# Creative weed management approaches in sugarbeet

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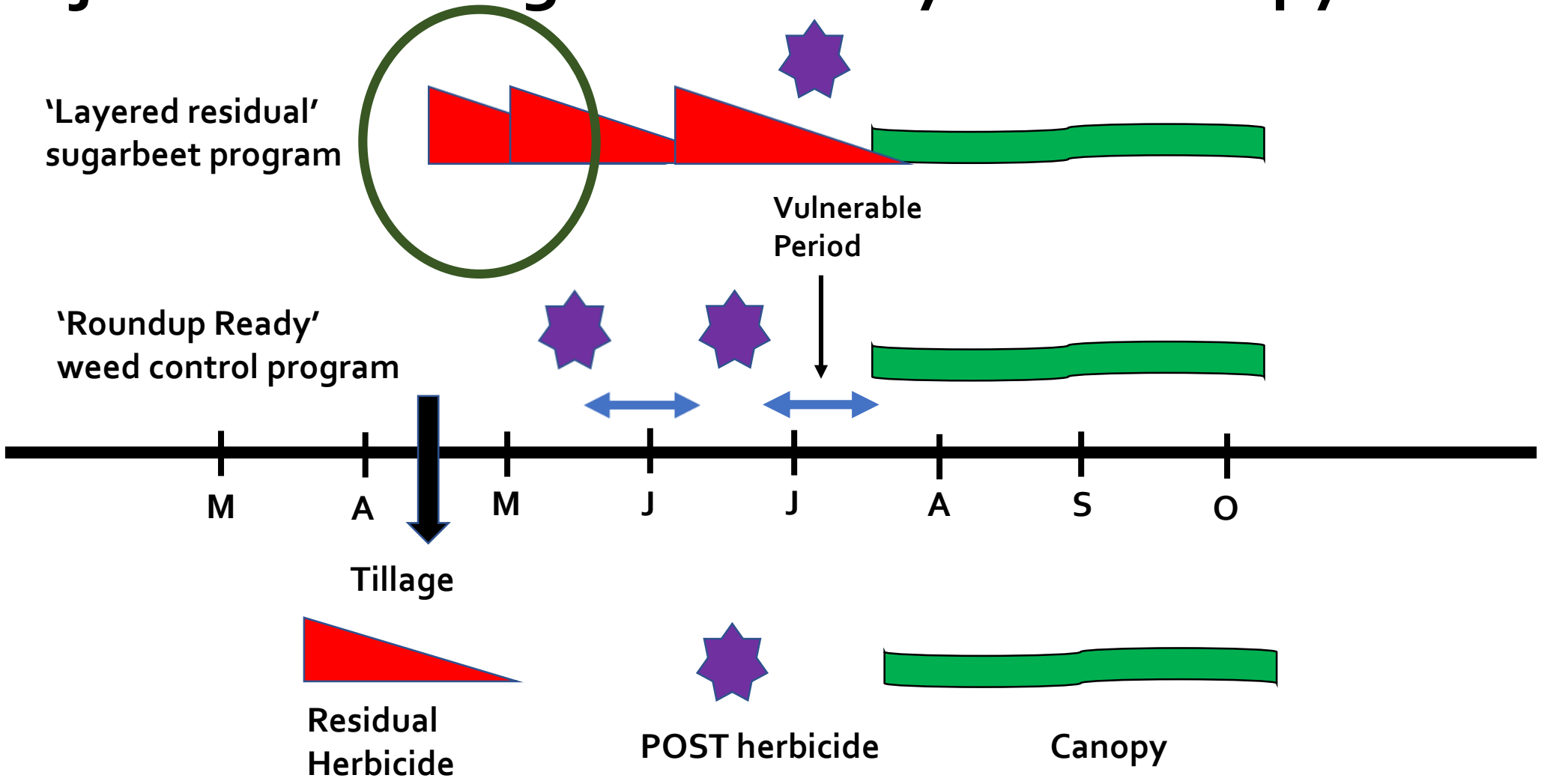
# Waterhemp is our most important weed control challenge in sugarbeet

- 635,000 acres sugarbeet in Minnesota and eastern North Dakota in 2020.
- Waterhemp was the most important weed control challenge on 373,100 acres, 59% of acreage according to survey.
- 94% and 95% of surveyed Producers attending 2019 Willmar and Wahpeton Grower seminars, respectfully, used chloroacetamide herbicides for waterhemp control.
- Adoption of layered application technique (PRE fb POST, EPOST fb POST or PRE fb EPOST fb POST) increased 805% between the 2014 and 2019 growing seasons.

