Weed Management Options “New & Old” for Range & Pasture and Invasive Weed Programs
South Coast Workshop
Santa Maria, CA
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Rick Miller
Dow AgroSciences
916-212-8598
rmiller@dow.com

Introductions
Rick has been a California PCA since 1986; 30+ years in the industry; Bachelor’s (double major) in Environmental Biology & Environmental Studies, UCSB, 1980 Master’s in Entomology from Oregon State University, 1984 biosys, Inc 1985-1997 SePRO Corp. 1997-2005 Dow AgroSciences 2005 - present

Vegetation Management
Markets Served
Utility
Irrigation Districts
Roadside
Range and Pasture
Invasive Species
Forestry
Aquatics

A Systems Approach to Range & Pasture Management

Forage type
Soil Moisture
Soil pH
Soil Fertility
Labor
Cattle
Weed Control
Other

$$$
**Dow AgroSciences has many options for weed management**
Pasture, Irrigated or Dry Land
What is your objective?

- Gorse on the Hearst Ranch

**Dow AgroSciences**
Range & Pasture Portfolio

- Accord XRT II
- Capstone
- Forefront
- Milestone
- Pathfinder II
- Redeem
- Remedy Ultra
- Ultra/Garlon 4 Ultra
- Spike 80DF
- Spike 20P
- Rodeo
- Transline
- Vista XRT

**A Systems Approach to Weed Management in Range & Pasture**

- Biological Controls
- Fire
- Seed Mixes
- Fertility
- Non-Selective Herbicides
- Mechanical Grazing Density
- Selective Herbicides

**Selective Herbicides**

- Selective herbicides control the broadleaf weed and leave the grasses
- Use of a selective herbicide may be your most economical and effective tool for weed control
- Reduce competition – release desirable forage
Selective Herbicides

- More moisture & nutrients available for forage
- Increase grazing utilization
- Extend grazing production
- Increased yield = more pounds of BEEF = more profit

GPS Studies Show Cows Prefer Weed-Free Grass...

Given a choice, cattle grazed in the treated area 74% of the time

Missouri pasture

GPS Studies Show Cows Prefer Weed-Free Grass...

University of Missouri Published Research

Comparison of Time Spent Grazing Herbicide-treated and Untreated Portions of Pasture (Albany, Mo.)

Dr. Kevin Bradley, University of Missouri
Forage Yields in Actively Grazed Sites

- Treated sites yielded more forage even after grazing, compared to untreated sites
- Despite more grazing on treated sites, they maintained 430-570 lbs grass/acre
- Untreated sites lost forage volume over time, as weeds and uneven grazing pressure took their toll

Why not just use Roundup to kill Your Weeds?

- World’s largest herbicide
- Non-selective – kills grasses & broad leaves
- Opens up canopy for more broad leaf infestation
- No residual – spray today, gone tomorrow

Case Study: Artichoke thistle (Cynara cardunculus)

Artichoke thistle control, Solano County
Control of artichoke thistle with aminopyralid and other herbicides

Solano County
Treated 3/31/05
Evaluated 8/8/05

Artichoke Thistle Control Options

<table>
<thead>
<tr>
<th>Rate (oz/A)</th>
<th>Control (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>untreated</td>
<td>0</td>
</tr>
<tr>
<td>0.33</td>
<td>20</td>
</tr>
<tr>
<td>0.67</td>
<td>40</td>
</tr>
<tr>
<td>1.00</td>
<td>60</td>
</tr>
<tr>
<td>128</td>
<td>80</td>
</tr>
<tr>
<td>7</td>
<td>100</td>
</tr>
</tbody>
</table>

New rosettes

Artichoke thistle control with Milestone – Grass Release

Dow AgroSciences
Plant Growth Regulator
Herbicides - Pyridines

128 oz Glyphosate 4 MAA
Growth Regulator Herbicides

Key Attributes

- Auxins are a group of plant hormones which promote cell elongation and stimulation depending on the cell location and concentration.
- Pyridine chemistry (growth regulator herbicide) is recognized by the plant as an auxin hormone signal.

