Effectiveness of Roundup Ready Sugarbeet

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NDSU and U of MN
2012

NDSU EXTENSION SERVICE

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Presentation outline

1. The situation
2. Know the enemy - waterhemp
3. Waterhemp, common ragweed, & kochia management
4. Final reminders

The situation

- Can we maintain the effectiveness of glyphosate and RR sugarbeet?
  - Raise your hand if yes

The situation

- What must we do to maintain the effectiveness of RR sugarbeet?
  - Have greater fear for the future impact of weeds.
    - Eliminate weed seed rain (weed seed production).
    - The weed seed bank is powerful!
    - Herbicides have caused us to become complacent!
  - React more quickly to changing weed populations.
    - We blame the weather and other factors too quickly!
    - Herbicides will not stay effective if we do not do our part.

The situation

- What must we do to maintain the effectiveness of RR sugarbeet? (Continued)
  - Maximize herbicide activity at all times.
  - Eliminate weeds in other crops in the rotation.
  - Diversify weed management strategies at all times.

Past versus present weed control in RR sugarbeet

Crystal: 90% growers reported Excellent weed control with glyphosate

SMBSC: 76% Excellent

Crystal: 81% growers reported Excellent weed control with glyphosate

SMBSC: 59% Excellent

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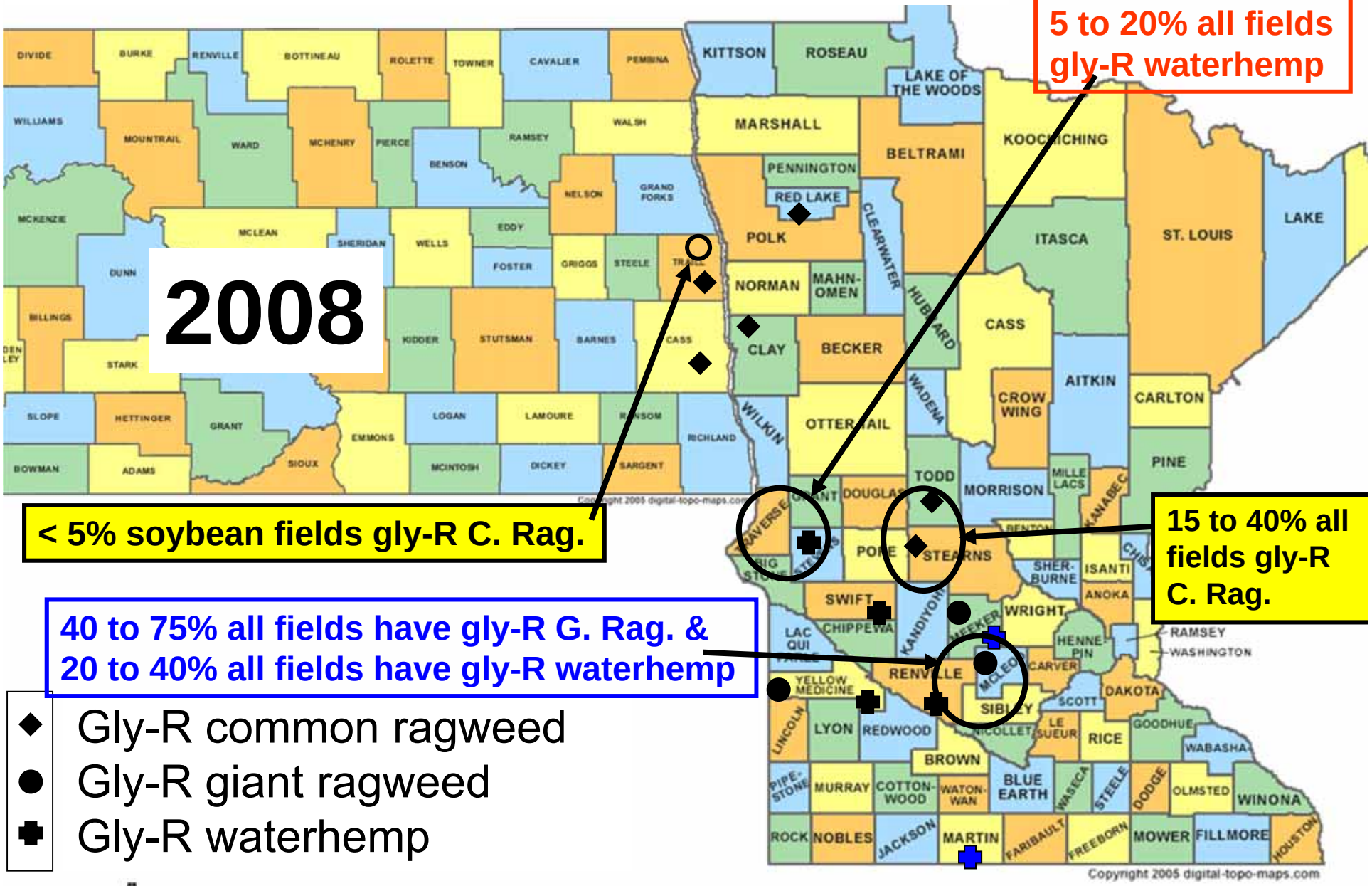
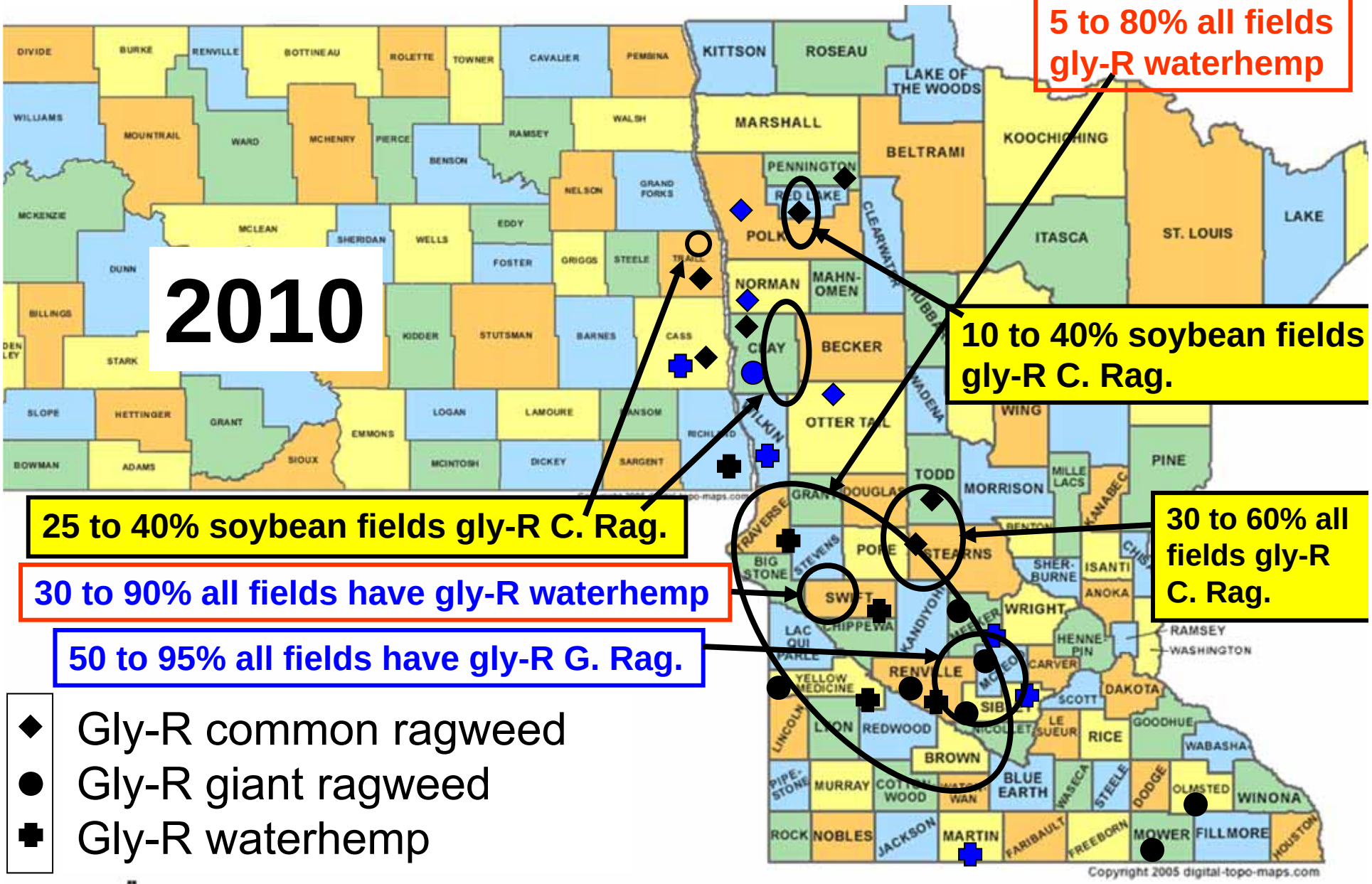
Areas and counties of ND and MN having confirmed and suspected glyphosate-resistant weeds



