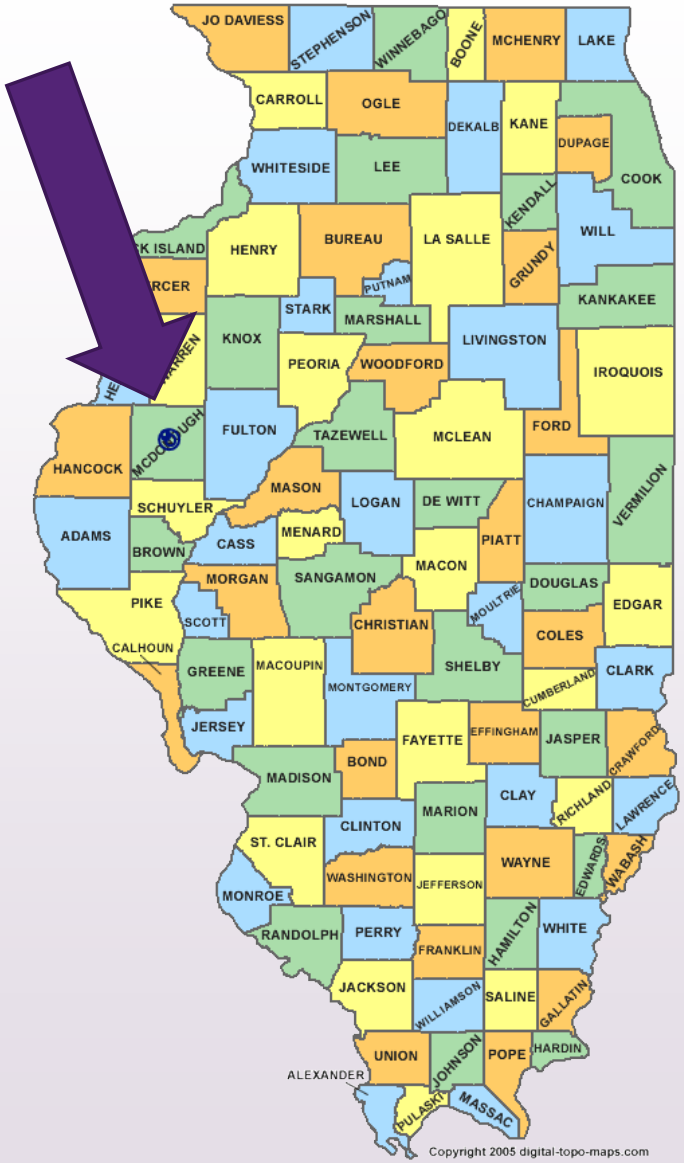
# Sundry Studies Related to Weeds at WIU

Mark L. Bernards

Western Illinois University

# Western Illinois U. Macomb, IL



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# WIU Agronomy Farm

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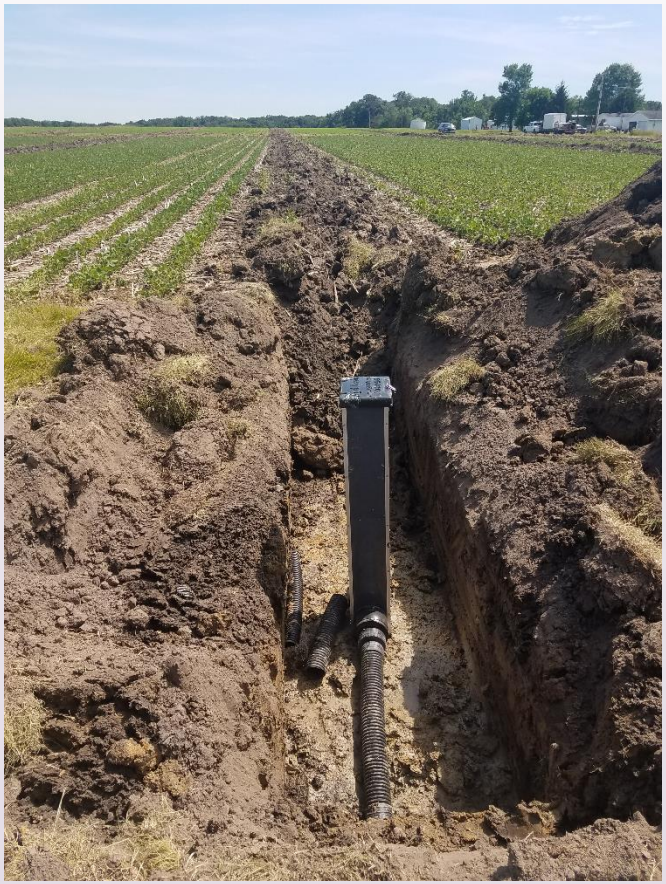
# WIU Kerr Agronomy Farm



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# Greenhouses and Sprayer

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# Driver weeds on WIU farms

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# GR Waterhemp – resistance threshold?

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# Most important thought

- No weed seed return
- Dicamba is 85% effective on waterhemp – what happens to plants that survive

https://www.country-guide.ca/2016/03/03/we-need-to-get-our-herbicide-resistance-response-right/48359/

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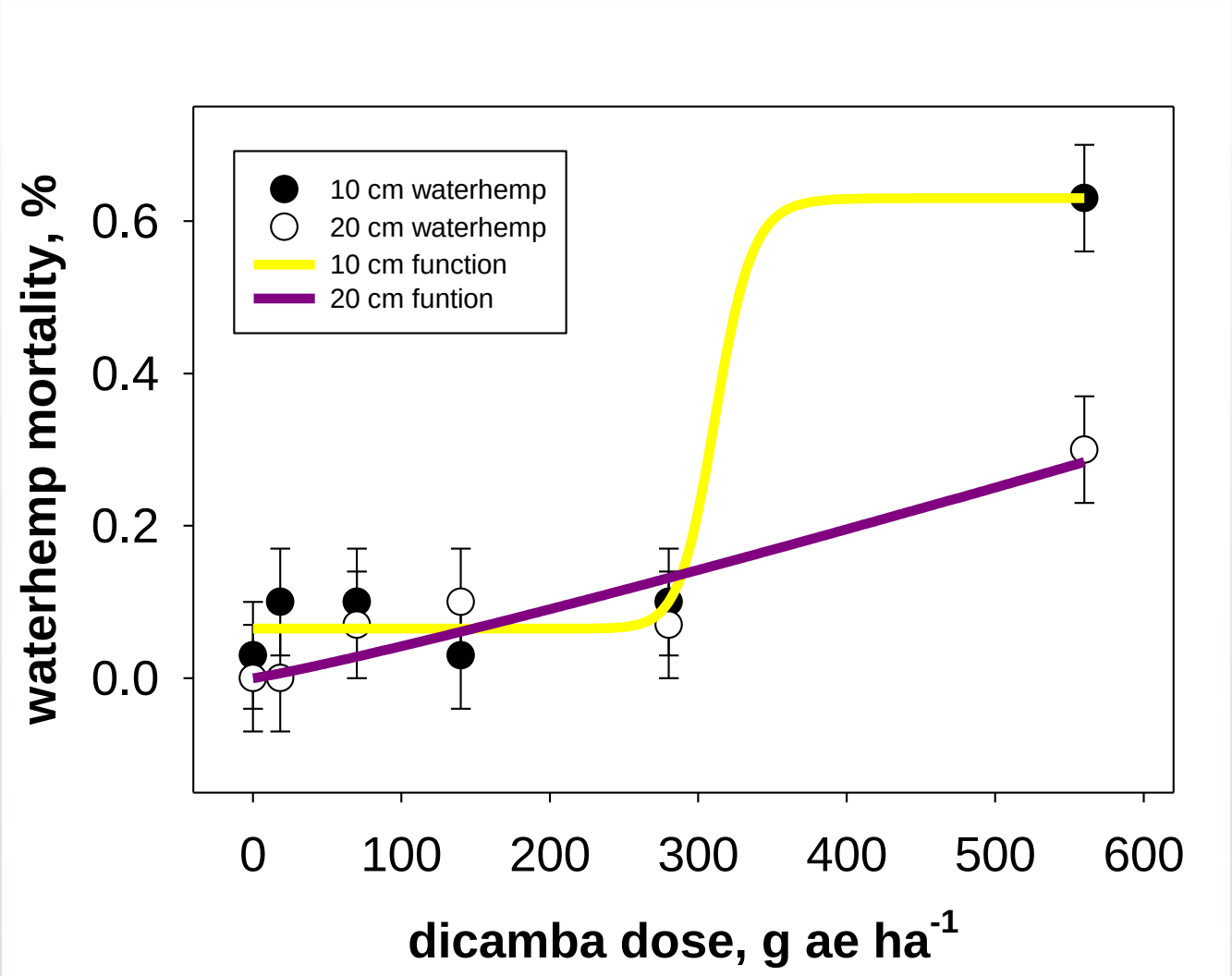
# Rumler (2017 ) – Waterhemp response to dicamba

