Costs and benefits of establishing alfalfa with glyphosate across seven production fields in Wisconsin

Mark Renz
Univ. of Wisconsin, Madison
Many people involved
Background

• Roundup Ready alfalfa re-released in 2011

• Low adoption compared to other glyphosate tolerant crops in WI
  • <5% seed sales in 2011 were RR alfalfa

• Clientele want more information on performance
  • Specifically in the establishment year
  • Improve recommendations
When are applications typically made in seedling alfalfa in WI?

Results of Crop Consultant survey n=247

- 1-4” tall, 1-3 Leaves: 30%
- 5-8” tall, 4-6 Leaves: 50%
- >8” tall, >6 leaves: 10%

Weed height, # leaves
Objective

• Compare **weed control**, **productivity** and **alfalfa plant density** between glyphosate and a conventional establishment method

• **Effects in the establishment year**
• **Is timing of application important?**
Locations
counties in Wisconsin

Released Thursday, August 9, 2012
Mark Svoboda, National Drought Mitigation Center
Methods

• Randomized complete block design 3 replications
  – 50-125 ft long; 10-20 ft wide

• Treatments
  – Glyphosate (0.75 lbs ae a\textsuperscript{-1}) + AMS applied to small weeds
  –Glyphosate (0.75 lbs ae a\textsuperscript{-1}) + AMS applied to large weeds
  – Imazamox (Raptor 5 fl oz a\textsuperscript{-1}) + MSO applied to small weeds
  – Imazamox (Raptor 5 fl oz a\textsuperscript{-1}) + MSO applied to large weeds
  – Untreated control

• Plots harvested as close to farmer’s schedule
  • 1\textsuperscript{st} cutting typical timing
  • 2\textsuperscript{nd} cutting delayed (2 sites), didn’t occur (3 sites)
## Locations

<table>
<thead>
<tr>
<th></th>
<th>Dane</th>
<th>Jackson</th>
<th>Brwn</th>
<th>FDL</th>
<th>Door</th>
<th>Wshbrn</th>
<th>Clark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1\textsuperscript{st} timing + weed ht</td>
<td>5/22 (2-6”)</td>
<td>5/25 (1-6”)</td>
<td>6/11 (2-9”)</td>
<td>5/30 (1-5”)</td>
<td>6/7 (8-10”)</td>
<td>6/8 (1-4”)</td>
<td>6/5 (2-8”)</td>
</tr>
<tr>
<td>Days + height diff</td>
<td>14 (3-14”)</td>
<td>13 (5-18”)</td>
<td>9 (6-9”)</td>
<td>16 (2-10”)</td>
<td>8 (2-14”)</td>
<td>17 (4-11”)</td>
<td>13 (8-22”)</td>
</tr>
</tbody>
</table>

### Applications were made approx.:
1. two weeks apart (8-17 days)
2. To weeds that were 8” taller
   - 2-7” vs 7-21” inches tall
Measurements

- Visual estimates (taken at each harvest)
  - Alfalfa: % injury and growth reduction
  - Weeds: % control and cover of major species = Lambsquarter

- Biomass estimates both cuts
  - Quadrats from each plot
    - Separated forage into weeds and alfalfa
    - Dried and weighed
  - Forage harvester 3 foot swath length of the plot (100-300 ft²)

- Alfalfa plant density (counted in Fall)
Data Analyzed

• Averaged across locations
• Each location separately
Weed Pressure (% Weed Biomass)

<table>
<thead>
<tr>
<th>WEED POPULATION</th>
<th>Low</th>
<th>Moderate</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dane</td>
<td></td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Jackson</td>
<td></td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Brown</td>
<td></td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>FDL</td>
<td></td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Door</td>
<td></td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Washburn</td>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Clark</td>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
### Lambsquarter control

<table>
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<th>Moderate</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>25%</td>
<td>50%</td>
<td>75%</td>
</tr>
<tr>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* treatments different than gly1 (P<0.05)
Jackson County