Provided by: Drs. Jeff Stachler and Mike Christoffers

Black symbols: confirmed resistant cases; Blue: highly suspected

Areas and counties of ND and MN having confirmed and suspected glyphosate-resistant weeds



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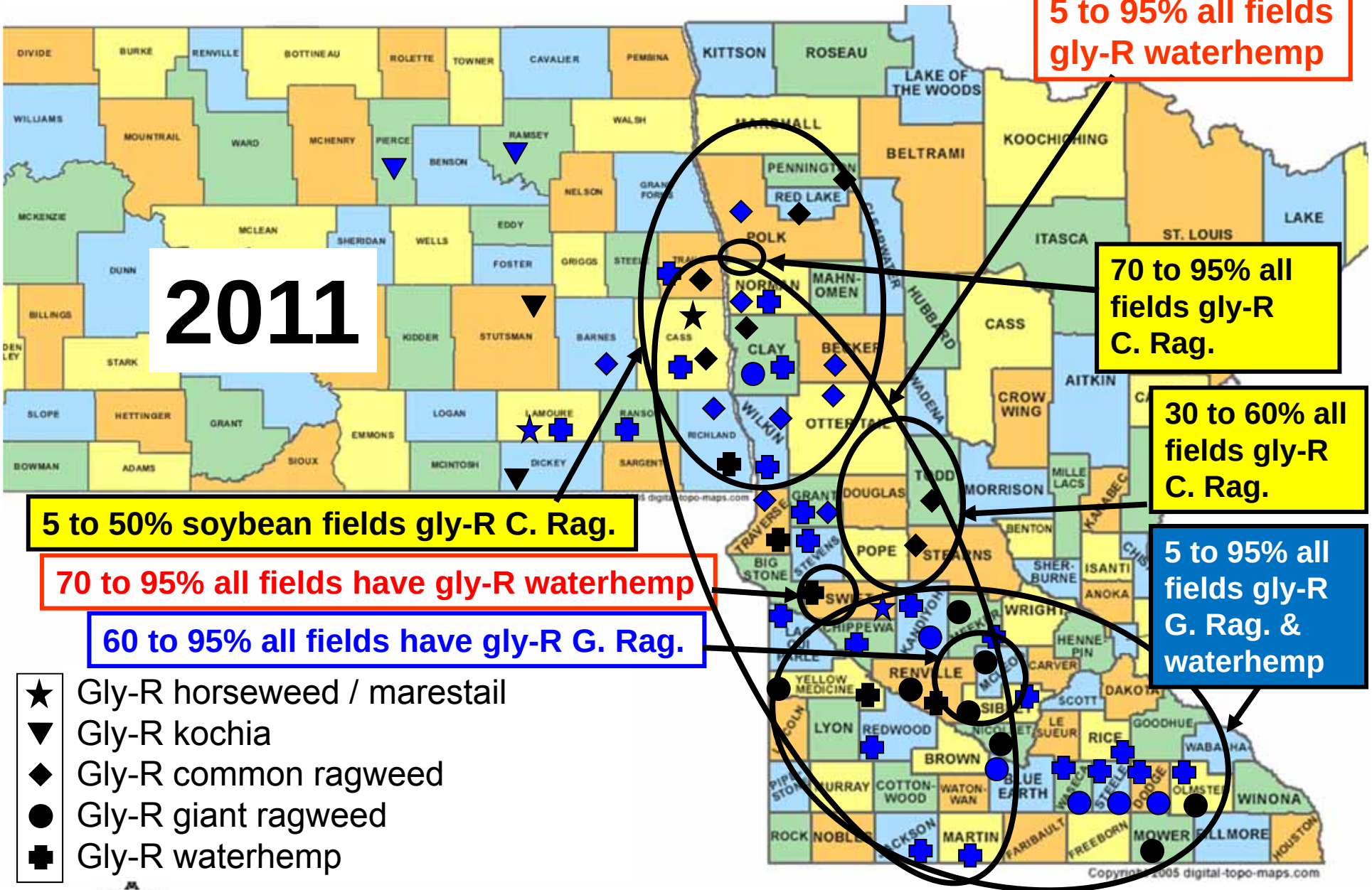

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Waterhemp - Moorhead, MN – 2011
After 2 glyphosate applications