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# Rumler (2017) – Waterhemp seed production and dicamba dose

Table 1. Number of waterhemp plants that did and did not produce seed as affected by dicamba dose and plant size at application.

| Height cm | Dose g ae $ha^{-1}$ | No seed | Produced seed |
|---|---|---|---|
| 10 | 560 | 6 | 5 |
| 10 | 280 | 17 | 8 |
| 10 | 140 | 17 | 12 |
| 10 | 70 | 17 | 10 |
| 10 | 18.4 | 14 | 13 |
| 10 | 0 | 17 | 12 |
| 20 | 560 | 15 | 6 |
| 20 | 280 | 16 | 14 |
| 20 | 140 | 13 | 12 |
| 20 | 70 | 13 | 15 |
| 20 | 18.4 | 14 | 16 |
| 20 | 0 | 16 | 14 |

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# Rumler (2017) – Waterhemp seed production and dicamba dose

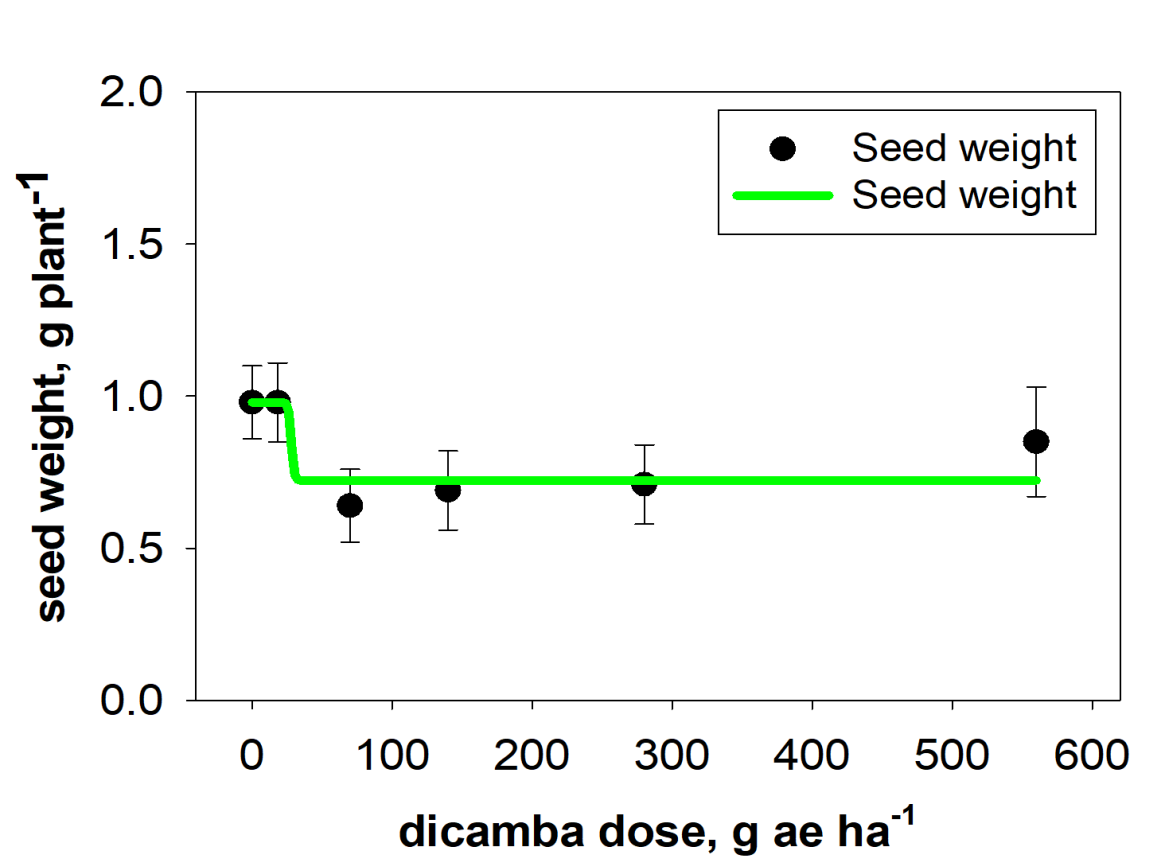


Figure 6. Waterhemp seed weight per plant that produced seed four months after treatment as affected by dicamba dose. Data were fit to a 4-parameter log logistic equation.

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# Rumler (2017) – Waterhemp seed germination and viability and dicamba dose

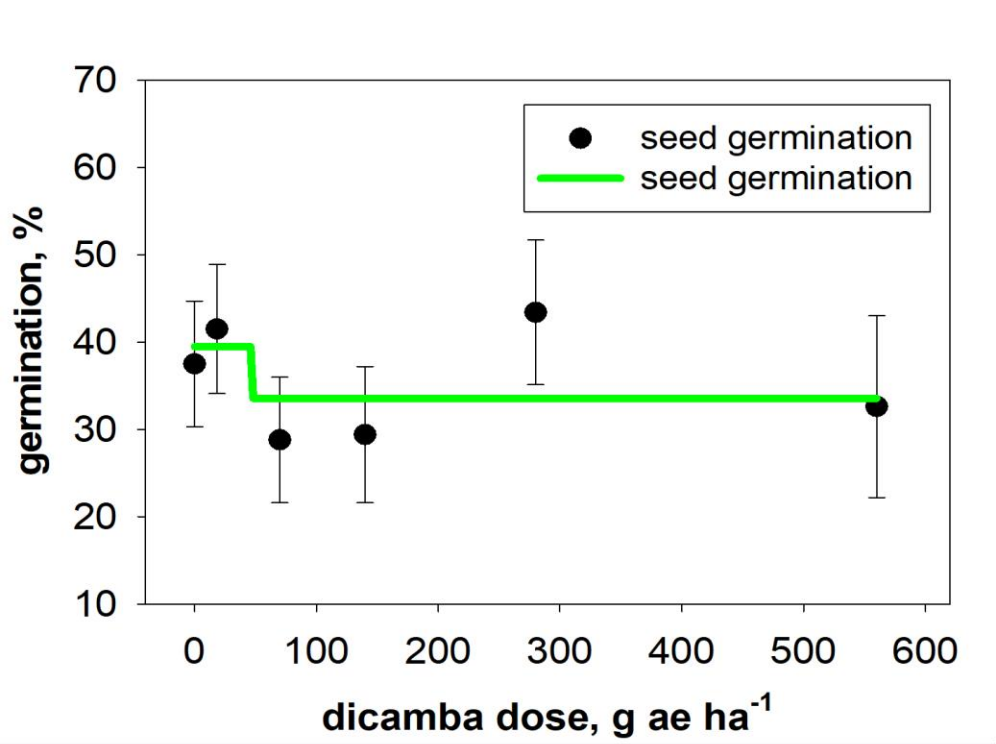


Figure 7. Waterhemp seed germination as affected by dicamba dose. Data were fit to a 4-parameter log logistic equation.

Figure 3. Viable waterhemp seed on left showing pink embryo, and non-viable seeds on right showing cream colored embryo.

95% of waterhemp seeds were viable – dicamba dose had no effect!

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# Dicamba off-target movement

https://aapco.org/2015/07/02/dicamba/

- July 16, 2018 update
- **Illinois**
- Total drift complaints: 303
- Auxin drift complaints: 206
- 2017 auxin drift complaints: 246

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# Dicamba movement to trees

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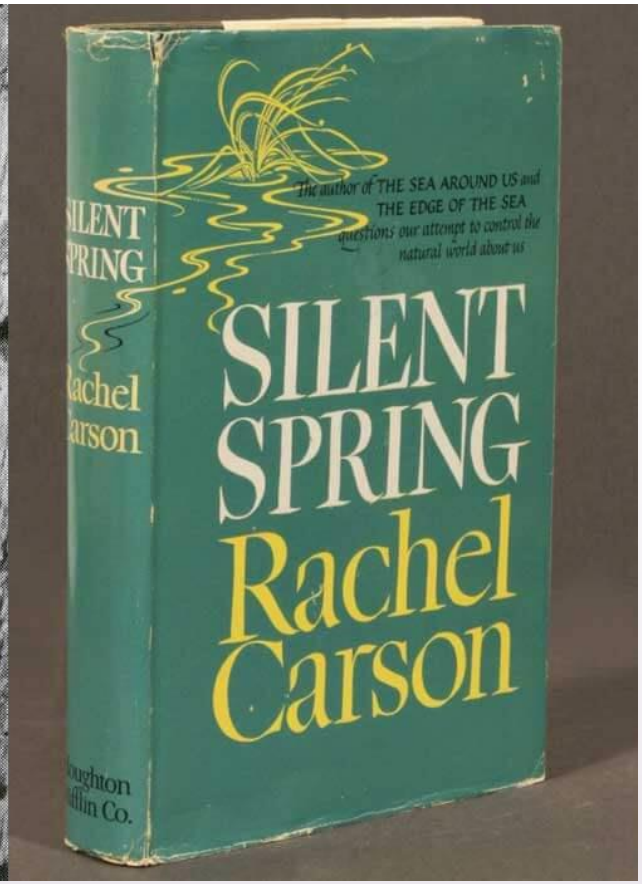


# Sequel??? – *Treeless Countryside*

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# Potential dicamba volatility solution

- Apply dicamba earlier in the season??