Yellow Starthistle Data

Milestone control of yellow starthistle at 1 year after treatment

Average of 3 sites: CA, OR, ID

- LSD (0.05) = NS

Transline Tordon 22K
fl oz/ac 2 2.5 3 4 5 7 4 8 16 24

Percent control
0 10 20 30 40 50 60 70 80 90 100

---Milestone---
Pre-emergent Herbicides Kill the Seedling
Very small plants require much less herbicide for control

Application Interception Control

Effect of treatment timing on yellow starthistle control in Northern California
Treatments from Nov 2002 to March 2003, final evaluation in July 2003

Effect of Milestone and Transline on grass forage in following year
Treated in 2003 Evaluated in spring 2004

Yellow Starthistle at 1 year AT – rosette application

* LSD (P=0.05)
Milestone and Capstone, formerly known as “Milestone VM” and “Milestone VM Plus”

Performance on Puncturevine and Annual Bursage

Control of Puncturevine and Annual Bursage From Herbicides Applied in Early April before Weed Emergence (Milestone at 5 and 7 oz/A was also applied post-emergent in early July)

- Soil: 2.5 lb
- Gold: 6 oz
- Prowl: 10 oz
- Tert: 2 oz
- Ultima: 9 oz
- Aminopyralid: 48 oz

Milestone Performance

Other Milestone VM rates 7 and 5 fl oz pre or 5 fl oz post were equally good

Aminopyralid: Milestone, Capstone

- **NOT** “restricted use” pesticides
- Registered as EPA **reduced** risk pesticide
- No grazing restrictions
- Has **pre and post emergent activity** for season long control of target broadleaf weeds
- Can be applied to "seasonally dry wetlands" and sprayed up to the waters edge

Aminopyralid Environmental and Ecotoxicology Summary

- Moderate degradation rates in soil
  - Soil half life = 34.5 days
- Mobility
  - Low potential for groundwater contamination
- Degradation by soil microbes
  - **NO** significant metabolites: mostly CO₂ and NH₃
- Aquatic degradation
  - degraded by sunlight in water: Half life = 15 hours
  - Low vapor pressure = essentially non-volatile

Milestone VM Ecotoxicology Review

Based on laboratory studies
Milestone is practically non-toxic to:

**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

Activity of Milestone on 98 species of forbs
All Forb Species Combined- 1 YAT

Data were collected on 68 species approximately 2 years after treatment. Many forbs recovered by the second year following Milestone® application with only 14 of 68 native forbs rated either moderately susceptible or susceptible. Forbs classified as tolerant and moderately tolerant increased from 41% in the first year after treatment to 17% in the second year after treatment showing excellent recovery of the forb community. Sunflowwers, perennials, and forbs were very susceptible to Milestone® while Lupines, golden Alexander and wild bergamot were very tolerant.

Effect of Milestone on 68 Species of Forbs 1 & 2 years after treatment

[Graph showing results of 68 forb species with both 1 and 2 YAT data showing increase in species tolerance by the second year following treatment.]

29 plant families represented, with asters accounting for 35%

Milestone®
Pre-Emergent & Post-Emergent Control

- Pre- and post-emergent activity on
  - 17 broadleaf families represented
  - 75 broadleaf weeds now labeled
- Pre-emergent activity 6+ months on
  - Russian thistle
  - Marestail
  - Fleabane
  - Mustards
- CAUTION signal word
- Reduced-risk Chemistry
- Very affordable per acre
  - Qts, 2.5s, and Continuum
**Aminopyralid Stewardship**
- Labeled for “non-crop” areas only
- *Please stay out of grapes, vegetables, cotton, alfalfa, soybeans, ornamentals, fruit trees and other desirable trees*
- Always read the product label for specifics
  - Don’t mulch treated manure or hay
- Sprayer cleanout protocol