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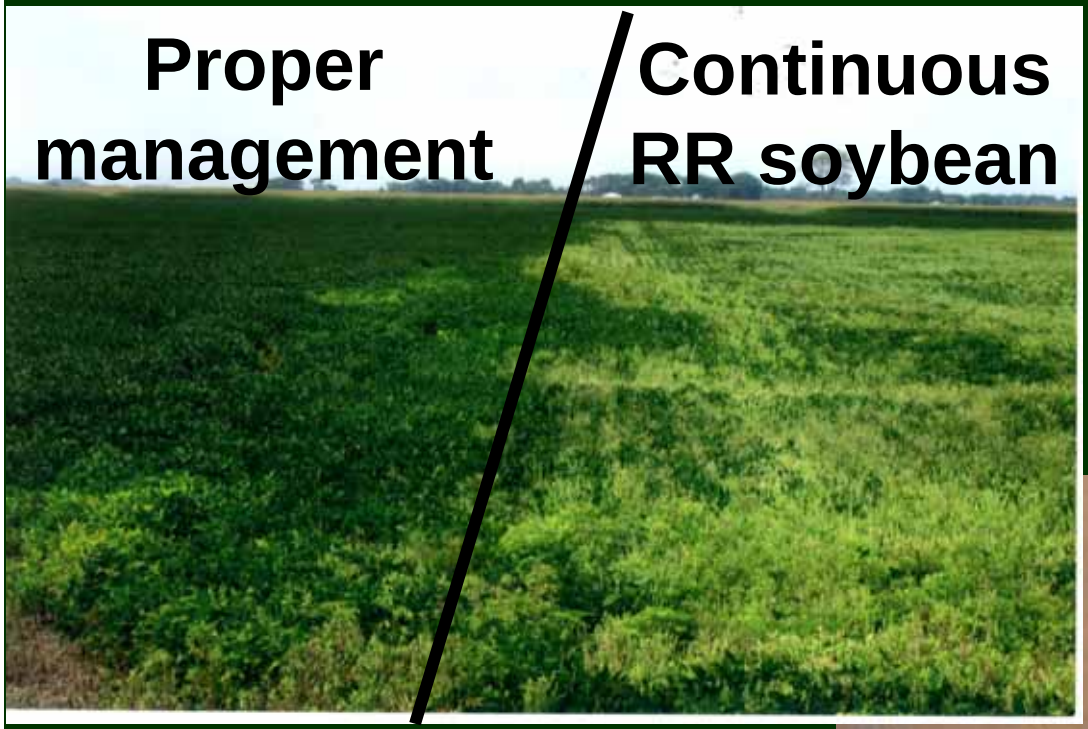
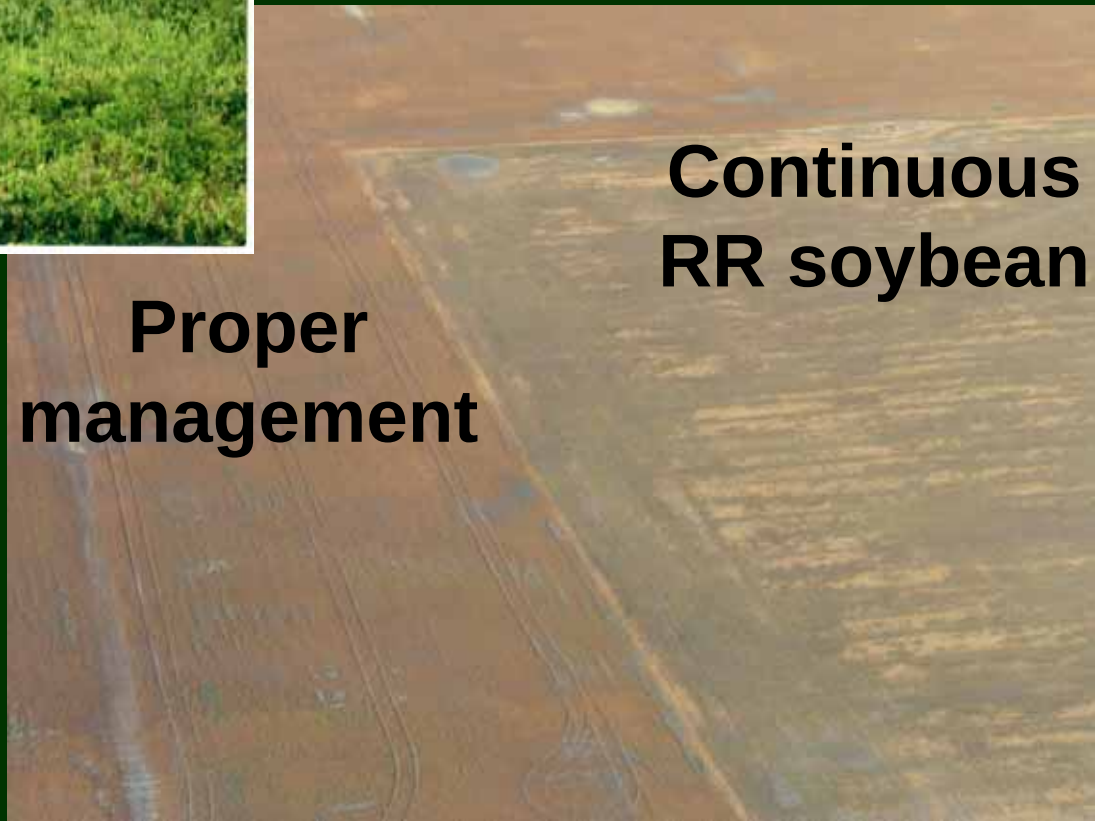
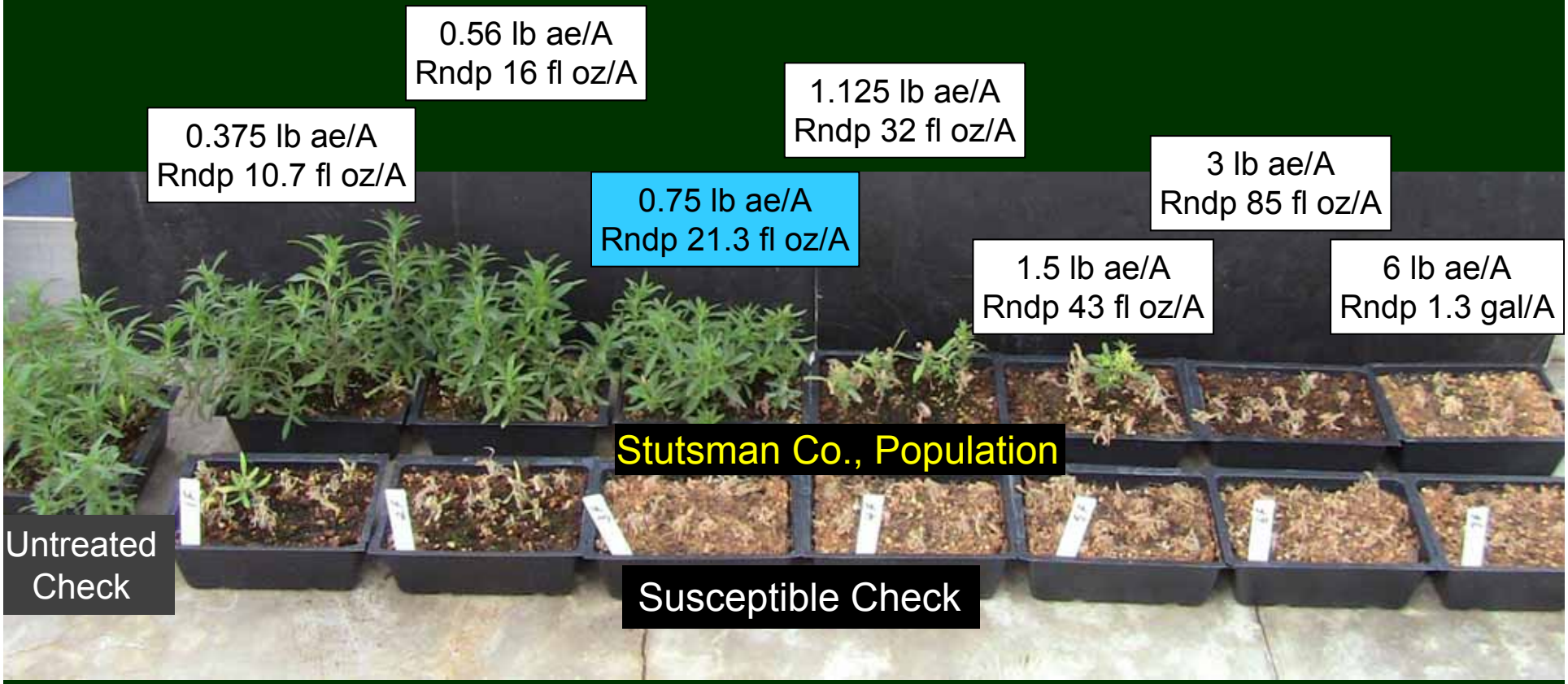
Common ragweed - E. of Nielsville, MN - 2011





Common ragweed - E. of Nielsville, MN – 2011
two glyphosate applications

Glyphosate-resistant kochia – Stutsman Co., ND - 2011



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Trail of kochia plants in a soybean field near Colby, KS in 2007 after spraying three times with glyphosate (from: Phil Stahlman / Dallas Peterson - KSU).

Phillip Co. KS – 2010; grower application at 10 gpa
April 21: 42 oz Buccaneer Plus + 9 oz 2,4-D LVE + AMS + NIS
June 2: 49 oz Buccaneer Plus + 1 oz Sharpen + AMS + NIS (1 DPP)
June 24: 31 oz Buccaneer Plus + 0.7 oz Cadet + COC + Guardian (POST)
(from: Phil Stahlman / Dallas Peterson - KSU).

Multiple –R???
Cobra applied near Holloway, MN

Species known to have multiple resistance

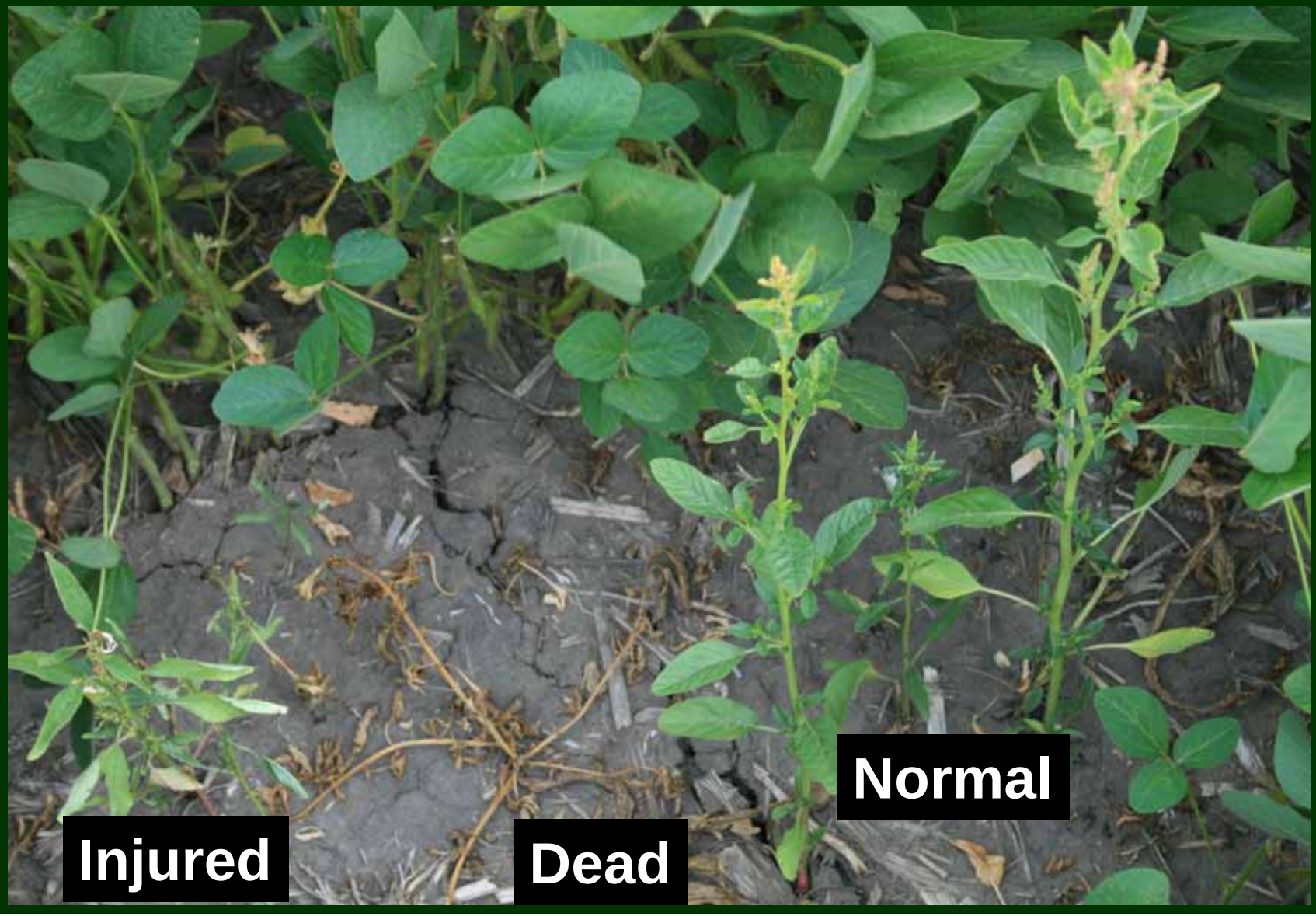
- Waterhemp
  - Glyphosate (Group 9) + ALS-inhibitors (2) (many+MN,ND?)
  - PPO inhibitors (14) + Gly (9) + ALS (2) (MO,KS, IL, IA)
  - HPPD inhibitors (27) + Photosystem II (5) + ALS (2) (IL,IA)
  - Gly (9) + ALS (2) + PPO (14) + PS II (5) (IL)
- Giant ragweed
  - Gly (9) + ALS (2) (MN,OH,MO,IA)
  - PPO (14) + ALS (2) (OH)
- Common ragweed
  - Gly (9) + ALS (2) (MN,OH,MO,IA)
  - PPO (14) + ALS (2) (OH)
  - Gly (9) + PPO (14) + ALS (2) (OH)