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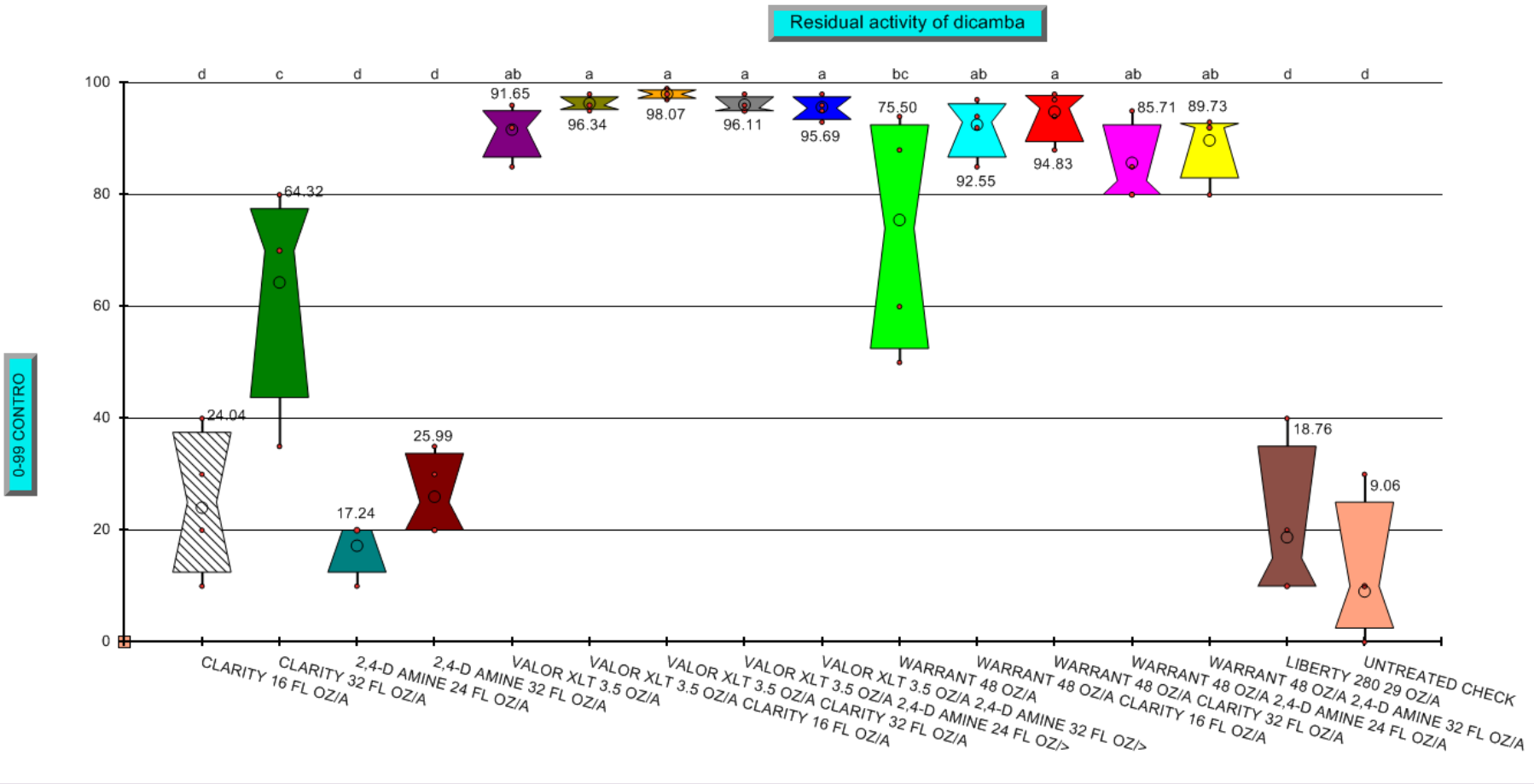
# Waterhemp, 37 days after appl.

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Early application of dicamba has merit, but how will off-target movement be affected by tank-mixes with other herbicides?

Adjuvant solutions???

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# Dicamba – (Some of) The Rest of the Story

Rich Zollinger
NDSU Extension Weed Specialist

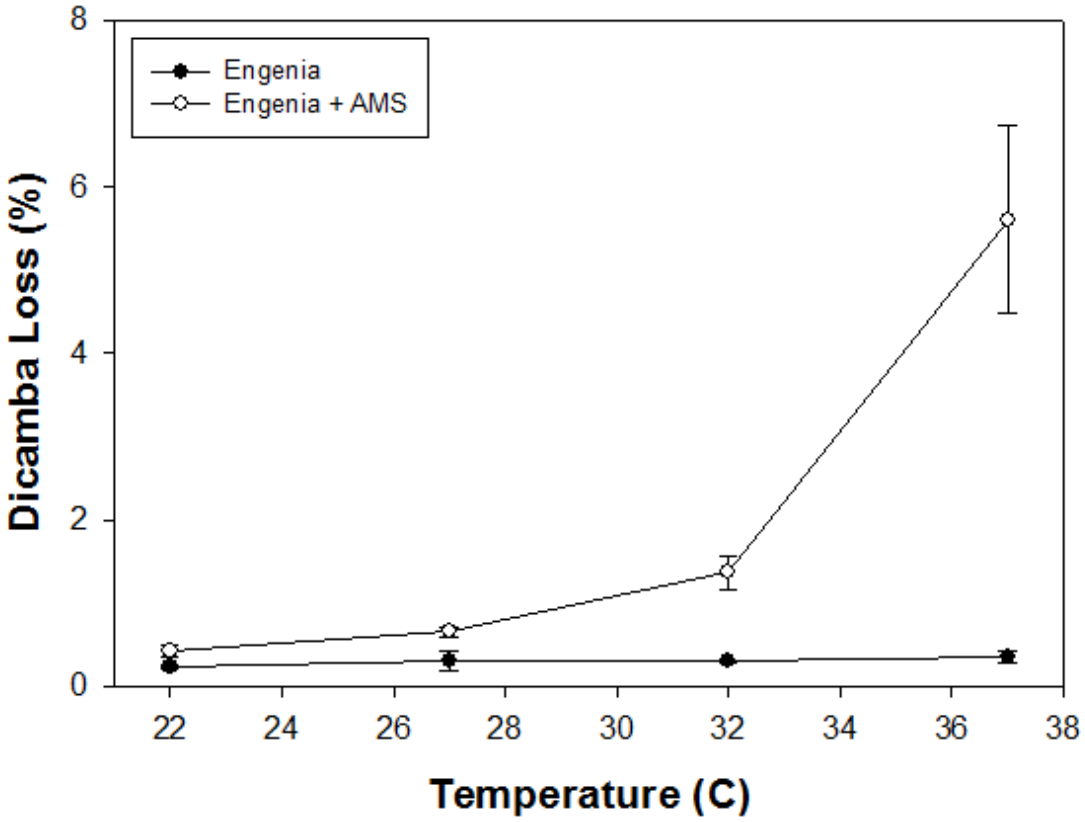
# Very important question

How long after droplet is released from nozzle does BAPMA salt or Vapor Grip disassociate from dicamba?