**Milestone use under trees – some species are not affected**
- Cottonwood
- Yellow poplar
- Ash
- Elm
- Cedars
- Oaks
- Black cherry
- Sweetgum
- Willow
- Maple
- Aspen
- Dogwood

**Milestone: Do not use under leguminous or rosaceous trees**
- Black locust
- Honey locust
- Other locust spp.
- Redbud
- Mimosa
- Caragena
- Rose
- Redwoods
- *Deodora* cedar

**Transline® Herbicide as Option Around Trees**
- Clopyralid – selective control
- **CAUTION** signal word
- Non-volatile
- Safer around most crops
- Safer under desirable trees
Milestone Registered Use Sites

- Rangeland & pastures
- Conservation Reserve Program acres
- Non-cropland areas (such as roadsides)
- Non-irrigation ditch banks
- Natural areas such as wildlife management areas, wildlife openings, wildlife habitats, recreation areas, campgrounds, trailheads and trails
- Grazed areas in and around labeled sites.

Sutter Basin Milestone 7 oz
6 Months After Treatment

“Up to the waters edge” labeling

Perennial Pepperweed Control
with Milestone Spot Treatment
Modesto, CA

Grover Landscaping
**Inyo County Pepperweed Demo**

**Perennial pepperweed Reduction – 1 year**

Inyo County Data Summary

**Fiddleneck**

(*Amsinckia menziesii*)

Controlled by Milestone
Not controlled by Transline

**Effect of treatment timing on coast fiddleneck**

(*Amsinckia menziesii*) control in Davis, California

Treatments from Nov 2002 to January 2003, final evaluation in March 2003

* LSD (P=0.05)
5 oz Milestone Distaff thistle
San Luis Obispo County

Milestone 7 oz/ac 4 weeks after treatment

Capstone®
• Excellent grass safety
• Non-volatile
• CAUTION Signal word
• Not a Restricted Use Pesticide
• No grazing or haying restrictions
  – Including lactating dairy animals
• Packaging: 2.5’s, 30’s, bulk

Capstone®
• Key Woody species controlled
  Tree of Heaven
  Scotch broom
  Poison oak
  Himalayan blackberry

• Key Broadleaf weeds controlled
  Horseweed (marestail)
  Thistles
  Yellow starthistle
  Knapweeds
  Russian thistle (w/ glyphosate)
Capstone – Post Clean up and Selective Woody Plant Removal

May 25, 2013
Day of Application

August 4, 2013
71 DAT

Poison Oak on my walking trail

“Up to the waters edge” labeling

Capstone on Himalayan Blackberry
8 pints/Acre 43 DAA

Capstone @ 9 pt/ac - Applied November 2009 Evaluation May 2010

Tree of Heaven Demo in Visalia Foliar treatment
9 pints of Capstone/acre
Pretreatment

Capstone on Tree of Heaven 7 months after treatment

28 DAT

Capstone on Tree of Heaven 26 months after treatment
Visalia Highway 198
Photo Taken Nov 2nd, 2010

Dead Ailanthus Roots 7 MAT

Capstone on Tree of Heaven 49 months after treatment
Visalia Highway 198
Photo Taken Oct 24th, 2012

Tree of Heaven Caltrans Demos With Capstone
Capstone on Tree of Heaven
54 Months after Treatment
Photo Taken March 2013

Woody Plant Post Option
Vista XRT with Garlon

Selective Post-emergent Removal of
Fast Growing Hardwoods such as Cherry, etc.

Vista XRT/Garlon Combo
Post-emergent Option
Salt Cedar (Tamarix spp.)

- Very invasive
- Uses lots of H20 but thrives in dry conditions
- Accumulates salts in tissues and releases into soil

Why Control Weeds?

Park Setting

Industrial Setting

Herbicide Considerations

Salt Cedar (Tamarix spp.)

Basal Bark:
Garlon® 4 Ultra 25 to 30% in basal — or Pathfinder® II specialty herbicide

Cut stump
Garlon 4 Ultra undiluted to cut surfaces any time of year.