Mechanism of Action (MOA)
Pgs 104 & 105
2012 ND Weed Guide

Solution to situation

- Recommend diligent scouting before AND after each herbicide application!
  - Determine if plants are surviving the herbicide(s)
    - Is the population changing in response to the herbicide?

Response of a resistant waterhemp population

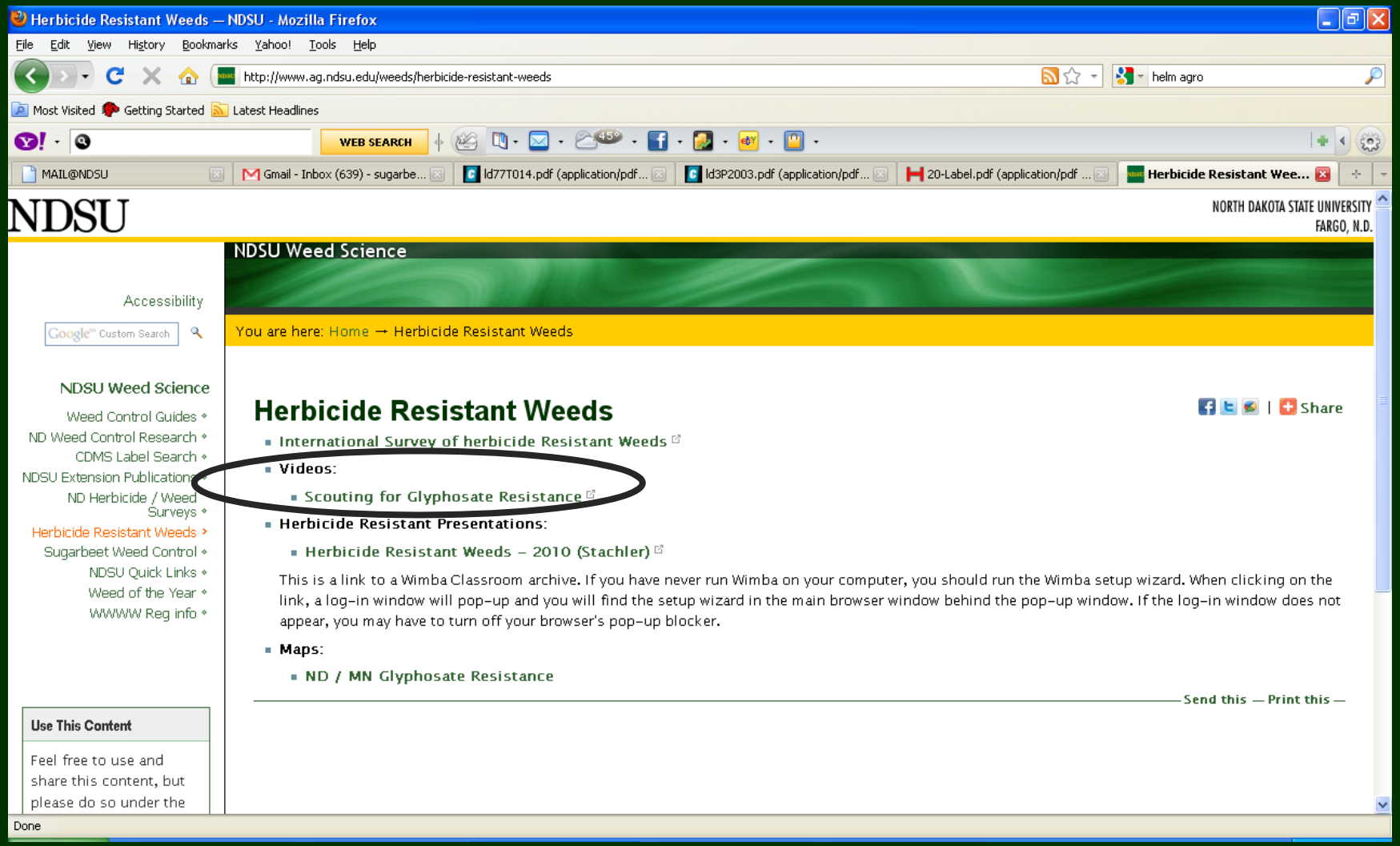


Continuous response of common ragweed to glyphosate

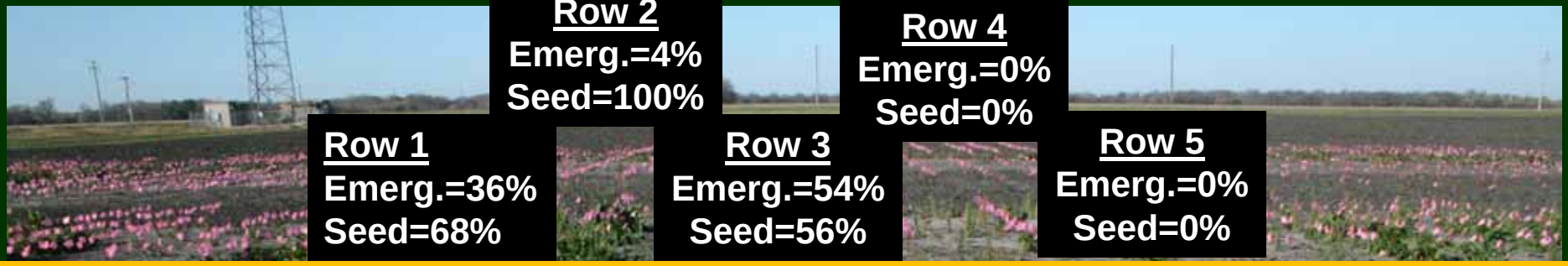
Picture from Al Cattanach

Website address for video "Scouting for Glyphosate Resistance":

http://www.ag.ndsu.edu/weeds/herbicide-resistant-weeds



Annual beets – seeds planted in 2010 from plants collected from soybean field in Clay, Co., MN in 2009



Annual beets – seeds planted in 2010 from plants collected from soybean field in Clay, Co., MN in 2009

The situation

- What is the future impact of a single waterhemp plant remaining at the end of the season?

Single waterhemp plant in 2011 (Clay County, MN) actual seed number per plant = 142,000

Scenario: seed number on 1 plant in 1 acre = 100,000 seeds

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Scenario

- If 25% (40% is possible) of seeds emerge next season (2012)
- Only 10% of emerged plants are resistant
- Same herbicide is applied as previous year
- How many plants may be present in 1 acre at the end of the season (2012)?

2,500 plants/A – 1 year later (2012)

Scenario

- If 2,500 plants produce 100,000 seeds/plant
- 25% of seeds emerge next season (2013)
- Only 10% of emerged plants are resistant
- Same herbicide is applied as previous 2 years
- How many plants may be present in the 1 acre at the end of the season (2013)?

6,250,000 plants/A!! - 2 years later (2013)

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The situation

- What may be the cost to manage glyphosate-resistant (R) waterhemp in sugarbeet?

