Weed Management Research in Alfalfa Seed Production

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Weed Control Issues and Challenges in Alfalfa Seed Production

• Weeds lower seed yield and quality and increase seed cleaning costs
• Alfalfa seed crops normally planted in wider rows and lower plant populations – providing less competition with weeds
• Multiple harvests of forage alfalfa also provide weed control benefits that are lacking in alfalfa seed production
• Weed resistance/tolerance to ALS inhibitor type herbicides (Pursuit and Raptor). Prickly lettuce, mayweed chamomile, kochia, Russian thistle, common groundsel, sowthistle)
Alfalfa Weed Research

- Fall-seeded alfalfa tolerance to flumioxazin (Chateau). (3 planting dates, 4 forage harvests)
- Tolerance of established forage alfalfa to herbicides
- Tolerance of seed alfalfa to herbicides
- ‘Setback’ herbicide trial in alfalfa seed
Fall-seeded alfalfa tolerance to flumioxazin (Chateau)

1) Flumioxazin @ 0.125 lb ai/a + 0.5 lb ai/a paraquat
2) Flumioxazin @ 0.25 lb ai/a + 0.5 lb ai/a paraquat
3) Paraquat @ 0.5 lb ai/a
4) Nontreated Check

(paraquat NOT labeled on new seedings in northern U.S.)

Planting dates (2006 and 2007)
1) August 15
2) September 5
3) September 26

Treatments replicated 4 times in split block design.
Fall-seeded alfalfa tolerance to Chateau applied in dormant stage (Feb. 4, 2007 or Feb. 19, 2008).
Effect of planting date and Chateau + Gramoxone on hay yield of fall-seeded alfalfa near Prosser, WA in 2007-08.

<table>
<thead>
<tr>
<th>Planting date</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st cutting</td>
<td>2nd cutting</td>
</tr>
<tr>
<td>August 15 (early)</td>
<td>2.7 a</td>
<td>1.7 a</td>
</tr>
<tr>
<td>September 5 (mid)</td>
<td>1.8 b</td>
<td>1.6 a</td>
</tr>
<tr>
<td>September 26 (late)</td>
<td>1.6 b</td>
<td>1.3 b</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Herbicide (lb ai/a)²</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flumioxazin² (0.125) + Paraq.</td>
<td>1.9 b</td>
<td>1.5</td>
</tr>
<tr>
<td>Flumioxazin (0.25) + Paraq.</td>
<td>1.8 b</td>
<td>1.5</td>
</tr>
<tr>
<td>Paraquat (0.5)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Nontreated</td>
<td>2.4 a</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Lsd (0.05) | 0.29  | 0.19  | 0.56  | n.s.  |

1First cutting of alfalfa planted Sept. 26 was one week later, on May 23, 2007.

2Flumioxazin treatments included paraquat at 0.5 lb ai/ a and COC at 1% (v/ v).
Summary

- Later planted alfalfa (Sept. 5 or 26) yielded less in 1st cutting than early planted (Aug. 15).
- Flumioxazin applied during dormant stage reduced 1st cutting hay yield in 1 of 2 years.
- Flumioxazin did not affect yield of 2nd cutting.
- Later planted (smaller) alfalfa was injured more by dormant applied flumioxazin, but no signif. interaction between planting date and herbicide treatment on 1st cutting hay yield.
CHATEAU® HERBICIDE WDG USE IN ALFALFA Supplemental Label

TIMING TO ALFALFA

*Chateau* WDG may be applied to *established alfalfa* with a maximum amount of regrowth of 6 inches or less for the preemergence control of the weeds listed in Table 1,....

Use on alfalfa seed crops is allowed.
Weeds controlled by flumioxazin

- Carpetweed
- Chickweeds
- Dandelion
- Eclipta
- Evengingprimrose
- Florida Pusley
- Henbit
- Kochia
- Lambsquarters
- Little Mallow
- Marestail/horseweed
- Nightshade sp.
- Pigweed sp.
- Prickly Sida
- Puncturevine
- Purslane
- Radish, wild
- Redmaids
- Shepherd’s-purse
- Smallflower Morningglory
- Spotted spurge
- Venice mallow

Some annual grass suppression
Established Forage Alfalfa Tolerance to Herbicides - 2008

1) Chateau (flumioxazin) 0.125 lb ai/a + Gramoxone
2) Spartan (sulfentrazone) 0.19 lb ai/a + Gramoxone
3) Gramoxone (paraquat) 0.5 lb ai/a