1. Deposit formation after water evap.
2. pH of leaf surface and soil
3. Pool of $H^+$ on leaf surface and soil
4. Effect dew and small rain events

# Engenia™ Herbicide

## Why will AMS be restricted?



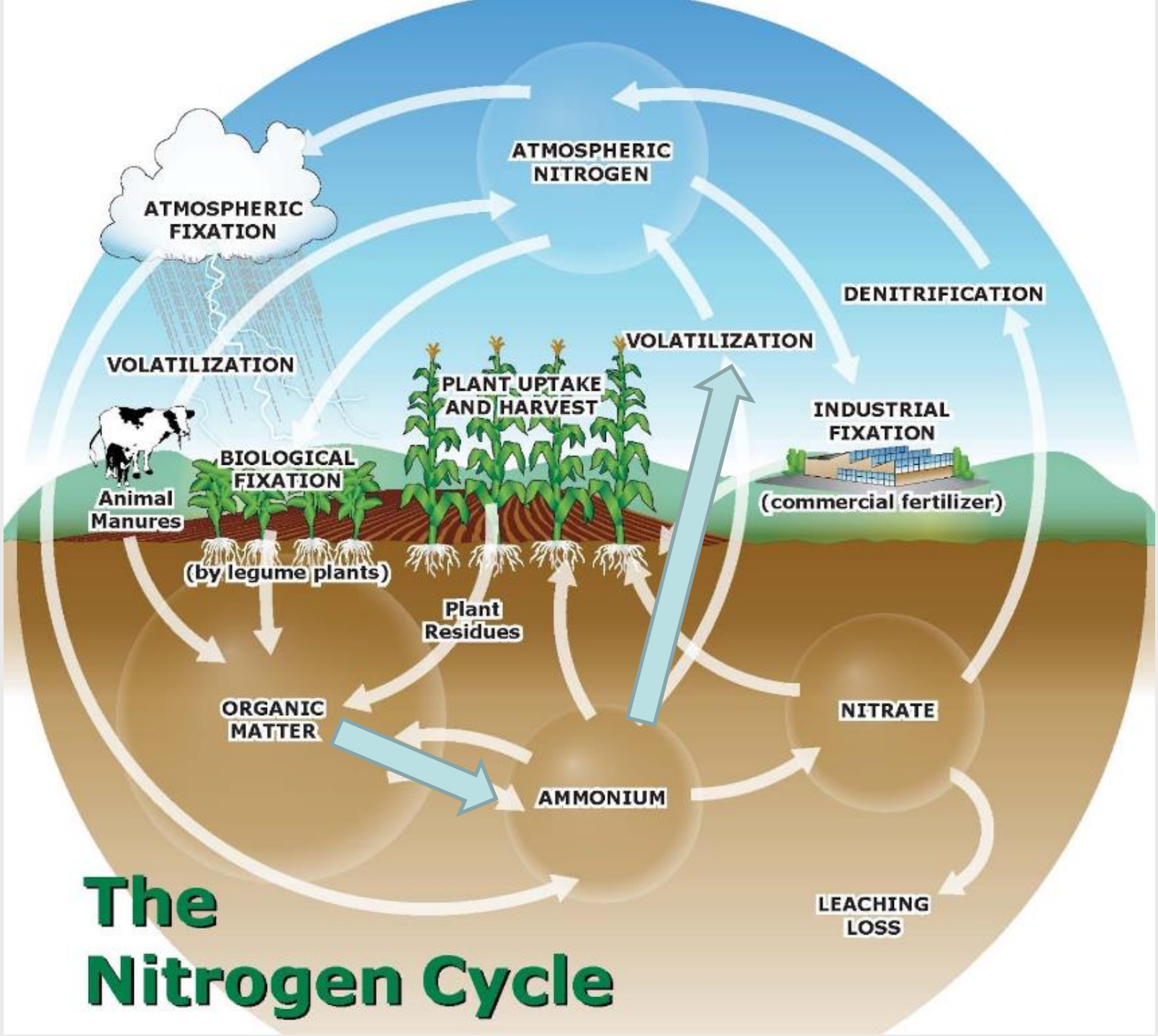

Mechanism of action:

1. NH3 volatilizes
2. Leaves behind H+
3. H+ lowers pH
4. > dicamba-acid

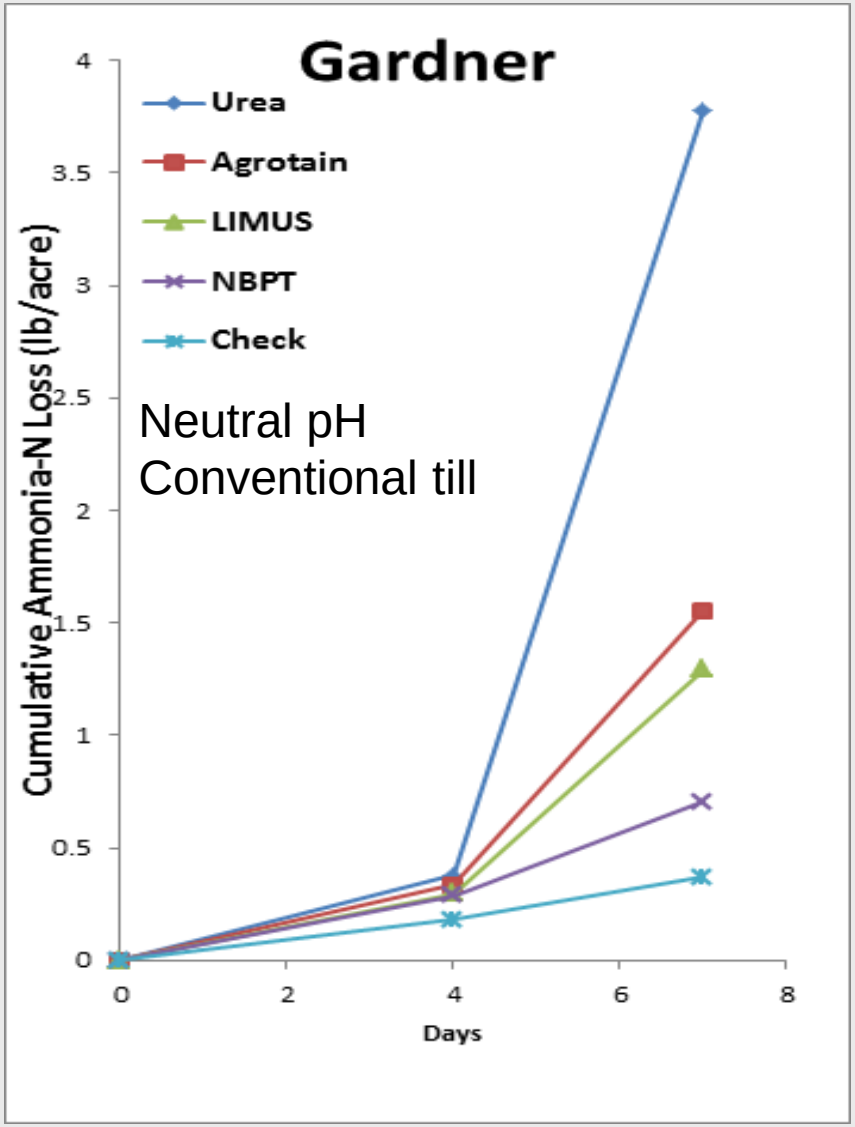
Application rates:
Engenia – 560 g/ha
AMS – 0.5% w/v