Cost to control glyphosate-R waterhemp in sugarbeet

$12.00/A

Roundup PowerMAX (32 / 22 / 22 fl oz/A)

$145/A

Ro-Neet (5.3 pt/A) [PPI] fb Betamix (12 / 16 / 24 fl oz/A) + Nortron (4 / 4 / 4 fl oz/A) + Outlook (14 / 10 fl oz/A) + Roundup PowerMAX (32 / 22 / 22 fl oz/A)

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Solution to situation

- Recommend removing surviving plants by hand from a field, especially when there are just a few!
  - There in no better way to STOP the increase of resistant biotypes.

  - NO novel herbicide(s) are expected to be released for any crop in the next 5 to 10 years!
    - Must protect what we have

Solution – Practicing zero seed rain

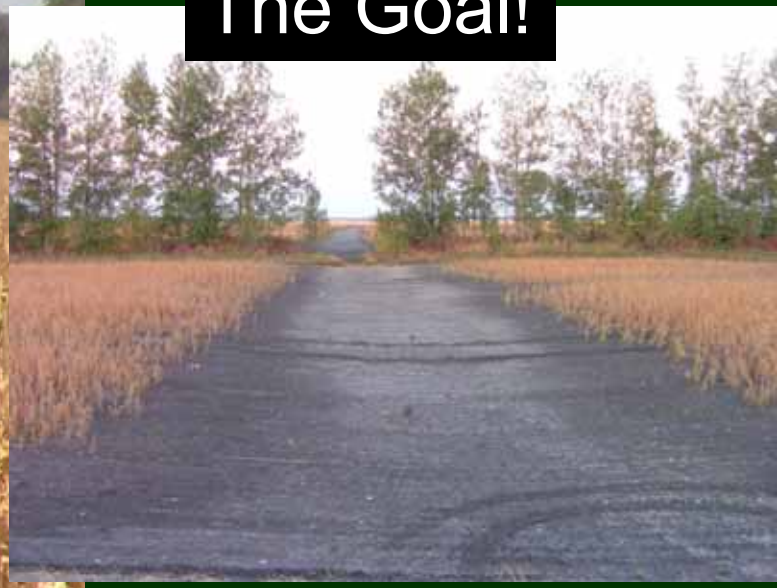
- 52% of AR cotton hand-weeded in 2011
  - Average cost = $29.43/A (beets = $21.00/A)
  - Proactive hand-weeding - $4-5/A
- 2010 hand-weeding – 110 hours
- 2011 hand-weeding – 5 hours

Solution to situation

- Understand impact of weed seed movement by:
  - Water (especially for waterhemp)
  - Machinery
  - Wind
  - Humans
  - Animals / birds

MPR Photo/Ann Arbor Miller

Management of weeds along crop edges



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Field perimeter management (2010)

Ramifications of not managing field perimeter (2011)

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Know The Enemy - Waterhemp

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Waterhemp versus redroot pigweed

Waterhemp biology

- Begins emerging early to mid-May.
- Continues to emerge through early August.
  - Requiring multiple herbicide applications.
- Seed viability:
  - At least 3 to 5 years if near soil surface.
  - Deep burial, may reduce viability.
- Moderate competitor

Seed Survival in Soil: Burnside et. al. Weed Sci: 44;74-85

Species	Years of burial, Lincoln. 0	1	2	4	8	17
	% germination					
C. Lambsquarters	28	53	43	40	21	28
Redroot pigweed	66	69	38	40	6	1
Waterhemp	**40**	**42**	**39**	**24**	**9**	**1**

Waterhemp, Common Ragweed, and Kochia Management

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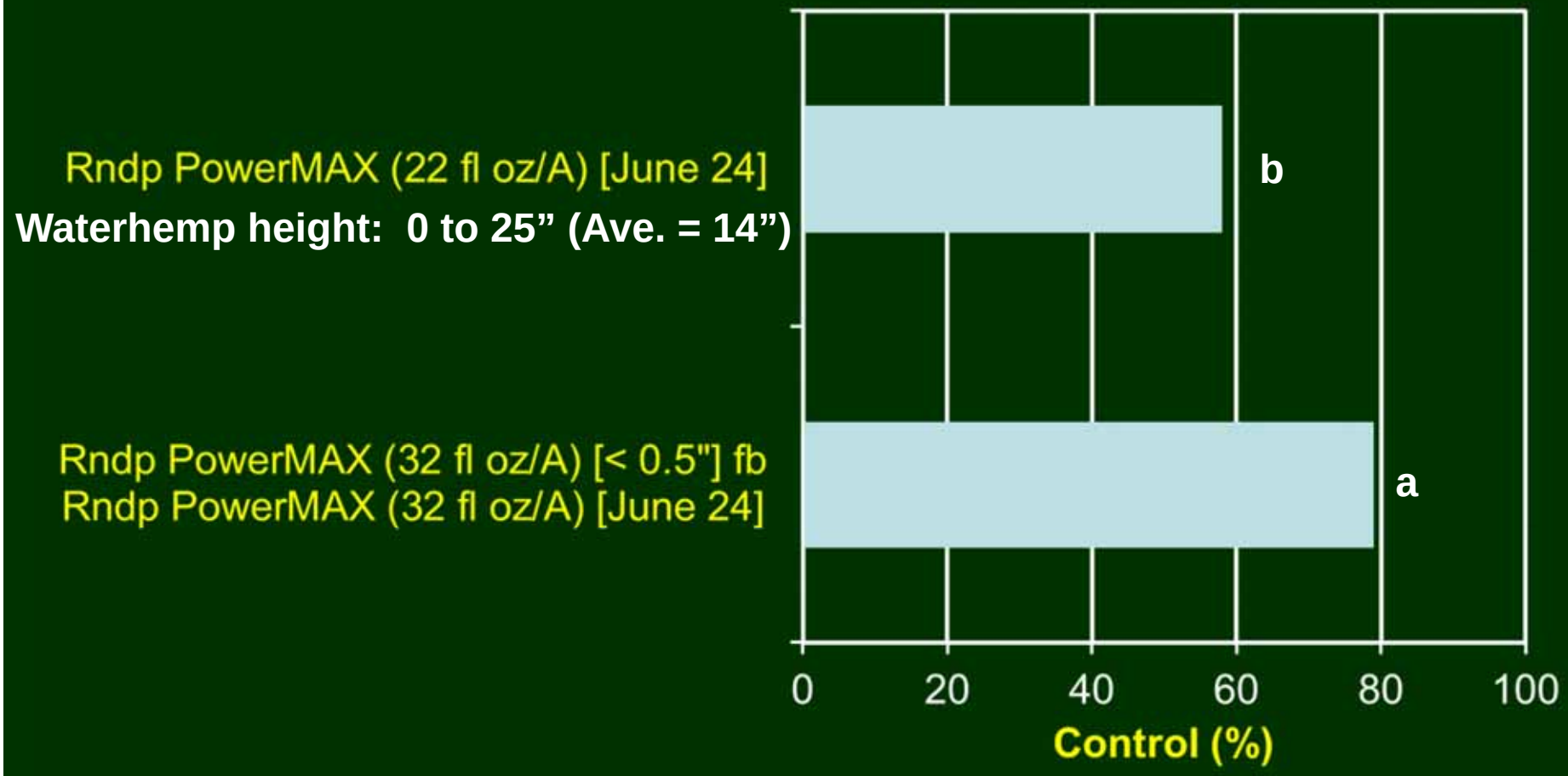
Overall management

- Choose crop where glyphosate is most critical to manage weeds and protect its use!
  - Reduce glyphosate use to no more than every other year and preferably longer.
  - Adopt LL technology.
- Apply POST herbicides to small (1 to 3”) waterhemp.

Effect of glyphosate timing and rate on control of glyphosate-R waterhemp in soybean – Sept. 27



