Sundry Studies Related to Weeds at WIU

Mark L. Bernards
Western Illinois University
WIU Agronomy Farm
WIU Kerr
Agronomy
Farm
Greenhouses and Sprayer
Driver weeds on WIU farms
GR Waterhemp – resistance threshold?
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/
Rumler (2017) – Waterhemp response to dicamba

![Graph showing waterhemp mortality (%) in response to dicamba dose (g ae ha\(^{-1}\)). The graph compares 10 cm and 20 cm waterhemp mortality at different dicamba doses.]
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.

<table>
<thead>
<tr>
<th>Height cm</th>
<th>Dose g ae ha⁻¹</th>
<th>No seed</th>
<th>Produced seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>560</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>280</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>140</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>70</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>18.4</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>20</td>
<td>560</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>20</td>
<td>280</td>
<td>16</td>
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<td>14</td>
</tr>
</tbody>
</table>
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.
Rumler (2017) – Waterhemp seed germination and viability and dicamba dose

95% of waterhemp seeds were viable – dicamba dose had no effect!
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
Dicamba movement to trees
Sequel?? – Treeless Countryside
Potential dicamba volatility solution

Apply dicamba earlier in the season??
Waterhemp, 37 days after appl.
Early application of dicamba has merit, but how will off-target movement be affected by tank-mixes with other herbicides?

Adjuvant solutions???
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?

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

Mechanism of action:
1. NH₃ volatilizes
2. Leaves behind H+
3. H+ lowers pH
4. > dicamba-acid
Ammonia loss from soil, ND

Gardner

- Urea
- Agrotain
- LIMUS
- NBPT
- Check

Cumulative Ammonia-N Loss (lb/acre)

Neutral pH
Conventional till

Days

Valley City

- Urea
- Agrotain
- LIMUS

Cumulative Ammonia-N Loss (lb/acre)

Slightly acid pH
No-till

Days

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
Figure 1. Plant with symptoms rated 20% damage on left, and with 50% damage on right.
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.
<table>
<thead>
<tr>
<th>Temp</th>
<th>03/23/18 N1</th>
<th>03/24/18 D1 and N2</th>
<th>03/25/18 D2 and N3</th>
<th>03/26/18 D3 and N4</th>
<th>03/27/18 D4</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>50 F</td>
<td>35 F</td>
<td>41 F</td>
<td>49 F</td>
<td>51 F</td>
</tr>
<tr>
<td>Low</td>
<td>32 F</td>
<td>30 F</td>
<td>29 F</td>
<td>32 F</td>
<td>36 F</td>
</tr>
</tbody>
</table>

Table 2. Outside high and low temperatures and sky conditions for Macomb, March 23-27, 2018.
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

The more you know, the harder it is to take decisive action.

Once you become informed, you start seeing complexities and shades of gray.

You realize that nothing is as clear and simple as it first appears. Ultimately, knowledge is paralyzing.

Being a man of action, I can't afford to take that risk.

You're ignorant, but at least you act on it.
Don Penner

- Dicamba volatility and tomato bioassays
Liberty herbicide

Anything to help make it work consistently?
From Rich Zollinger:

AMS – pure alchemy

ammonium sulfate
Purpose of adjuvants

- Maintain same biological activity at reduced pesticide rate
- Increase biological activity at standard pesticide rate
AMS dose response

- Velvetleaf: \(a=61.3, b=-3.0, x_0=0.40, R^2=0.98\)
- Sunflower: \(a=104.6, b=-2.3, x_0=0.46, R^2=0.99\)
- Green foxtail: \(a=89.6, b=-2.5, x_0=0.47, R^2=0.95\)
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: †, $p=0.10$; **, $p=0.01$. 
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.
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.
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: *, $p=0.05$. 
Challenge to CPDA

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