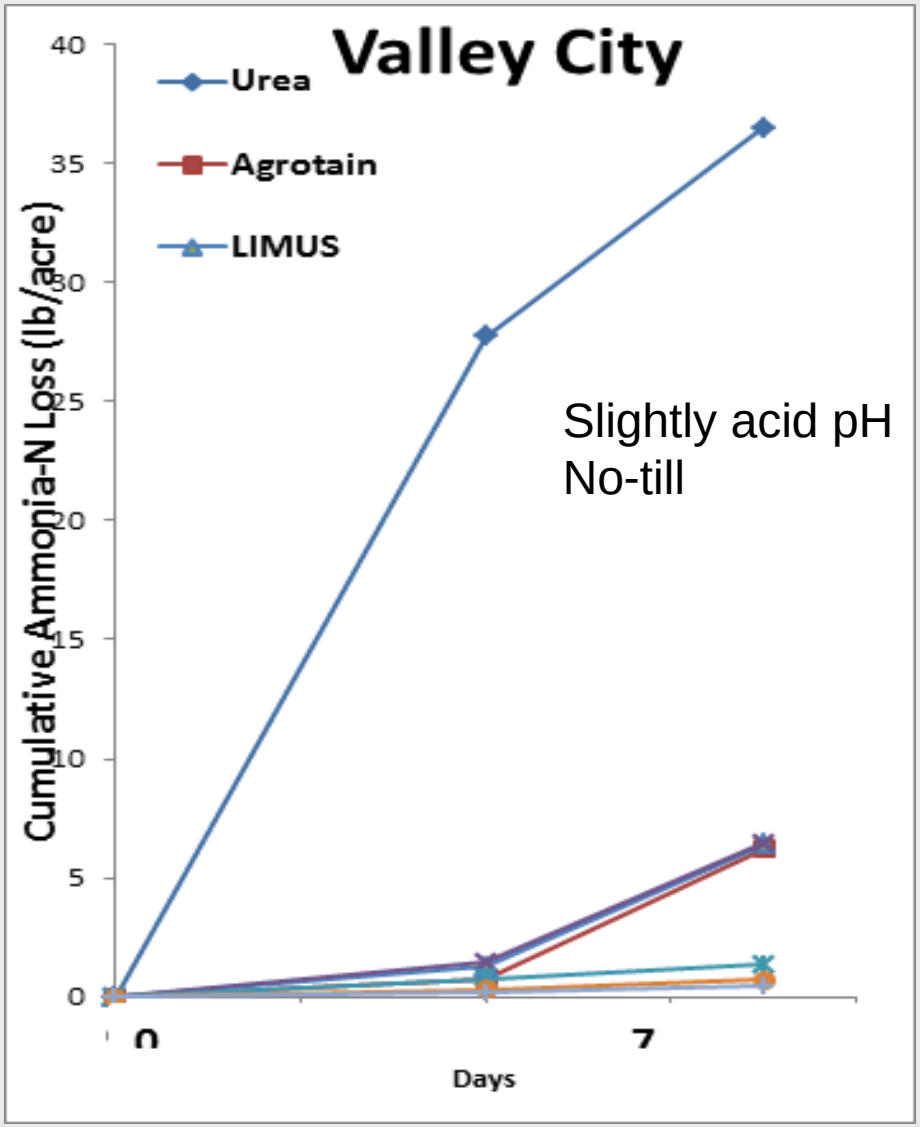
**Test Conditions:**

Time: 1 day (24 hr), Air flow: 0.5 l/min
using 2.5 l tank, Relative Humidity: 5%, Substrate: glass


ATMOSPHERIC NITROGEN
ATMOSPHERIC FIXATION
DENITRIFICATION
VOLATILIZATION
VOLATILIZATION
PLANT UPTAKE AND HARVEST
INDUSTRIAL FIXATION
BIOLOGICAL FIXATION
Animal Manures
(commercial fertilizer)
(by legume plants)
Plant Residues
ORGANIC MATTER
NITRATE
AMMONIUM
LEACHING LOSS
The Nitrogen Cycle

# Ammonia loss from soil, ND




2015, Franzen, NDSU

# Dicamba volatility and N fertilizer?

- 2 soils
  - Prairie (>3% organic matter)
  - Timber (2% organic matter)
- Urea ammonium nitrate (32-0-0)
  - Yes
  - No
- All pots were treated with dicamba
- Pots were placed in humidity domes with sensitive soybean 0, 1, 2 and 3 days after dicamba application
- Soybean plants were replaced each day/night.
- Injury was rated 2 weeks after dicamba application

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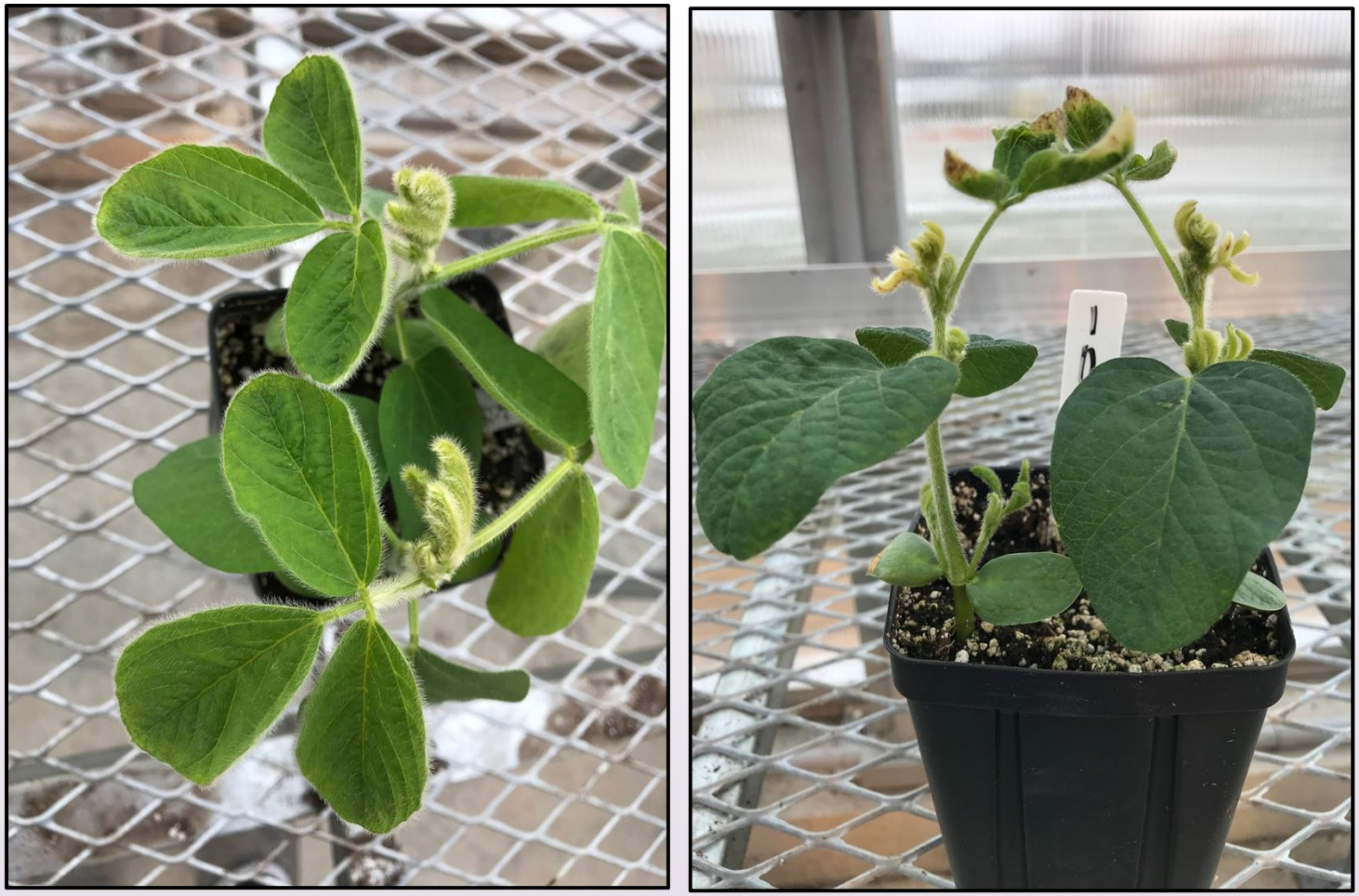

Figure 1. Plant with symptoms rated 20% damage on left, and with 50% damage on right.