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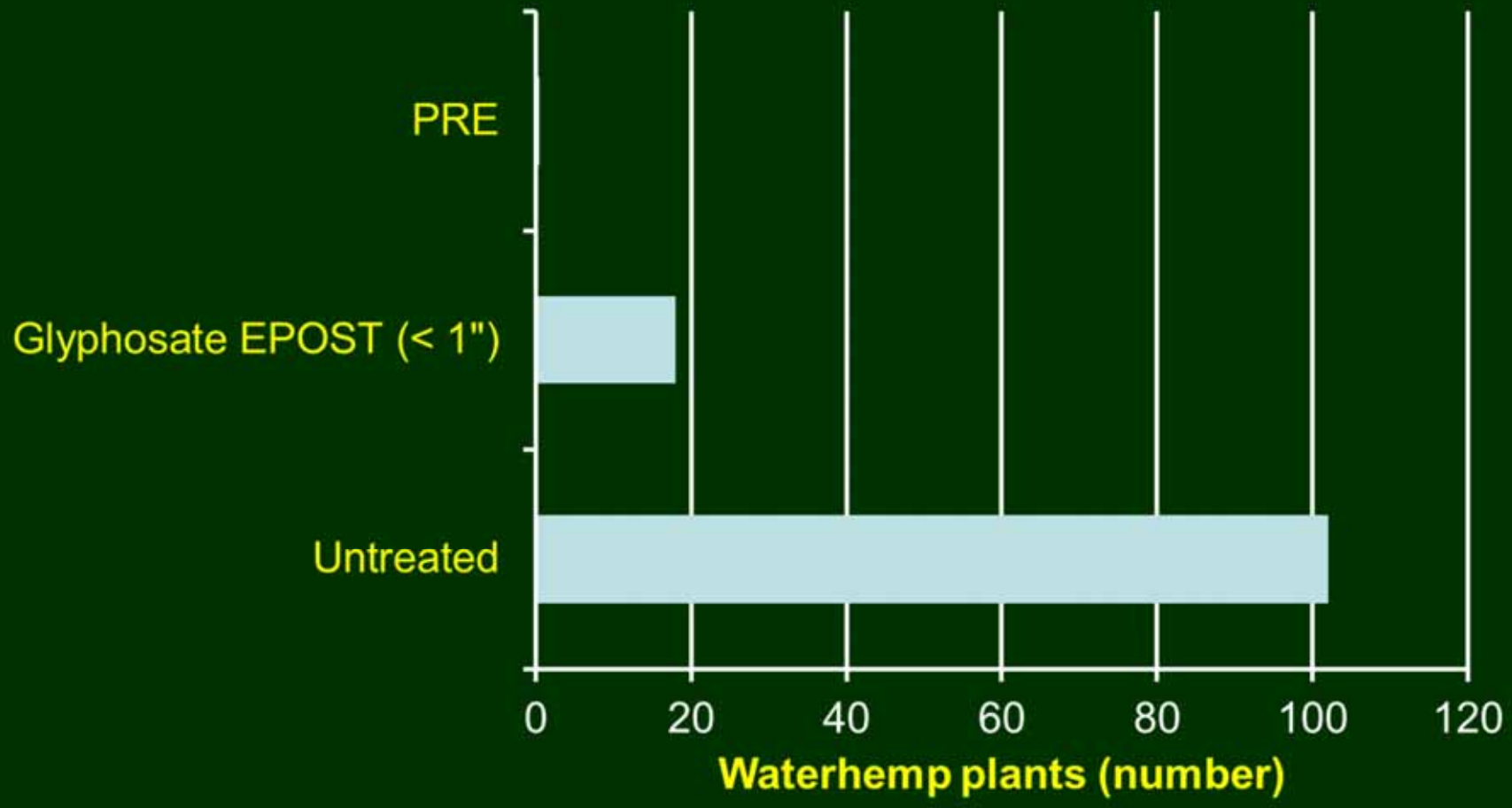
Overall management

- PRE followed by (fb) POST system is best.
  - Choose best PRE herbicide(s).
  - Tank-mix PRE's for greatest control.
  - If RR crop, mix other herbicide(s) with glyphosate.
  - Timing the POST application is more flexible.
  - Scout to determine need for 2nd POST application.
  - PRE herbicides less likely to have resistance.
  - Reduces the number of plants at POST application, reducing risk for resistance.

Effect of PRE herbicide upon number of waterhemp plants at LPOST application



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Overall management

- Total POST system **(not recommended).**
  - Apply to small (1 to 3”) waterhemp.
    - Timing is very critical!
  - Apply a mixture of herbicides.
    - Choose 2 or more of the most effective herbicides having different mechanisms of action.
  - Use the best adjuvant(s) for the mixture.
  - If mixing acetamide herbicides (Warrant, Outlook, Dual) in soybean, apply to small (1”) waterhemp.
  - Scout to determine timing and need for 2nd POST application.
    - Determine need for herbicide mixture.

Corn herbicides to control waterhemp

PRE/PPI Herbicides

- **Excellent**
  - Lumax (3 pt/A)
  - Verdict (> 12 fl oz/A)
  - Zemax
- **Good to Excellent**
  - Balance Flexx (ND only)
  - Callisto
  - Harness / Surpass
  - Prequel (ND only)
  - Sharpen (3 fl oz/A)
- **Good**
  - Dual
  - Outlook
  - SureStart / TripleFlex**

POST Herbicides

- **Excellent**
  - Callisto + atrazine
  - Capreno
  - Halex GT (RR corn only)
  - Impact + atrazine
  - Laudis + atrazine
  - Lumax
- **Good to Excellent**
  - Atrazine (0.5 lb/A)
  - Callisto
  - Impact
  - Laudis [10-18]
- **Good**
  - Banvel / Clarity
  - Status
  - Liberty / Ignite 280 (LL corn only)

≥ 18 month rotation to sugarbeet; ** > 24 mo. rotation to sugarbeet

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Soybean herbicides to control waterhemp

PRE/PPI Herbicides

- **Excellent**
  - Fierce (not labeled)
- **Good to Excellent**
  - Boundary
  - Gangster**
  - Prefix (S. I-94 & E. I-29)
  - Sonalan 13/12”
  - Treflan 12S/14F/12”
  - Valor
- **Good**
  - Dual
  - Outlook
  - Sencor

POST Herbicides

- **Excellent**
  - None
- **Good to Excellent**
  - Cobra / Phoenix
  - Flexstar (E. US 281 & S. US 2)
  - Flexstar GT 3.5 (RR soy only)
- **Good**
  - Ultra Blazer
  - Liberty / Ignite 280 (LL soy only)

≥ 18 month rotation to sugarbeet; ** ≥ 30 mo. rotation to sugarbeet

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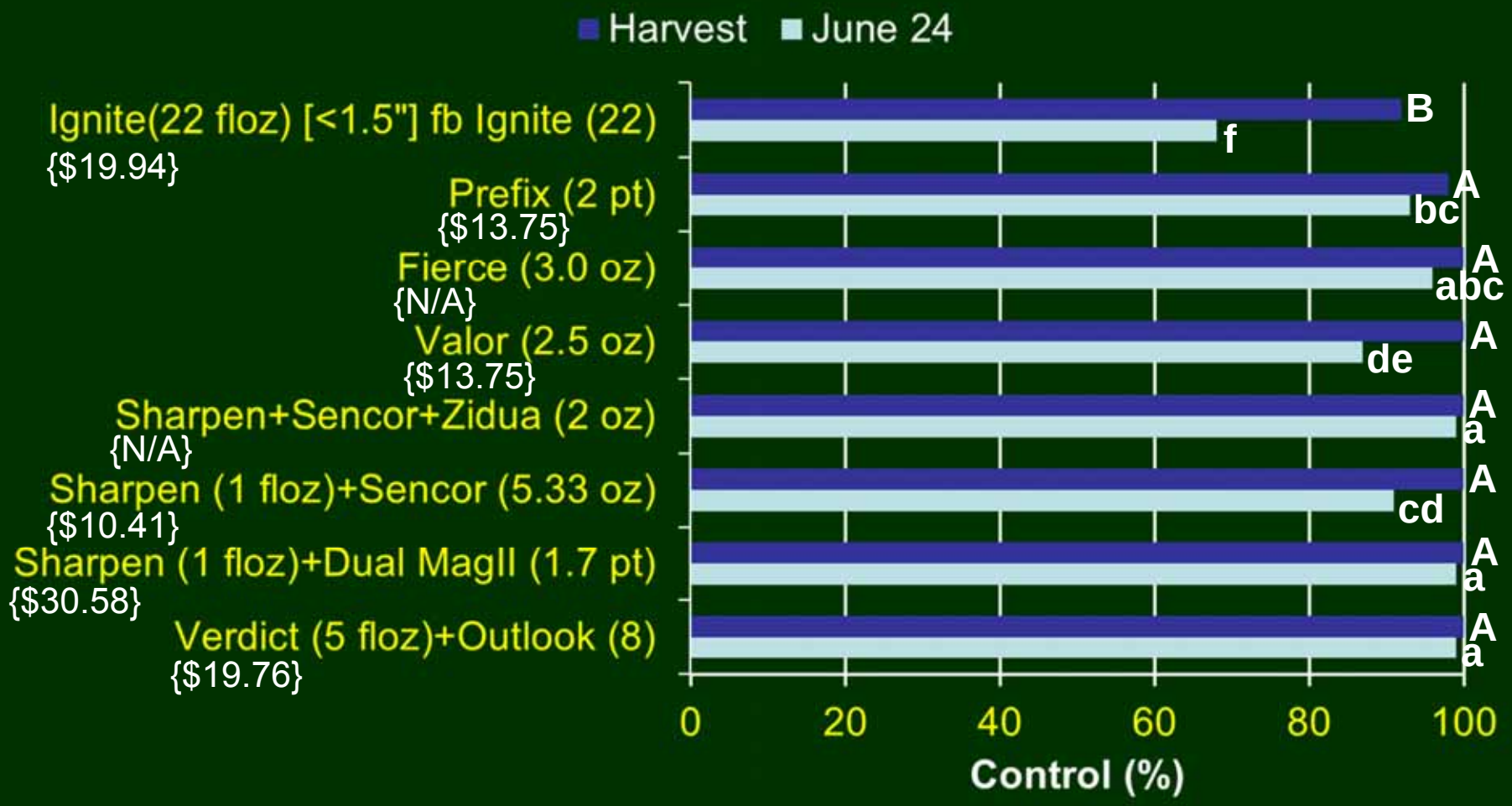
Control of glyphosate-R waterhemp in LL soybean with PRE herbicides