4) Resource (flumiclorac) 0.04 lb ai/a
5) Blizzard (fluthiacet-methyl) 0.0043 lb ai/a
6) Firstrate (chloransulam) 0.021 lb ai/a
7) Python (flumetsulam) 0.056 lb ai/a
8) Sandea (halosulfuron) 0.026 lb ai/a
9) Raptor (imazamox) 0.04 lb ai/a
10) Harmony GT (thifensulfuron) 0.004 lb ai/a
11) Nontreated check

All herbicides included nonionic surfactant @ 0.25% (v/v)
Trts replicated 3 times in a RCB design
First cutting hay yield taken May 29, 2008

Trts 1-3 applied Feb. 27, 2008 to dormant alfalfa

Trts 4-10 applied March 25, 2008 to alfalfa 2 to 4 inches tall
Alfalfa injury April 23, 2008 following ten herbicide treatments
Alfalfa 1st cutting hay yield May 29, 2008 following ten herbicide applications

Yield (T/a)

- Chateau
- Spartan
- Gramox
- Resource
- Blizzard
- Firstrate
- Python
- Sandea
- Raptor
- Harmony GT

LSD(0.05) = 0.34
Summary: Spring-applied herbicides on established alfalfa

- Chateau, Spartan, Firstrate, Harmony GT*, Raptor – no alfalfa injury or yield reduction at rates and timing tested.
- Resource and Blizzard - < 15% injury early, none at 60 DAT
- Python – 16% stunting at 60 DAT
- Sandea – excessive injury ~ 80%
  (Sandea labeled in AZ and CA between cuttings and spot treatment for yellow nutsedge)
Herbicide Trial in Alfalfa Seed - 2007
Established commercial alfalfa seed field, sprinkler irrigated
PRE – applied March 15, 2007 (alfalfa 1-2 in. tall)
POST – applied April 5 (alfalfa 5-10 in. tall)
Entire trial treated with Prowl (2 lb ai/a)

Non-registered herbicides tested
• Asulox (asulam)
• Aim (carfentrazone)
• Chateau (flumioxazin)
  (now labeled)

Registered herbicides included:
• Gramoxone
• Velpar
• Karmex
• Raptor
<table>
<thead>
<tr>
<th>Herbicide (lb ai/a)</th>
<th>Application Timing</th>
<th>Alfalfa injury April 19, 2007 (%)</th>
<th>Alfalfa bloom May 23, 2007 (%)</th>
<th>Alfalfa seed yield Aug. 9, 2007 (lb/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Diuron (1.5) + paraquat (0.5)</td>
<td>PRE</td>
<td>0</td>
<td>13</td>
<td>1929</td>
</tr>
<tr>
<td>2. Flumioxazin (.125) + paraquat (0.5)</td>
<td>PRE</td>
<td>3</td>
<td>8</td>
<td>1731</td>
</tr>
<tr>
<td>3. Flumioxazin (.25) + paraquat (0.5)</td>
<td>PRE</td>
<td>5</td>
<td>12</td>
<td>1700</td>
</tr>
<tr>
<td>4. Hexazinone (0.67) + paraquat (0.5)</td>
<td>PRE</td>
<td>1</td>
<td>14</td>
<td>1183</td>
</tr>
<tr>
<td>5. Hexazinone (1.34) + paraquat (0.5)</td>
<td>PRE</td>
<td>0</td>
<td>15</td>
<td>1796</td>
</tr>
<tr>
<td>6. Asulam (1.25) + (1.25)</td>
<td>PRE + POST</td>
<td>0</td>
<td>23</td>
<td>1681</td>
</tr>
<tr>
<td>7. Paraquat (0.5) + Asulam² (1.25)</td>
<td>PRE + POST</td>
<td>0</td>
<td>13</td>
<td>1828</td>
</tr>
<tr>
<td>8. Carfentrazone (.016) + (.016)</td>
<td>PRE + POST</td>
<td>86</td>
<td>0</td>
<td>1449</td>
</tr>
<tr>
<td>9. Carfentrazone (.032) + (.032)</td>
<td>PRE + POST</td>
<td>89</td>
<td>0</td>
<td>1368</td>
</tr>
<tr>
<td>10. Paraquat (0.5) + Imazamox (0.04)</td>
<td>PRE + POST</td>
<td>1</td>
<td>14</td>
<td>--</td>
</tr>
<tr>
<td>11. Paraquat (0.05) - Control</td>
<td>PRE</td>
<td>0</td>
<td>20</td>
<td>1664</td>
</tr>
<tr>
<td>Lsd (0.05)</td>
<td></td>
<td>3.5</td>
<td>8.4</td>
<td>388.8</td>
</tr>
</tbody>
</table>

PRE treatments were applied March 15, 2007 and POST treatments were applied April 5, 2007
All treatments included R-11 nonionic surfactant at 0.25% spray volume.
March 1

April 5 (POST applic.)