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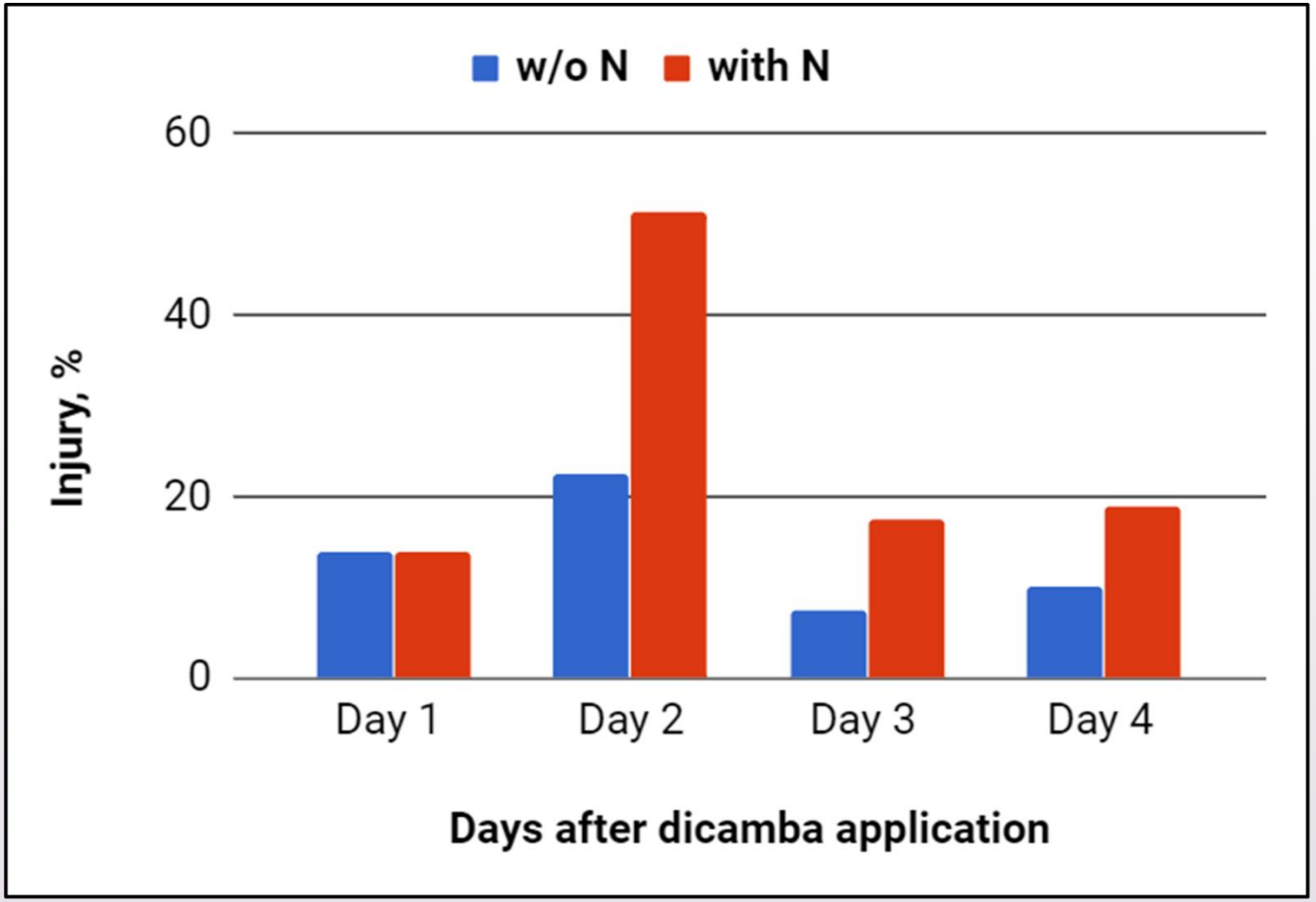


Figure 2. Soybean injury from dicamba volatility as affected by nitrogen application to the soil surface. Columns marked with the same letter within a day are not statistically different, p=0.05.

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| Table 2. Outside high and low temperatures and sky conditions for Macomb, March 23-27, 2018. | | | | | |
|---|---|---|---|---|---|
| Temp | 03/23/18 N1 | 03/24/18 D1 and N2 | 03/25/18 D2 and N3 | 03/26/18 D3 and N4 | 03/27/18 D4 |
| High | 50 F | 35 F | 41 F | 49 F | 51 F |
| Low | 32 F | 30 F | 29 F | 32 F | 36 F |
| Sky | | | | | |

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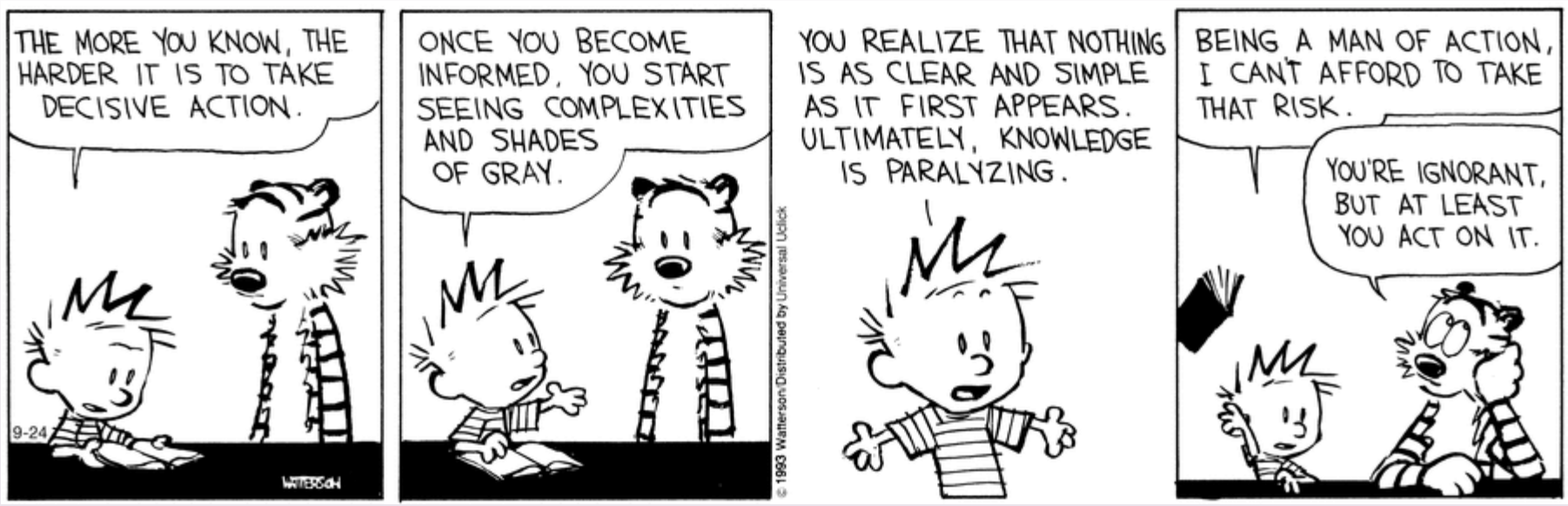
Are there adjuvants that might be added to minimize dicamba interaction with ammonium or other ions in the environment that may cause volatility?

VaporGrip = acetic acid + ????

# Calvin and Hobbes

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# Don Penner

- Dicamba volatility and tomato bioassays

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# Liberty herbicide

- Anything to help make it work consistently?

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# From Rich Zollinger:

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# Purpose of adjuvants

- Maintain same biological activity at reduced pesticide rate
- Increase biological activity at standard pesticide rate

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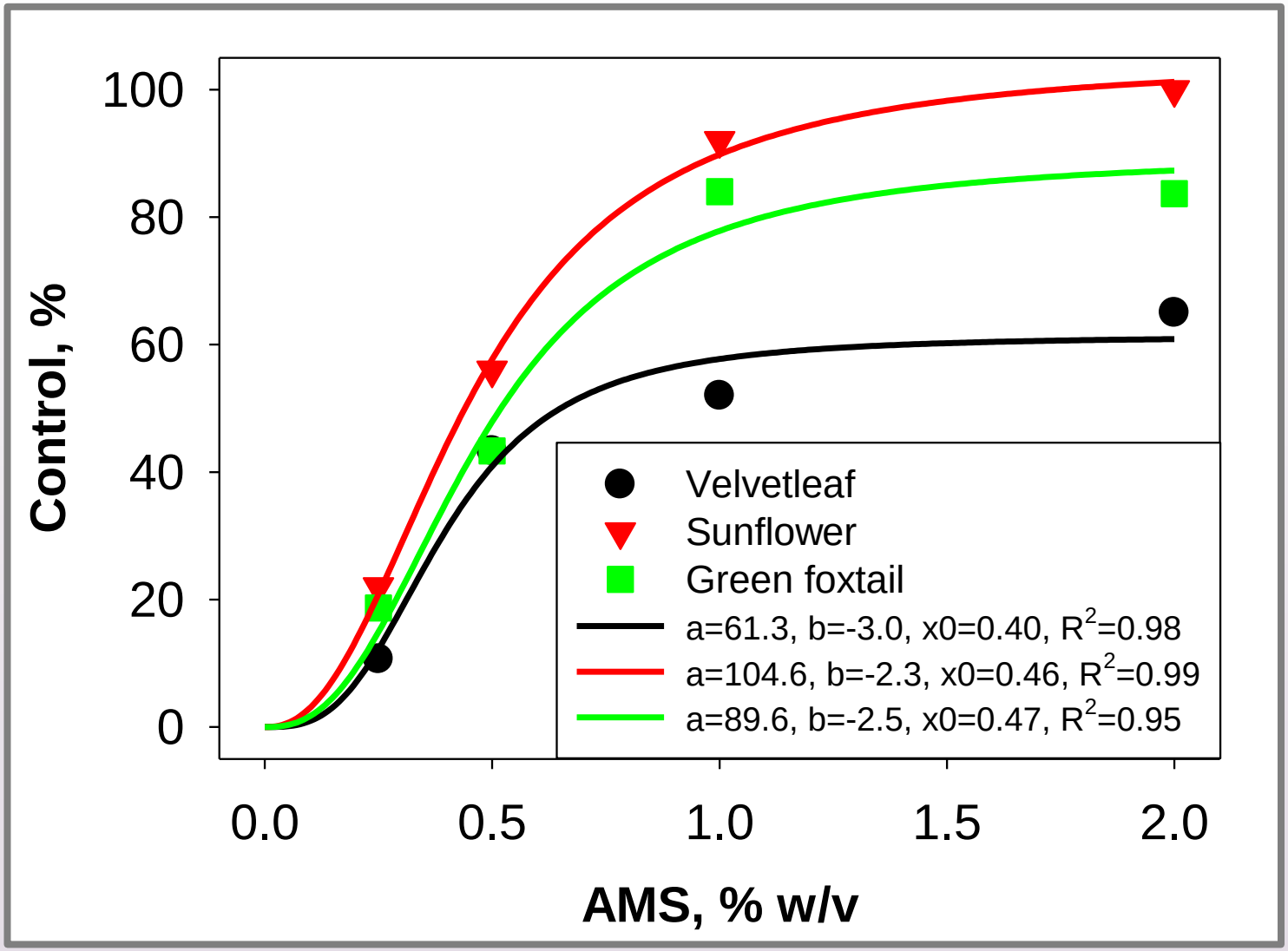
# AMS dose response

