Medusahead Control with Milestone Herbicide

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WHAT’S NEW
1. Research update on Fall Pre and Spring post Medusahead control with Milestone
2. Milestone expanded label
3. Future plans

Burn it, eat it, spray it!!!
Previous medusahead research – all with excellent results

- Greenhouse trial at UC Davis with pre and post emergent applications
- Field research (3 sites) with UC Davis on pre emergent applications
- Larger scale applications in CA
- USDA-ARS study on seed viability after applications at 3 post emergent stages
  - Follow-up study with 2014 and 2015 studies in the field in CA (4 locations)

PREVIOUS WORK

Figure 1: Cover 6 months after herbicide applications

Treated: fall 2009
Evaluated: May 2010

<table>
<thead>
<tr>
<th>% COVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS 3 oz</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Winters</td>
</tr>
<tr>
<td>MS = Milestone</td>
</tr>
</tbody>
</table>
Milestone at 7 fl oz vs. Non-treated
Treated Oct 2009 - Photo May 2010

Plateau at 8 fl oz
Treated Oct 2009 - Photo May 2010

-note release of annual ryegrass-
Red Bluff, CA

Medusahead Control at the
Vineyard Mountain Ranch

Treated by Nathan Sanders, Ranch Manager
with 7 oz/acre Milestone, October 2012
at early post-emergence on medusahead

Annual Ryegrass Release
Milestone @ 7 fl oz/A
Spray Skip Tells the Story

Spray skip

Treated – Release of annual ryegrass
SFREC, CA
Research on Milestone® Effects on Medusahead and Ventenata Seed Production

- Dr. Rinella, USDA-ARS Rangeland Ecologist, showed that Milestone, Tordon 22K and some other growth regulator herbicides applied post emergence on Japanese brome and cheatgrass (downy brome) had an effect on seed development.
  - Does Milestone have an effect on seed development of medusahead similar to that of growth regulators on Japanese brome?
Herbicide Effects on Seed Development

These are Japanese brome hulls* but the same lack of seed development occurs with medusahead and ventenata

Normal Seeds  
Milestone treated plants

* see research data on previous slide

Milestone and Opensight herbicides

- 2(ee) Label Recommendations and now on the section 3 Milestone label
  - For Control or Suppression of Medusahead Rye and Other Winter Annual Grasses
    » Cheatgrass (downy brome)
    » medusahead rye
    » Ventenata

Supplemental Label for Medusahead Control Issued in 2011

Product Bulletin

Milestone®

For Distribution and Use in the States of Arizona, California, Colorado, Idaho, Oregon, Nevada, Utah, Wyoming

For Control or Suppression of Medusahead Rye and Other Winter Annual Grasses

Latest Literature Piece 2013

Medusahead control with Milestone® herbicide

Rick Miller¹, Beau Miller¹, Vanelle Peterson¹, Scott Ornelia², Guy Kyser², and Joe DiTomaso²

¹ Dow AgroSciences, ² UC Cooperative Extension, Cattlemans, and ³ University of California Cooperative Extension, Davis
Program approach and why it will work

• Why it will work?
  – Medusahead seed has a short viability – about 3 years
• Program:
  – Preemergent applications in the fall with Milestone at either 7 or 14 fl oz/A
  – Follow-up post emergent application in the spring of Milestone to reduce/eliminate seed viability
  – Follow-up with spot applications as needed

2014 and 2015 Research

• 2014 field trials in CA in partnership between Dr. Matt Rinella and the University of California where repeated in 2015 to observe seed viability
• Trials established in the Intermountain west (UT and ID) to test effectiveness of the pre and post emergent (fall and spring) applications
  – Data will be taken in 2016

Preliminary Information
CA 2015 Research Methods

• 4 treatment sites in California
• Milestone® applied at 3, 7 or 14 oz in the Spring or
• Milestone applied at 7 or 14 oz in the Fall
• Seeds were collected from medusahead, wild oats, soft chess and annual rye and tested for viability
• Percent cover of species of interest was estimated

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Growth stage of grasses and timing of Fall application of Milestone

<table>
<thead>
<tr>
<th>Species</th>
<th>Madera</th>
<th>SFREC</th>
<th>Bobcat</th>
<th>Red Bluff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>application date</td>
<td>Growth Stage at time of application</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medusahead</td>
<td>12/10/2013</td>
<td>pre-emergence</td>
<td>pre-emergence</td>
<td>5%-10% germ</td>
</tr>
<tr>
<td>Soft Chess</td>
<td>10/15/2013</td>
<td>pre-emergence</td>
<td>pre-emergence</td>
<td>pre-emergence</td>
</tr>
<tr>
<td>Annual Rye</td>
<td>11/15/2013</td>
<td>pre-emergence</td>
<td>pre-emergence</td>
<td>n/a</td>
</tr>
<tr>
<td>Wild Oat</td>
<td>9/27/2013</td>
<td>re-emergence</td>
<td>pre-emergence</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Trademark of The Dow Chemical Company (“Dow”) or an affiliated company of Dow
Growth stage of grasses and timing of spring application of Milestone

