberty + Powermax + Outlook (1 qt + 1 qt + 12 fl oz) POST	92
Zidua PRO (4.5 fl oz) PRE Engenia + Liberty + Powermax + Zidua SC (12.8 fl oz + 1 qt + 1 qt + 3.25 fl oz) POST	97
Broadaxe (25 fl oz) PRE Tavium + Powermax (3.53 pt + 1 qt) POST	97
Boundary (1.67 pt) PRE Flexstar GT 3.5 (2.7 pt) POST	78
Mauler + Warrant (8 fl oz + 1.5 qt) PRE Xtendimax + Powermax + Warrant (22 fl oz + 1 qt + 1.5 qt) POST	95
Xtendimax + Mauler + Warrant (22 fl oz + 8 fl oz + 1.5 qt) PRE Xtendimax + Powermax + Warrant (22 fl oz + 1 qt + 1.5 qt) POST	96
Kyber (1.5 pt) PRE Xtendimax + Powermax + EverPreX (22 fl oz + 1 qt + 1 pt) POST	99
Xtendimax + Fierce MTZ (22 fl oz + 1.5 pt) PRE Xtendimax + Powermax + Perpetuo + Select Max (22 fl oz + 22 fl oz + 6 fl oz + 9 fl oz) POST	97

Soybean PRE fb POST

Herbicide (Rate/A) PRE @ Planting; POST @ 28 Days After Planting	Palmer Control 28 days after POST
Boundary (1.67 pt) PRE Flexstar GT 3.5 (2.7 pt) POST	63
Broadaxe (25 fl oz) PRE Flexstar GT 3.5 (2.7 pt) POST	79
Prefix (1.5 pt) PRE Flexstar GT 3.5 (2.7 pt) POST	69
Boundary (1.67 pt) PRE Tavium + Powermax (3.53 pt + 1 qt) POST	98
Broadaxe (25 fl oz) PRE Tavium + Powermax (3.53 pt + 1 qt) POST	96
Prefix (1.5 pt) PRE Tavium + Powermax (3.53 pt + 1 qt) POST	92

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This Publication Supercedes All Previous Issues

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North Dakota Weed Control Guide

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