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# AMS, Water conditioner or more glyphosate???

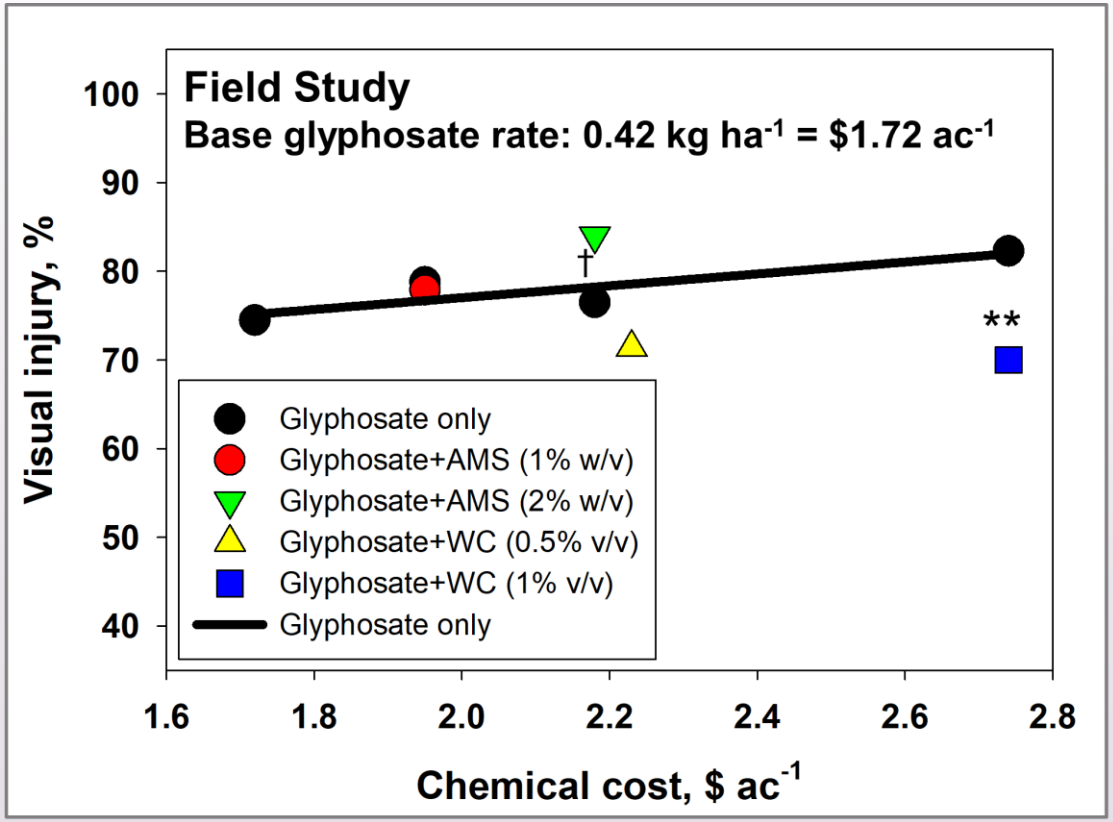


Figure 2. Weed control 14 DAT as affected by glyphosate rate (y=6.7x + 63.7) or AMS source. Data represent the average of 4 replications of velvetleaf, buckwheat, glufosinate-resistant soybean and corn. Marked separations: †, p=0.10; **, p=0.01.

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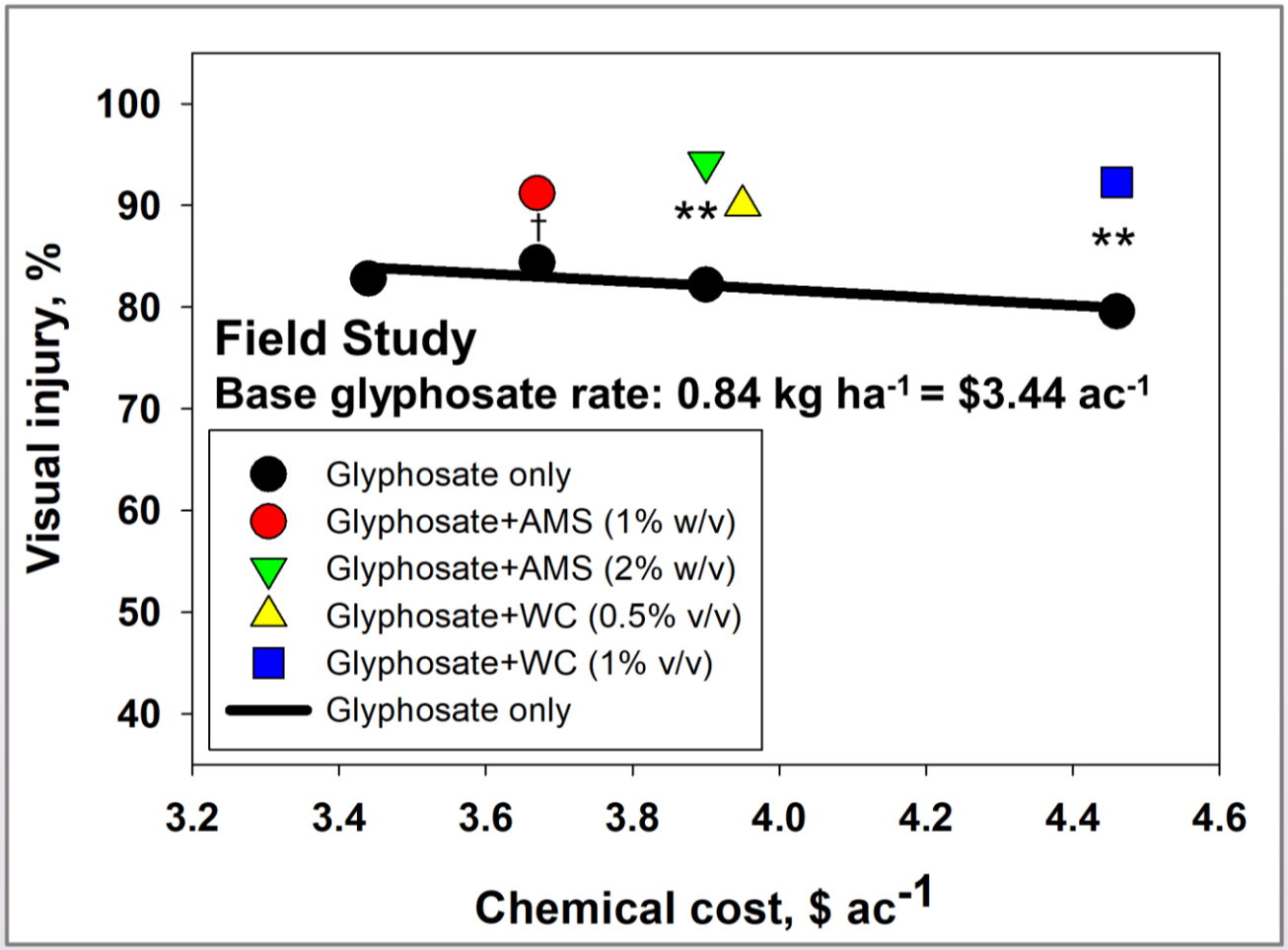


Figure 3. Weed control 14 DAT as affected by glyphosate rate (y= – 3.9x+97.2) or AMS source. Data represent the average of 4 replications of velvetleaf, buckwheat, glufosinate-resistant soybean and corn. Marked separations : †, p=0.10; **, p=0.01.