<table>
<thead>
<tr>
<th>Species</th>
<th>Madera</th>
<th>SFREC</th>
<th>Bobcat</th>
<th>Red Bluff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medusahead</td>
<td>late boot with few heading</td>
<td>10% headed/90% late-veg/early boot</td>
<td>mid to late boot</td>
<td></td>
</tr>
<tr>
<td>Soft Chess</td>
<td>boot to heading</td>
<td>fully headed out</td>
<td>fully headed out</td>
<td>headed</td>
</tr>
<tr>
<td>Annual Rye</td>
<td>boot</td>
<td>fully headed out</td>
<td>fully headed out</td>
<td>n/a</td>
</tr>
<tr>
<td>Wild Oat</td>
<td>boot to heading</td>
<td>fully headed out</td>
<td>early heading</td>
<td>n/a</td>
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</tbody>
</table>

Viability of medusahead seed in 2014 following application of Milestone at varying rates in the fall 2013 and spring 2014

- 30% reduction at "Fadzayi site"
- 84% reduction at "James site"
- 60% reduction at "Kyser site"

NOTE: little to no rainfall at the "Fadzayi site"

Dr. Matt Rinella and University of California

Viable seed production following application of Milestone at varying rates in the fall and spring

- Medusahead
- Annual Rye
- Soft Chess
- Wild Oats

*Note – Wild oats and Annual Rye did not occur at the Red Bluff site

Dr. Matt Rinella and University of California

2015 cover estimates following application of Milestone at varying rates in the fall and spring

- Medusahead
- Annual Ryegrass
- Soft Chess
- Wild Oats

*Note – The Bobcat site was burned in the summer of 2014 so no cover data was collected

Dr. Matt Rinella and University of California
Milestone™ Herbicide

New Reduced Risk Herbicide
For Control of Invasive and Noxious Broadleaf Weeds in Rangeland, Pastures, Riparian Areas, Industrial Vegetation Management Sites, and coming Aquatic sites in 2015!!!

What’s New?
Expanded Milestone Label is Here
- 75 broadleaf weeds now labeled
- 17 broadleaf families represented
- New Pre-emergent section
- Medusahead on sec 3 label

1 quart tip n’ pour
- Treats 5-10 acres

2 1/2 gallon jug
- Treats 50 – 100 acres

Molecular configuration

Registered Use Sites Milestone
- Rangeland & pastures no grazing restrictions
- Conservation Reserve Program acres
- Non-cropland areas (such as roadsides)
- Non-irrigation ditch banks
- Irrigation ditch tops and outer banks
- Natural areas (such as wildlife management areas, wildlife habitats, campgrounds, trailheads, restoration sites and trails
Control of Canada Thistle with Fall Applications of Milestone® Compared to Standards at 1 Year after Application

<table>
<thead>
<tr>
<th>% CONTROL</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
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<td>5 fl oz/A</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>7 fl oz/A</td>
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<td></td>
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<tr>
<td>Transline 1 pt/A</td>
<td>81</td>
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<td>Raven® 1 pt/A</td>
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Milestone Evaluations at 1 year after treatment. Average of 22 trials in VA, ND, SD, NE, WY, CO, and WA

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^ Trademark of Micro Flo Company LLC

Milestone Ecotoxicology Review

Based on laboratory studies Milestone is practically non-toxic

**Birds** - bobwhite quail
mallard ducks

**Fish** - rainbow trout
bluegill sunfish
sheepshead minnow
fathead minnow

Milestone is Practically Non-toxic

Milestone Ecotoxicology Review

**Aquatic invertebrates**
*Daphnia magna*
mysid shrimp
eastern oyster (slight toxicity)
midge (*Chironomus riparius*)

**Terrestrial invertebrates**
honeybees and earthworms
Milestone  
Environmental Fate Summary

- **NO** significant metabolites (only CO₂ and NH₃)
- **Moderate degradation rates in soil**
  - Soil half life = 34.5 days (average of 4 studies)
- **Limited Soil Mobility**
  - Low leaching potential
- **Aquatic degradation**
  - Degraded by sunlight in surface water
- **Low groundwater contamination potential**
  - Low application rate and moderate field degradation
- **Low vapor pressure reduces volatility**

Where are we headed?  
Program approach and why it will work

- **Why it will work?**
  - Medusahead seed has a short viability – about 3 years
- **Program:**
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  - Follow-up post emergent application in the spring of Milestone at 5 – 7 oz rate to reduce/eliminate seed viability
  - Follow-up with spot applications as needed

From Dow AgroSciences  
Thank you for your business and for all of your support!