Aim 1 oz/A (2 WAT)

May 23
Summary: 2007 Herbicide Trial in Alfalfa Seed

• Asulox – good alfalfa tolerance with 3 or 6 pt/A, ~80% control of mayweed. Seed yield unaffected.
  (8 pt/a safe on alfalfa in several 2008 trials – marestail, prickly lettuce, blue mustard, wild oat, and downy brome control)

• Aim – 1 or 2 oz/A totally desiccated emerged alfalfa, normal regrowth, delayed bloom, did not control mayweed. Seed yield slightly reduced. Good candidate for ‘set-back’ herbicide.

• Chateau - applied PRE @ 4 or 8 oz/A slightly stunted alfalfa growth and 4 oz slightly delayed bloom. ~90% control of mayweed. Seed yield unaffected.
Summary: 2007 Herbicide Trial in Alfalfa Seed

• Velpar – applied PRE at 0.67 and 1.35 lb ai/a (2.7 to 5.4 pts) good alfalfa tolerance and 100% control of mayweed. Lower rate reduced seed yield, higher rate did not.  

• Karmex – applied PRE at 1.5 lb ai/a (1.9 lb product) gave 100% control of mayweed. Highest alfalfa seed yield in trial – 1929 lb/a.

• Raptor – applied POST at 5 oz/A in April controlled mayweed 67%.
Alfalfa Set-back Trial – 2008

1) Aim (carfentrazone) 0.032 lb ai/a (2 fl oz/a)
2) Gramoxone Inteon (paraquat) 0.5 lb ai/a (2 pts/a)
3) Blizzard (fluthiacet-methyl) 0.0089 lb ai/a (1.25 fl oz/a)
4) Nontreated check
5) Tillage set back

- Herbicides applied in water volume of 20 gpa and included NIS @ 0.25% (v/v)
- Tillage/herbicides applied April 17, 2008, when alfalfa was 6-8 inches tall
- Metribuzin + paraquat applied to entire trial March 15, 2008
- Treatments replicated 4 times in RCB
Two Weeks after Treatment

Aim (2 fl oz/a)  Gramoxone (2 pt/a)  Blizzard (1.25 fl oz/a)

Tillage  Nontreated
Alfalfa Regrowth at Five Weeks after Treatment

Aim (2 fl oz/a)  Tillage
Alfalfa desiccation, percent bloom, height, and seed yield after ‘set-back’ herbicide or tillage treatments on April 17, 2008 near Moses Lake, WA.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Rate (Lb ai/a)</th>
<th>Alfalfa desiccation 5/1/08 (%)</th>
<th>Alfalfa bloom 5/23/08 (%)</th>
<th>Alfalfa height 5/23/08 (Inches)</th>
<th>Alfalfa Seed Yield 8/12/08 (lb/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carfentrazone (Aim)</td>
<td>0.032</td>
<td>96 a</td>
<td>0 b</td>
<td>16 c</td>
<td>418 a</td>
</tr>
<tr>
<td>Paraquat (Gramox. Inteon)</td>
<td>0.5</td>
<td>78 c</td>
<td>1.3 b</td>
<td>18 b</td>
<td>449 a</td>
</tr>
<tr>
<td>Fluthiacet (Blizzard)</td>
<td>0.009</td>
<td>69 d</td>
<td>10.0 a</td>
<td>19 b</td>
<td>322 a</td>
</tr>
<tr>
<td>Mechanical set-back</td>
<td>--</td>
<td>89 b</td>
<td>0.5 b</td>
<td>16 c</td>
<td>431 a</td>
</tr>
<tr>
<td>Nontreated (no setback)</td>
<td>--</td>
<td>0 e</td>
<td>12.5 a</td>
<td>24 a</td>
<td>369 a</td>
</tr>
<tr>
<td>LSD (P=.05)</td>
<td>3.04</td>
<td>2.51</td>
<td>1.44</td>
<td>N.S.</td>
<td></td>
</tr>
</tbody>
</table>

Means within a column followed by same letter do not significantly differ (P=0.05)
Summary: Set-back trial – 2008

- Aim – alfalfa set-back, regrowth, and delay of bloom very similar to grower’s tillage treatment
- Gramoxone Inteon – only partial set-back and quicker regrowth and bloom than tillage
- Blizzard – least injury, quickest regrowth, and bloom
- Alfalfa seed yield low and variable – no significant differences
Acknowledgements

- Washington Alfalfa Seed Commission
- Washington State Commission on Pesticide Registration (WSCPR)
- Stewart Byerley and Ken Goodrich – Grower Cooperators
- Valent, FMC, DuPont, Dow, Chemtura, BASF, and UPI - United Phosphorus Inc.