# Layered Soil Residual Herbicides
## Objective: Prolong PRE activity until canopy fills




Adapted from a slide created by B Hartzler, ISU

# Producer evaluation*, waterhemp control from chloroacetamides' applied EPOST and POST


*2020 SMBSC Turning Point Grower Survey

# Waterhemp control POST in sugarbeet

- Desmedipham plus phenmedipham
- Cultivation to supplement residual herbicides (N. Haugrud)
- Ethofumesate POST at rates up to 3.75 lb/A POST (A. Lystad)
- Acifluorfen alone and in mixtures (E. Burt)
- **Hooded sprayers**
- **Electrical discharge systems**

# Herbicide post-directed though a hooded sprayer

- Common practice in cotton production
- Spray small weeds with a POST herbicide
- Contact herbicides / sugarbeet safety
- Equipment manufactured and sold by Willmar Fabrication

# Objectives of Research

- Determine sugarbeet tolerance and weed control when glufosinate or paraquat are applied at different rates and timings through a hooded sprayer

# Hooded sprayer designed by Willmar Fabrication


# Materials and Methods

## Sugarbeet Tolerance

- RCBD and 6 reps
- 2- to 4-,6- to 8- and 10 to 12-lf sugarbeet
- Liberty at 86 fl oz/A plus AMS at 3 lb/A
- Gramoxone at 32 fl oz/A plus non-ionic surfactant at 32 fl oz/A
- 19.4 gpa spray volume through 8002E Flat Fan nozzle
- Growth reduction
- Damage (num of spots on leaves, treated rows)
- Root yield, % sucrose, and recoverable sucrose

# Materials and Methods

## Waterhemp and Common Lambsquarters

- RCBD and 4 reps
- 19.4 gpa spray volume through 8002E Flat Fan nozzle
- Liberty at 32 and 43 fl oz/A plus AMS at 3 lb/A
- Gramoxone at 21 and 32 fl oz/A plus non-ionic surfactant at 32 fl oz/A
- Lambsquarters and waterhemp control at two sizes
  - Small waterhemp, 2- to 4-inch
  - Large waterhemp, 6- to 8-inch

# Phenotype observed on sugarbeet following Liberty POST directed through a hooded sprayer at the 6- to 8-lf stage

# Phenotype observed on sugarbeet following Gramoxone POST directed through a hooded sprayer at the 6- to 8-lf stage

# Growth reduction (%) and damage (number in treated row rows) in response to herbicides, Crookston and Lake Lillian, 2020[a]

| | | Crookston, MN | | Lake Lillian, MN | |
|---|---|---|---|---|---|
| **Herbicide treatment** | Growth Stage | GR | Damage | GR | Damage |
| | lvs | % | Num | % | Num |
| Glyphosate / glyp | 2-4 / 6-8 | 3 | 6 c | 2 c | 4 c |
| Liberty | 2-4 | 8 | 11 c | 22 ab | 81 ab |
| Liberty | 6-8 | 5 | 5 c | 5 c | 19 bc |
| Liberty | 10-12 | 9 | 80 a | 7 bc | 13 c |
| Gramoxone | 2-4 | 15 | 23 bc | 26 a | 134 a |
| Gramoxone | 6-8 | 18 | 46 b | 12 abc | 31 bc |
| Gramoxone | 10-12 | 7 | 27 bc | 13 abc | 30 bc |
| P-value | | 0.4596 | 0.0001 | 0.0002 | 0.0001 |