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Verdict (5 fl oz/A) + Outlook (8 fl oz/A) fb Ignite 280 [Liberty] (22 fl oz/A)

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Corn herbicides to control common ragweed

PRE/PPI Herbicides

- **Excellent**
  - **NONE**
- **Good to Excellent**
  - Balance Flex (ND only)
  - Callisto
  - Hornet**
  - Lumax (3 pt/A)
  - Prequel (ND only)
  - Sharpen (3 fl oz/A)
  - SureStart / TripleFLEX**
  - Verdict (> 12 fl oz/A)
- **Good**
  - Zemax

POST Herbicides

- **Excellent**
  - **2,4-D**
  - Halex GT (RR corn only)
  - Lumax (3 pt/A)
- **Good to Excellent**
  - Banvel / Clarity
  - Buctril
  - Hornet**
  - Liberty / Ignite 280 (LL corn only)
  - Permit**
  - Priority**
  - Status
- **Good**
  - Capreno [18/24]
  - Impact (+ atrazine)
  - Laudis [10-18] (+ atrazine)

- **18 month rotation to sugarbeet**
- **** > 24 mo. rotation to sugarbeet**

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Soybean herbicides to control common ragweed

PRE/PPI Herbicides

- **Excellent**
  - **NONE**
- **Good to Excellent**
  - **NONE**
- **Good**
  - Authority MTZ**
  - Boundary
  - Enlite** (MN only)
  - FirstRate**
  - Gangster**
  - OpTill**
  - Prefix (S. I-94 & E. I-29)
  - Sencor

POST Herbicides

- **Excellent**
  - FirstRate**
- **Good to Excellent**
  - Cobra / Phoenix
  - Liberty / Ignite 280 (LL soy only)
  - Flexstar (E. US 281 & S. US 2)
  - Flexstar GT 3.5 (RR soy only)
- **Good**
  - Blazer
  - Classic** (MN only)
  - Synchrony** (MN only)

≥ 18 month rotation to sugarbeet; ** ≥ 30 mo. rotation to sugarbeet

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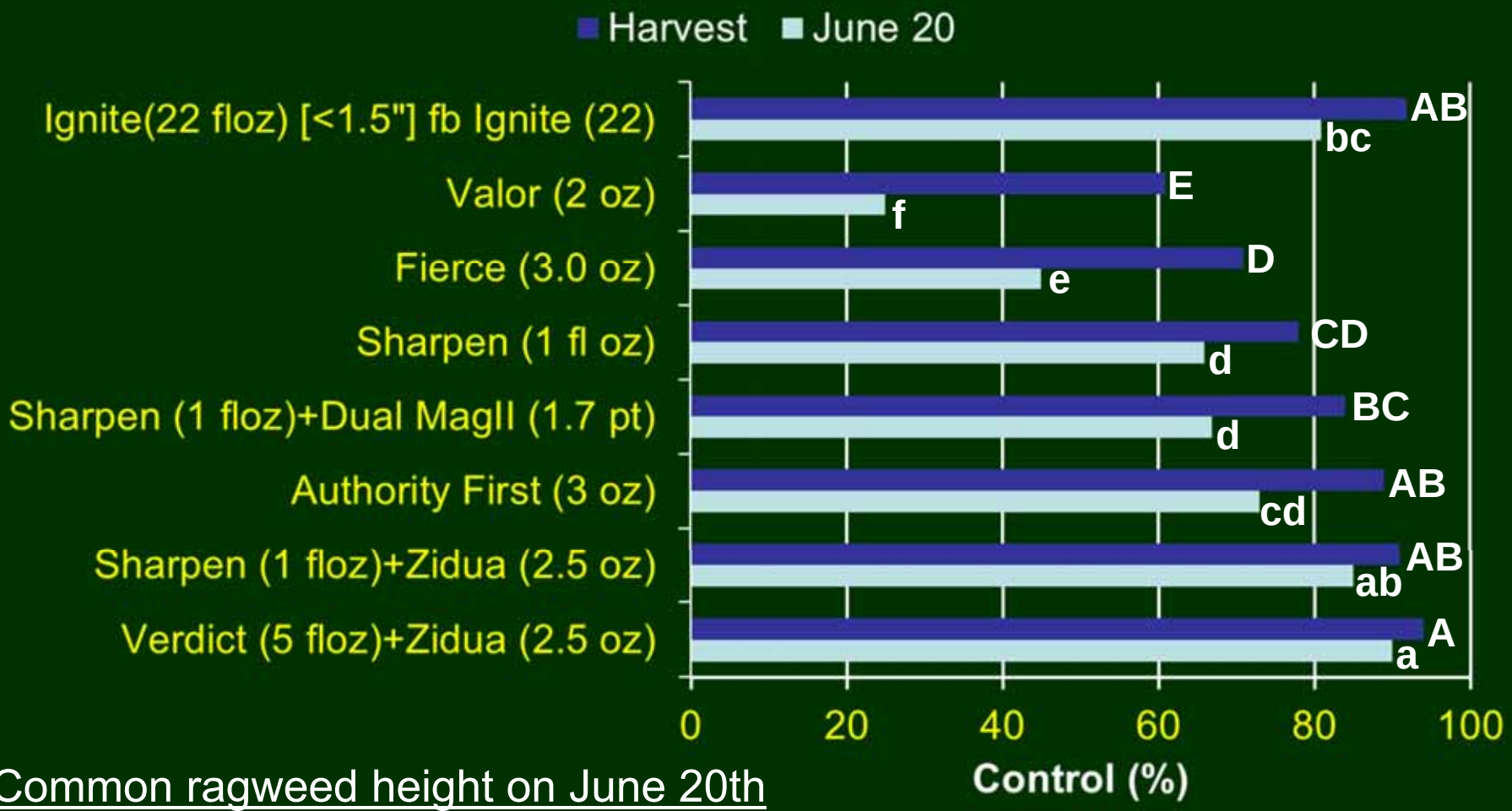
Control of glyphosate-R common ragweed in LL soybean with PRE herbicides



Common ragweed height on June 20th

1. Valor (2 oz) = 0.25 to 9" / Ave. 4"
2. Sharpen (1 fl oz) = 0.25 to 8" / Ave. 2.5"
3. Ignite fb Ignite = 0.25 to 2.5" / Av. 1.125"

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Verdict (5 fl oz/A) + Zidua (2.5 oz/A) fb Ignite (22 fl oz/A)

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Corn herbicides to control kochia

PRE/PPI Herbicides

- **Excellent**
  - Atrazine (0.5 lb/A)
  - Balance Flexx (ND only)
  - Verdict (> 12 fl oz/A)
- **Good to Excellent**
  - Atrazine (0.38 lb/A)
  - Lumax (3 pt/A)
  - Prequel (ND only)
  - Sharpen (3 fl oz/A)
- **Good**
  - None

POST Herbicides

- **Excellent**
  - Atrazine (0.38 to 0.5 lb/A)
  - Banvel / Clarity
  - Callisto + atrazine
  - Halex GT (RR corn only)
  - Impact + atrazine
  - Laudis [10-18] + atrazine
  - Liberty / Ignite 280 (LL corn only)
  - Lumax
  - Status
- **Good to Excellent**
  - Buctril
  - Capreno
- **Good**
  - None

≥ 18 month rotation to sugarbeet; ** > 24 mo. rotation to sugarbeet

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Soybean herbicides to control kochia

PRE/PPI Herbicides

- **Excellent**
  - Authority Assist**
  - Authority First / Sonic**
  - Authority MTZ**
  - Fierce (not labeled)
  - Spartan**
- **Good to Excellent**
  - Gangster**
  - Valor
- **Good**
  - **None**

POST Herbicides

- **Excellent**
  - Liberty / Ignite 280 (LL soy only)
  - Flexstar GT 3.5 (RR soy only)
- **Good to Excellent**
  - Flexstar (E. US 281 & S. US 2)
- **Good**
  - **None**

≥ 18 month rotation to sugarbeet; ** ≥ 30 mo. rotation to sugarbeet

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Weed management in sugarbeet