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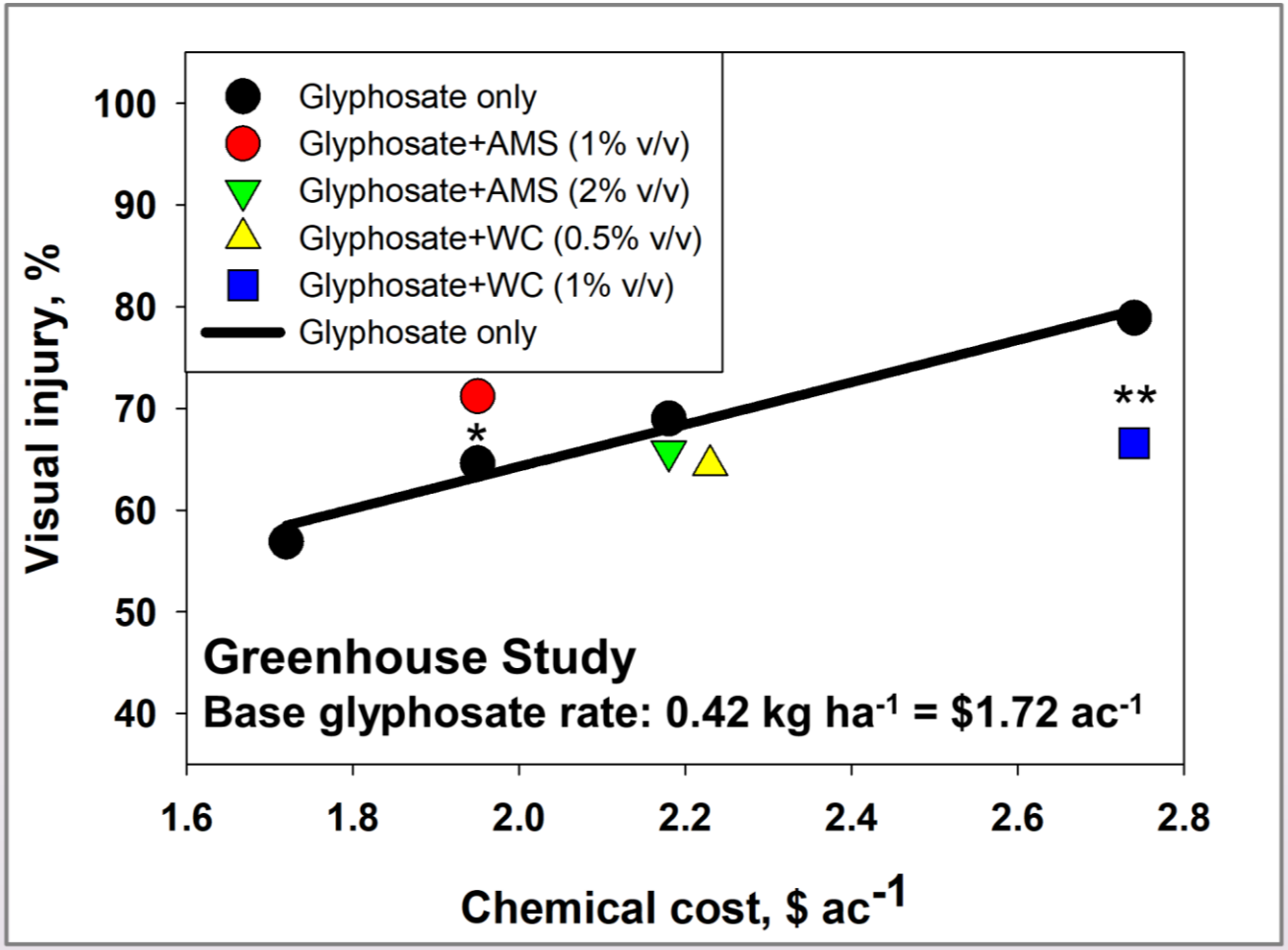


Figure 4. Weed control 10 DAT as affected by glyphosate rate (y=20.7x + 22.8) or AMS source. Data represent the average of 2 runs (6 reps per run) of velvetleaf, buckwheat, common sunflower, amaranth, and giant foxtail. Marked with: *, p=0.05; **, p=0.01.

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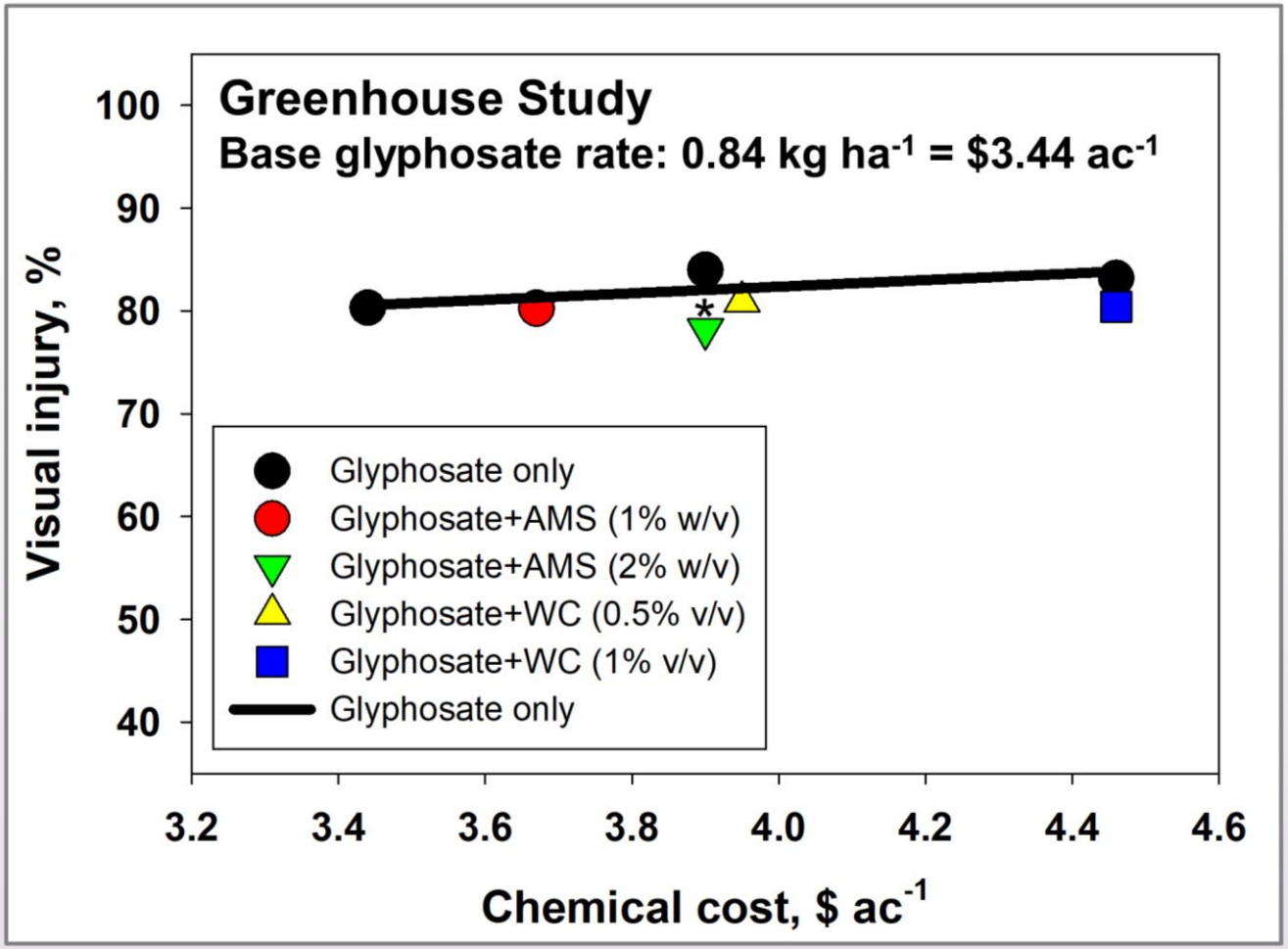


Figure 5. Weed control 10 DAT as affected by glyphosate rate (y=3.2x + 69.9) or AMS source. Data represent the average of 2 runs (6 reps per run) of velvetleaf, buckwheat, common sunflower, amaranth, and giant foxtail. Marked with: *, p=0.05.

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# Challenge to CPDA

- Develop water conditioning adjuvants that are more cost effective than more glyphosate

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