[a]Crookston, 7 to 8 DAT; Lake Lillian, 4 to 9 DAT

# Root yield, % sucrose, and recoverable sucrose in response to herbicides, Crookston, Lake Lillian and Prosper, 2020

| Herbicide treatment | Sugarbeet stage | Root Yield | % Sucrose | Recoverable sucrose |
|---|---|---|---|---|
| | --lvs-- | Ton/A | -%- | lb/A |
| Glyp / glyp | 2-4 / 6-8 | 30.1 | 16.2 | 8,628 |
| Liberty | 2-4 | 27.9 | 16.4 | 8,055 |
| Liberty | 6-8 | 29.3 | 16.2 | 8,789 |
| Liberty | 10-12 | 29.2 | 16.0 | 8,468 |
| Gramoxone | 2-4 | 27.9 | 16.4 | 8,392 |
| Gramoxone | 6-8 | 29.2 | 16.1 | 8,680 |
| Gramoxone | 10-12 | 28.6 | 16.0 | 8,362 |
| P-value | | 0.3146 | 0.8799 | 0.6049 |

# Waterhemp[a] control in response to herbicide treatments, 2020

| Herbicide | Rate | Size | Lake Lillian | Moorhead |
|---|---|---|---|---|
| | fl oz/A | | ----------%---------- | |
| Gly / gly | 28 / 28 | S / L | 45 b | 64 cd |
| Liberty | 32 | S | 80 a | 81 bc |
| Liberty | 32 | L | 51 b | 61 d |
| Liberty | 43 | S | 81 a | 90 ab |
| Liberty | 43 | L | 57 b | 82 ab |
| Gramoxone | 21 | S | 94 a | 87 ab |
| Gramoxone | 21 | L | 88 a | 91 ab |
| Gramoxone | 32 | S | 96 a | 96 a |
| Gramoxone | 32 | L | 95 a | 96 ab |

[a]Small and large waterhemp, Lake Lillian, 4- to 8-inch; Moorhead, 2- to 6-inch

Gramoxone at 21 fl oz/A, Lake Lillian, MN

Glufosinate at 32 fl oz/A, Lake Lillian, MN

# Summary

1. Liberty and Gramoxone are not approved for POST directed application in sugarbeet.
2. Growth reduction was negligible at Prosper and Crookston. Liberty or Gramoxone at the 2- to 4-leaf stage caused more injury than application after 6-lf sugarbeet.
3. Number of damaged leaves was transient and random; caused by operation or environment related factors.
4. Liberty and Gramoxone did not reduce yield, % sucrose or recoverable sucrose.
5. Liberty and Gramoxone improved control of 4- and 6-inch waterhemp as compared to repeat glyphosate applications.

# Should a farmer make the Investment?

BASF Corp. is developing a 24c local needs label for Liberty through the hooded sprayer for waterhemp control in sugarbeet. We believe the hooded sprayer could be a component of a weed management strategy in sugarbeet but should not be a substitute for soil applied herbicides for controlling glyphosate resistant weeds.

Pros:

- Liberty (and Gramoxone) control waterhemp escapes in sugarbeet
- Liberty (and Gramoxone) represent SOA currently not used in sugabeet production. Gramoxone is rarely used in crop production.
- An alternative for the producer not willing to consider inter-row cultivation

Cons:

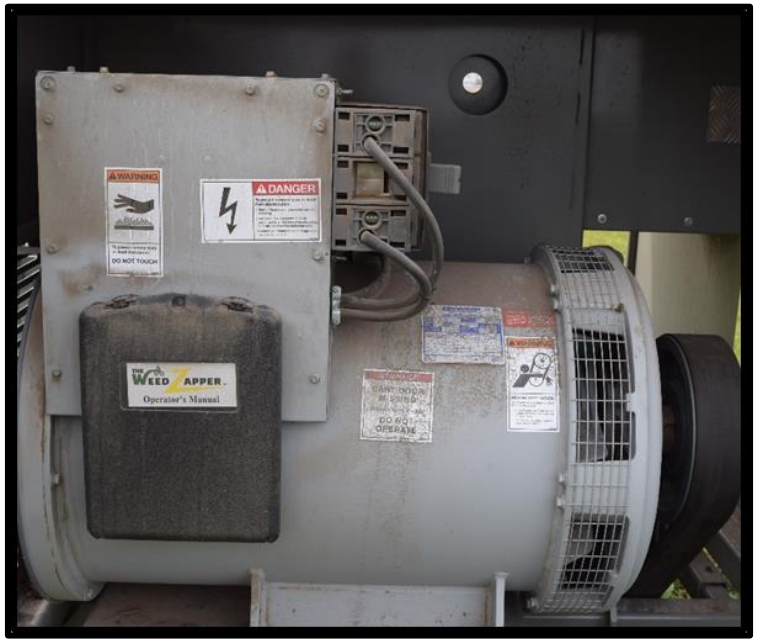
- Equipment purchase
- Hooded sprayer in 12-row, 18-row, and 24-row models does not offer the same application efficiency as the commercial equipment currently used for POST application