1. Must achieve near perfect control in other crops in rotation!
   - To reduce weed density in sugarbeet

2. Include at least 1 LL crop in rotation.
   - Soybean most logical
     - Especially if dealing with common ragweed and kochia

Waterhemp management in RR sugarbeet

- Apply a soil-applied herbicide
  - Nortron (PPI / PRE) [$89 for 7.5 pt]
  - Dual Magnum (PRE) [$23 for 1.5 pt]
  - Eptam + Ro-Neet (PPI) [$45 for 2.3 pt + 3.3 pt/A]
  - Ro-Neet (PPI) [$50 for 5.3 pt]
  - Eptam (PPI) [$21 for 3.4 pt]
- Must adjust rate for soil type to reduce injury!
  - The lower the OM and higher sand content, greater injury

Waterhemp management in RR sugarbeet

- POST Option 1 (most effective)
  - Betamix (12 / 16 / 24 fl oz/A) or higher rates (+ no oil) [$45]
  - + Nortron (4 / 4 / 4 fl oz) [$9]
  - + Lay-by
    - Outlook (14 / 10 fl oz) [$34]

    OR
    - Dual Magnum (1.5 / 1 pt) [$37]
  - +Glyphosate (1.125 {Rndp 32} / 0.75 {Rndp 22}/ 0.75 lb ae/A)[$12]
  - + Scout
  - + Hand labor ?
  - fb glyphosate (0.75 lb ae/A {Rndp 22}) [$3] ??
- 1st application to 2 lf sugarbeet
- Add MSO {safe to glyphosate like Destiny HC} (1.5 to 2 pt) + AMS
- 14 to 18 days between applications

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Waterhemp management in RR sugarbeet

- POST Option 2 (only for light infestations)
  - Glyphosate (1.125 {Rndp 32} / 0.75 {Rndp 22}/ 0.75 lb ae/A) [$12]
  - + Lay-by
    - Outlook (14 / 10 fl oz) [$34]

    OR
    - Dual Magnum (1.5 / 1 pt) [$37]
  - + Scout
  - + Cultivation
  - + Hand labor
  - fb glyphosate (0.75 lb ae/A {Rndp 22}) [$3] ??
- 1st application to 2 lf sugarbeet
- Add MSO {safe to glyphosate like Destiny HC} (1.5 to 2 pt) + AMS
- 14 to 18 days between applications

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Waterhemp management in RR sugarbeet

- POST Option 3 (only useful if limited resistant plants)
  - Glyphosate (1.125 {Rndp 32} / 0.75 {Rndp 22}/ 0.75 lb ae/A) [$12]
  - + Scout
  - + Cultivation
  - + Hand labor
  - fb glyphosate (0.75 lb ae/A {Rndp 22}) [$3]
  - + Hand labor ??
- 1st application at 2 lf sugarbeet
- Could consider adding Nortron (4 fl oz/A) [$9] in 1st 3 apps.
- 14 to 18 days between applications

RR Sugarbeet recommendations – common ragweed

- Apply Stinger (2.5 to 4 fl oz/A) + glyphosate (1.125 lb ae/A) + AMS to 1” common ragweed
- Apply Stinger (2.5 to 4 fl oz/A) + glyphosate (0.75 lb ae/A) + AMS 14 to 21 DAT
- Scout field to determine need for a third application
- Apply Stinger no later than July 18th for Sept. 1 harvest!
- Apply no greater than 10.5 fl oz/A of Stinger for season.

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Kochia management in RR sugarbeet

- Apply a soil-applied herbicide
  - Nortron (PPI / PRE) [$89 for 7.5 pt] {F-G}
  - Eptam (PPI) [$21 for 3.4 pt] {F}
- Must adjust rate for soil type to reduce injury!
  - The lower the OM and higher sand content, greater injury

Kochia management in RR sugarbeet

- POST Option 1 (Best strategy)
  - Betamix (12 fl oz / 3 pt / 4 pt) [$92]
  - + Nortron (4 / 4 / 4 fl oz) [$9]
  - + Lay-by ????
    - Outlook (14 / 10 fl oz) [$34]

    OR
    - Dual Magnum (1.5 / 1 pt) [$37]
  - +Glyphosate (1.125 {Rndp 32} / 0.75 {Rndp 22}/ 0.75 lb ae/A)[$12]
  - + Scout
  - + Hand labor ?
  - fb glyphosate (0.75 lb ae/A {Rndp 22}) [$3] ??
- 1st application to cotyledon to 2 lf sugarbeet
- Add MSO {safe to glyphosate like Destiny HC} (1.5 to 2 pt) + AMS
- 10 to 14 days between applications

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Kochia management in RR sugarbeet

- POST Option 2 (only useful if limited resistant plants)
  - Glyphosate (1.125 {Rndp 32} / 0.75 {Rndp 22}/ 0.75 lb ae/A) [$12]
  - + Scout
  - + Cultivation
  - + Hand labor
  - fb glyphosate (0.75 lb ae/A {Rndp 22}) [$3]
  - + Hand labor ??
- 1st application to cotyledon to 2 lf sugarbeet
- Could consider adding Nortron (4 fl oz/A) [$9] in 1st 3 apps.
- 14 to 18 days between applications

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Final reminders

- **Zero** seed rain!
  - Remember the impact of a single plant at end of season!
- Apply **All** POST herbicides to **small (1-3”)** weeds at all times.
- Do not apply glyphosate too soon between applications.
  - Plants must resume growth before next application
    - 14 day interval usually minimum

Final reminders

- Maximize herbicide activity!
  - Of all herbicides at all times
  - For glyphosate consult these references:
    - Pgs 52 & 53 – 2012 Sugarbeet Production Guide
    - Pgs 69 to 71- 2012 ND Weed Control Guide
- It's the little things that will make a difference.

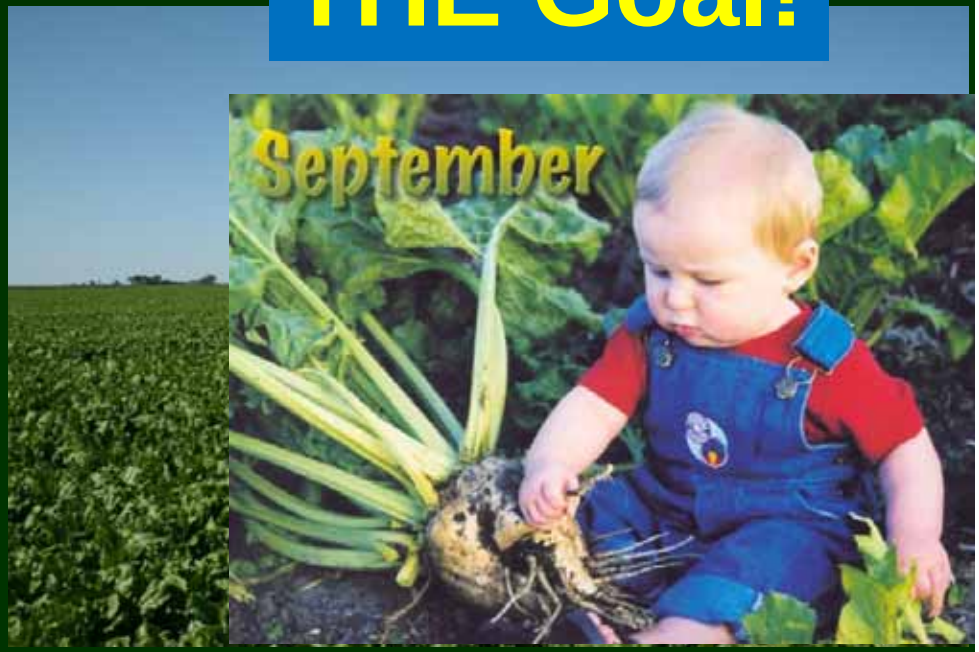
Final reminders

- Diversify weed management practices!
  - Use PRE herbicides in ALL crops!
    - Foundation weed control
  - Determine where glyphosate is most vital in the crop rotation and limit its use.
  - Incorporate LL technology into the crop rotation.
    - Do it right! – plan: PRE fb Liberty (29 fl oz/A-soy) twice
  - Use the most effective herbicides, especially in tank-mixtures!
    - NOT the most convenient
    - NOT the cheapest (pay a little know or pay a lot later)
  - Adjust crop rotation
  - Maximize cultural practices

Leave a Legacy

- The future success of your farming operation depends upon the weed control practices you choose today!
- Glyphosate is the most effective herbicide ever used in sugarbeet, so why not protect/preserve its effectiveness for sugarbeet.

THE Goal!



- Thank You!
  - SBREB
  - Lenny Luecke and many others
- ANY questions?
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  - 701-231-8131 (Office)
  - 218-790-8131 (Cell)
- Resources
  - http://www.ag.ndsu.edu/weeds/
  - http://www.sbreb.org/