Glyphosate small weeds
Jackson County
Door County

Glyphosate
Small weeds
Alfalfa Injury and Growth Reduction

1 MAT across locations

P<0.001
Yield 1st cut
across locations

P<0.001
Yield 1st cut across locations

Dry Biomass (Tons/A)

- gly1
- gly2
- imaz1
- imaz2
- utc

Weeds
Alfalfa

P<0.001
% Weed Biomass in 1\textsuperscript{st} Cut

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% weeds

* Denotes treatments different than gly1 (P<0.05)
Dane County Yield

1\textsuperscript{st} cut

<table>
<thead>
<tr>
<th>Dry Biomass (Tons/A)</th>
<th>weeds</th>
<th>alfalfa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WEED POPULATION = LOW**

Yield was similar across treatments

- gly1
- gly2
- imaz1
- imaz2
- utc
Jackson County Yield

1st cut

WEED POPULATION = moderate

- Yield was similar across treatments
- Alfalfa yield was less in UTC
- Weed yield was greatest in UTC
Clark County Yield
1st cut

WEED POPULATION = High

- Yield was greatest in UTC + Raptor late
- Early applications were better than late

Dry Biomass (Tons/A)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>dry Biomass (Tons/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>gly1</td>
<td>C</td>
</tr>
<tr>
<td>gly2</td>
<td>B</td>
</tr>
<tr>
<td>imaz1</td>
<td>C</td>
</tr>
<tr>
<td>imaz2</td>
<td>B</td>
</tr>
<tr>
<td>utc</td>
<td>A</td>
</tr>
</tbody>
</table>

Legend:
- weeds
- alfalfa
Yield $2^{nd}$ cut across locations

Dry Biomass (Tons/A)

- gly1: bc
- gly2: c
- imaz1: b
- imaz2: bc
- utc: a

- Weeds
- Alfalfa
% Weeds Biomass in 2nd Cut

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</thead>
</table>

* Denotes treatments different than gly1 (P<0.05)
Untreated plants resprout
Alfalfa plant density

Fall 2012

Alfalfa plants/square foot

gly1  gly2  imaz1  imaz2  utc

A    AB    AB    BC    C

A

AB

AB

BC

C

A

AB

AB

BC

C
Alfalfa Plant Density Fall 2012

WEED POPULATION

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<tr>
<td>Alfalfa Plant Density</td>
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Fall 2012

*** ns

Denotes treatments different than gly1 (P<0.05)

* Denotes treatments different than gly1 (P<0.05)
Alfalfa Plant Density Fall 2012

* Denotes treatments different than gly1 (P<0.05)
Conclusions

Lambsquarter Control

• Across sites: Gly to small weeds gave best control

• Within sites: highly variable
  – Glyphosate applied early always was top treatment
  – Glyphosate applied late was similar 5 out of 6 sites
  – Raptor (imazamox) applied early was similar 3 out of 6 sites
Conclusions

• **Alfalfa Yield 1st cut:**
  – Across sites: Gly to small weeds gave lowest % weeds, more alfalfa vs late applications + UTC
  – Benefit of treatment varied by site
    • **Low weed biomass (<15%)**
      – Herbicide treatment did not improve % alfalfa
    • **Moderate weed biomass (40-50%)**
      – any herbicide treatment improved % alfalfa
    • **High weed biomass (60-85%)**
      – glyphosate applied to small weeds gave greatest % alfalfa
Conclusions

• Alfalfa Yield 2\textsuperscript{nd} cut
  – % weeds greatest in UTC
  – no differences among herbicide trts in 3 out of 4 sites

• Alfalfa density
  – Across sites: all but late Raptor better than UTC
  – Within sites: Highly variable
    • Similar in 5 out of 6 locations
    • Difference at one location may be due to severe drought stress
Future questions

• Forage Quality
  – How does weed biomass affect forage quality?
  – What % of weed biomass is tolerable?
    • Milk production (will estimate)
  – Can we make some general recommendations?
    • or is it too site specific!!!!
Questions?