# EDS, generation II, 2020:

- The WeedZapper™, Sedalia, MO
- Developed in 2018
- 200,000 watts
- 40 to 44 ft boom front-end mounted
- PTO driven generator
- Requires a 275 PTO HP tractor
- 2 to 6 mph
- Safety improvements

# Voltage, Wattage, and Amperage
## using the analogy to water:

| Metric | Analogy to water through a pipe | Electricity | Weed Zapper |
|---|---|---|---|
| Voltage | pump forcing water to flow, i.e., water pressure | pressure, how strongly electricity is pushed in a circuit | up to 15,000 |
| Amperage | volume of water | the rate at which electricity flows | peak at 20 |
| Wattage | power produced i.e., propel a wind mill | measure of how much / how hard current is flowing, voltage x amps | 200,000 |





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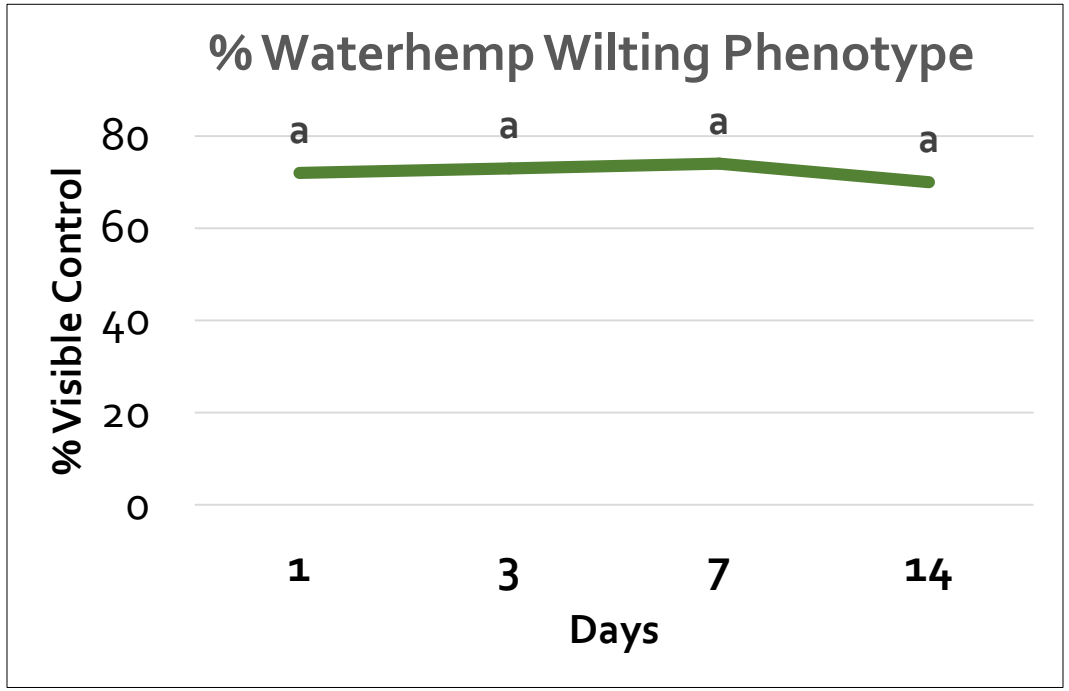
# Objectives

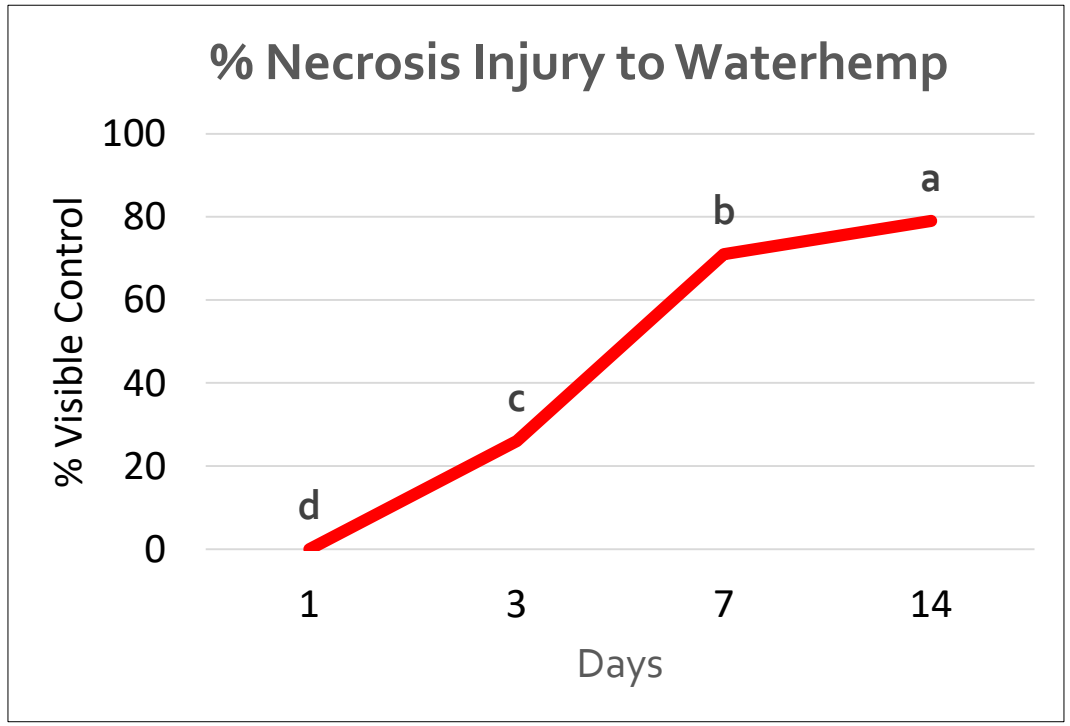
- Determine waterhemp (and kochia) control using the WeedZapper
- Determine if increasing pass number will enhance control
- Determine the viability of waterhemp seed at sugarbeet harvest

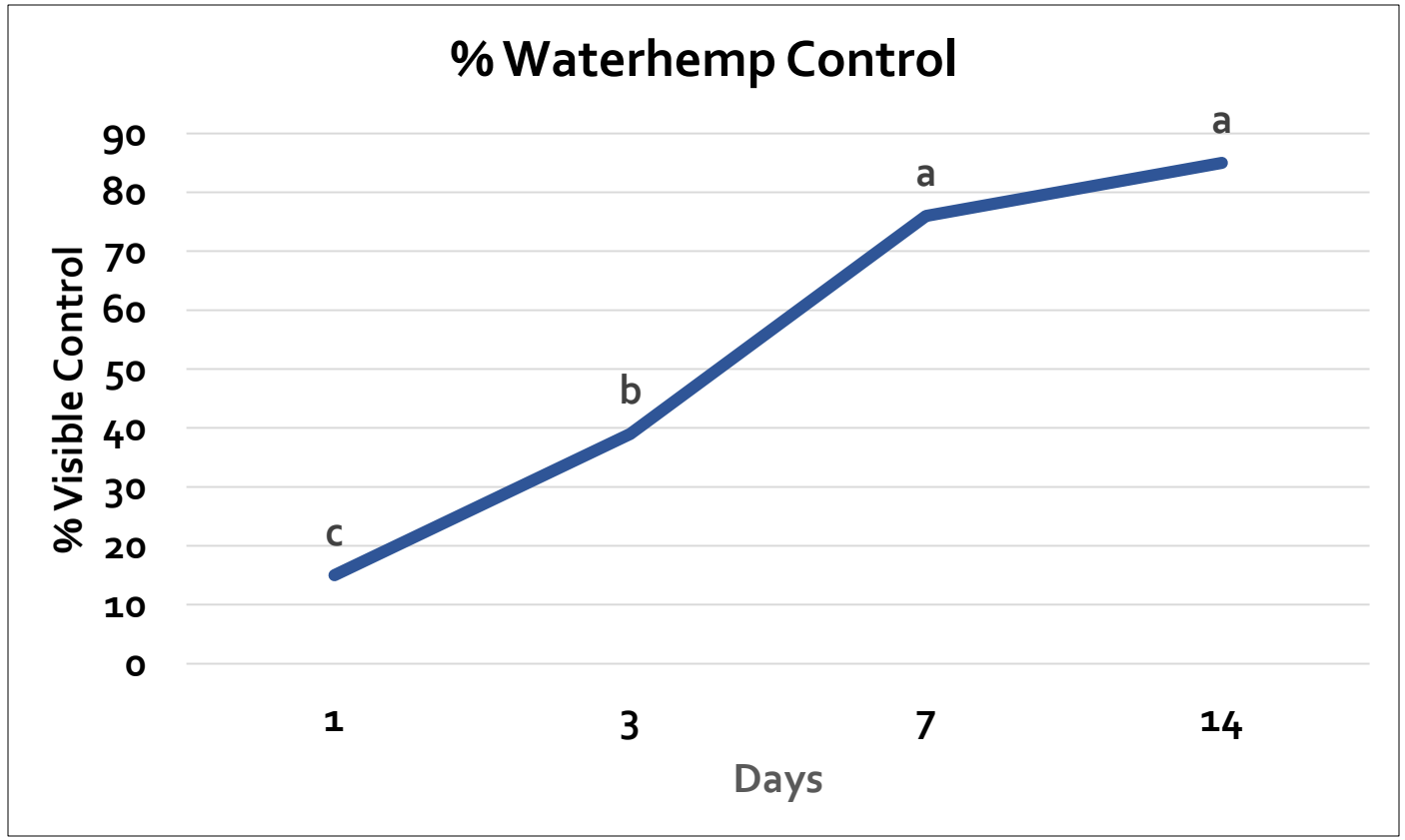
# Materials and Methods

- On-farm research in eight sugarbeet fields in July and August 2020.
- The WeedZapper™ was operated uniformly across the field.
- Data collection from two 5 x 5 square foot quadrats. Quadrats arranged in areas best representing weed density in fields. Quadrats were evaluated 1, 3, 7, and 14 days after treatment.
- Necrosis, wilting phenotype, and control (% visual control) were collected.
- Plant samples were collected from quadrats before sugarbeet harvest.

# Waterhemp control from the WeedZapper™, across locations, 2020



# Waterhemp: Timeline after treatment

Day 1:

Day 3-4:

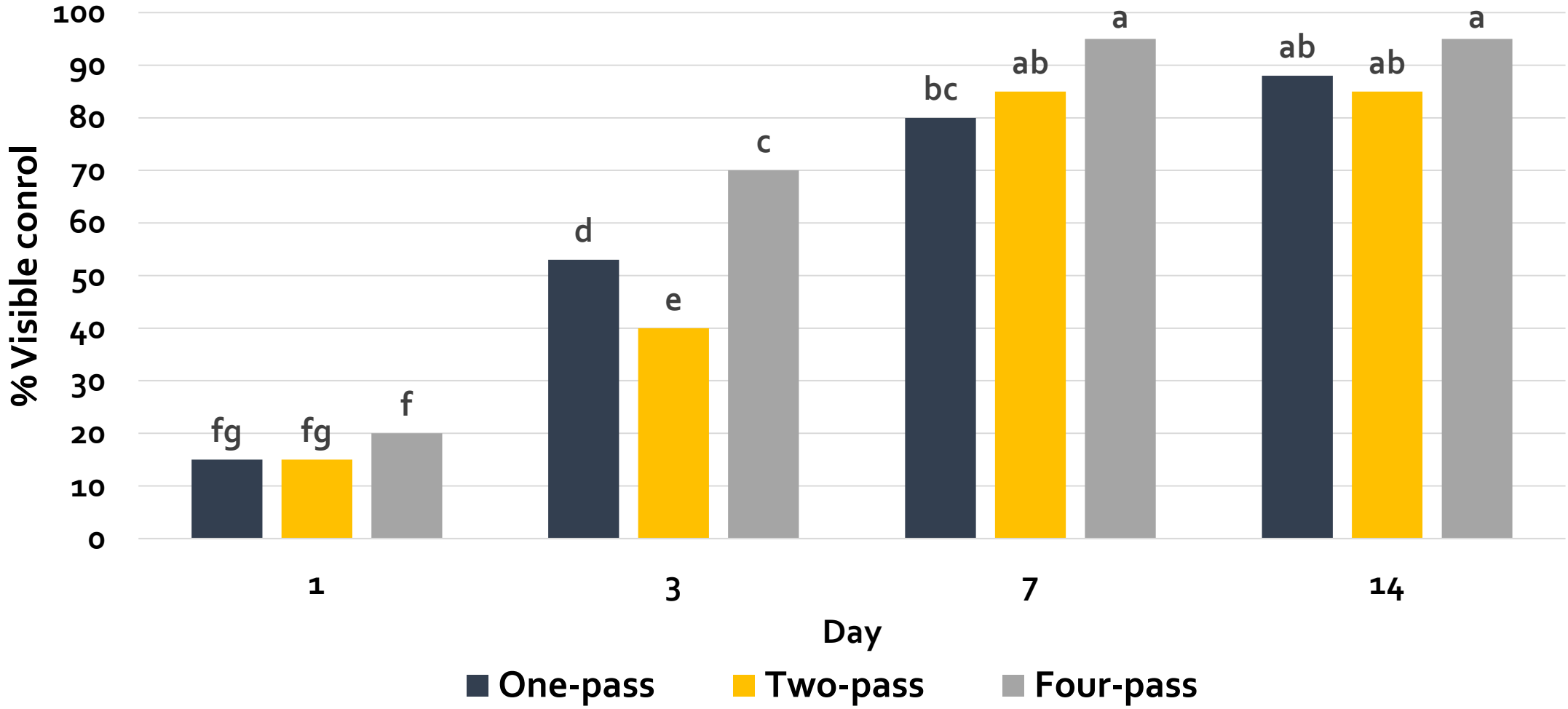
Day 7:

Day 14:

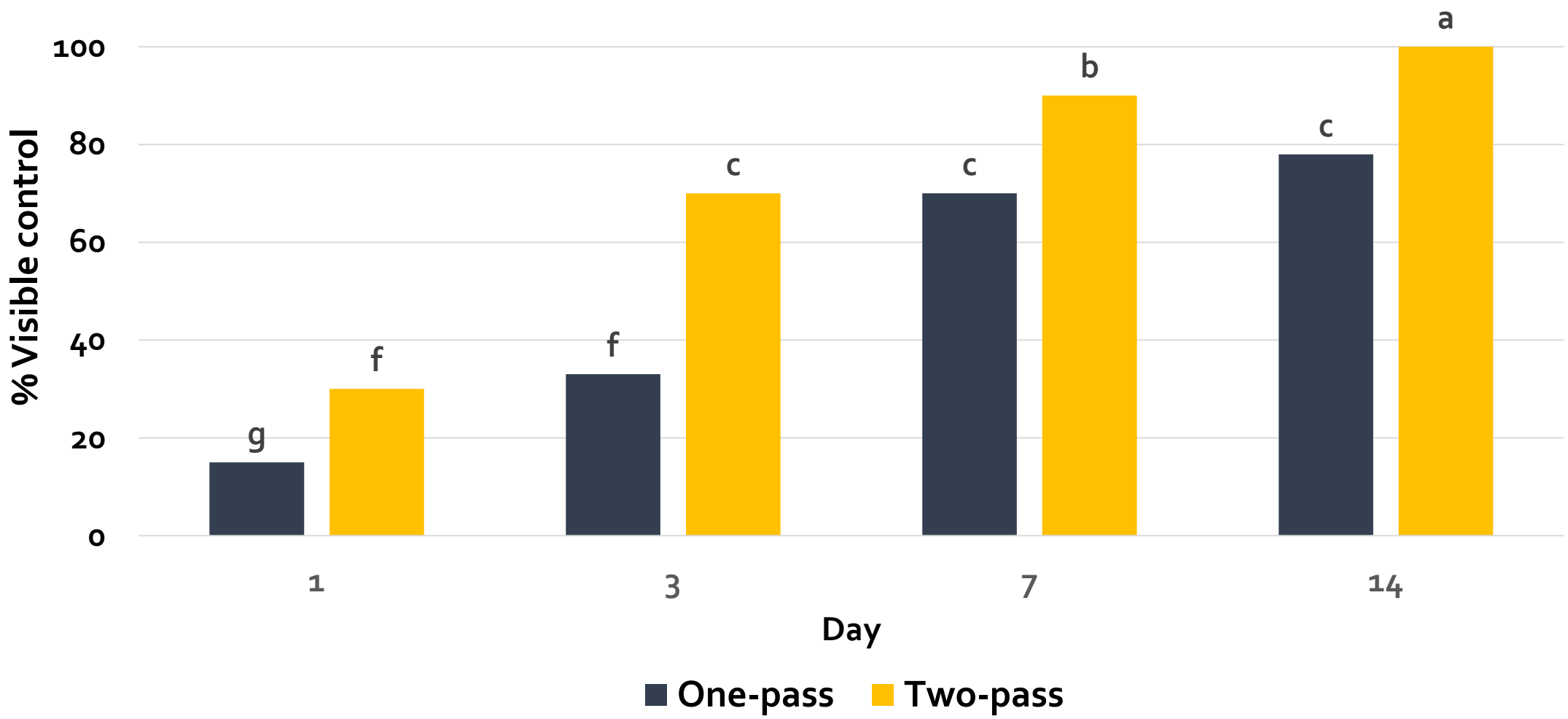
Untreated vs. 14-day treated

- Images were collected in field near Hillsboro, ND.
- Data was collected on the given day.

# Waterhemp control by treatment, Kragnes, MN, 2020



# Waterhemp control by treatment, Felton, MN, 2020



# Next Steps:

- Producers operated the WeedZapper™ middle of July, August, and early September.
- Some waterhemp plants had likely produced viable seed.
- Plant samples were collected before harvest to determine seed viability.
- Cold treatment to simulate winter.
- Growth room/greenhouse seed viability experiments will begin in January.

# Summary:

- The WeedZapper™ provided greater than 80% waterhemp control, 14 DAT.
- Operating speed did not influence waterhemp control (Univ of Missouri research).
- Multiple passes provided better waterhemp control in an open canopy; tended to provide better waterhemp control in a dense canopy.
- Waterhemp control (primary stem) from the WeedZapper™ was better than kochia control (highly branched).
- Will the seed viability experiment provide evidence that treatment timing is critical for true control?

# Should a farmer make the Investment?

The Weed Zapper Weed Zapper is not a replacement for soil residual herbicides, but can be a component of a weed management program in sugarbeet. The Weed Zapper, Hooded Sprayer, and Inter-Row Cultivation are effective management tools to control glyphosate resistant weed escapes.

Pros:

- Weed Zapper provided greater than 80% waterhemp control, 14 DAT
- Weed Zapper may reduce weed biomass in fields, improve harvest efficiency, and improve quality of sugarbeet stored on piles

Cons:

- Weed interference and resultant yield loss likely occurred since the Weed Zapper was operated after weeds extend above the crop canopy.

# Thank you for your Support

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