Foliar:
Milestone® Specialty Herbicide at 7 oz
Or Capstone at 1 gal/acre or equivalent

Note:
release of annual ryegrass

Capstone on Scotch Broom – Nor CA 2010 Trial – 9 MAT

Milestone at 7 fl oz vs Nontreated

Red Bluff

Thank You!
Scotch broom control with Capstone @ 8 pt/A at 15 MAT

Capstone – Post Clean up and Selective Woody Plant Removal

May 25, 2013
Day of Application

August 4, 2013
71 DAT

Perennial Pepperweed (Lepidium latifolium)

- Brassicaceae
- Grows in many habitats especially moist or seasonally wet.
- Forms large dense stand displacing desirable veg.
- Can infest entire stream corridors.
- Perennial mustard with large storage tubers – cannot kill the plant without killing the tuber and the seed bank in nearby soil

Perennial Pepperweed (Lepidium latifolium)
Perennial Pepperweed Control with Milestone Broadcast followed by Milestone Spot Treatment Next Season
Modesto, CA 2009

Milestone 7 oz broadcast
Grover Landscaping

Perennial pepperweed Reduction – 1 year
- Series 1
- Series 2
- Series 3

Inyo County Pepperweed Demo

Perennial Pepperweed Control with Milestone – Inyo County Ag Dept
Products applied Nov 2010; Photo April 2011
Aminopyralid Stewardship

- Labeled for “non-crop” areas only
- Please stay out of grapes, vegetables, cotton, alfalfa, soybeans, ornamentals, fruit trees and other desirable trees
- Always read the product label for specifics
  – Don’t mulch treated manure or hay
- Sprayer cleanout protocol

Milestone Drift into Alfalfa

Milestone® herbicide Guidelines for Use Around Woody Plants

Can I use Milestone® herbicide for weed control under trees?

Guidelines for Use Around Woody Plants

Milestone VM can be used as an under-canopy soil application for the following trees:

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alder</td>
<td>Alnus rubra</td>
<td>Maple</td>
<td>Acer spp.</td>
</tr>
<tr>
<td>Birch</td>
<td>Betula spp.</td>
<td>Poplar</td>
<td>Populus spp.</td>
</tr>
<tr>
<td>Cottonwood</td>
<td>Populus deltoides</td>
<td>Southern Yellow Pine</td>
<td>Pinus flexilis</td>
</tr>
<tr>
<td>Cypress</td>
<td>Cupressus spp.</td>
<td>Sycamore</td>
<td>Acer pseudoplatanus</td>
</tr>
<tr>
<td>Dogwood</td>
<td>Cornus florida</td>
<td>Sycamore</td>
<td>Platanus occidentalis</td>
</tr>
</tbody>
</table>

Milestone Phytotoxicity in Grapes
Milestone Application under Landscape Canopy – Unlabeled Use

Growth Regulator Galling in Redwood

New Growth & GR Galling in Affected Redwood

Milestone as a Pre-emergent for Medusahead Control: Technical Update
Rick Miller
Dow AgroSciences
Milestone can affect newly germinating grasses

Grass Planting Guidelines

Milestone®, Milestone VM®, and Forefront® Herbicides are registered for use to control weeds in a field or on sites with established grass. These guidelines answer questions about the use of these anaeoplastic-containing products in areas where grass seed may be planted either before or after application of an anaeoplastic-containing product.

When can post-emergence applications of anaeoplastic-containing products be applied to minimize injury to newly seeded perennial grass stands?

- Early Preemergence Applications. Do not apply Milestone, Milestone VM, or Forefront R&P on well-distributed grasses. A secondary root system is usually sufficiently developed by the time the grass seedling produces a solid tiller. Depending on environmental conditions and grass species planted, a secondary root system usually develops by 40 to 60 days after planting. Most perennial grasses show improved tolerance to post-emergence applications at this stage of development.

- Increased injury to grass seedlings may occur when Miletone and Milestone VM are applied in tank mixes with other herbicides such as 2,4-D. Consult label of other herbicides for guidance on their use on newly seeded grass stands.

- Over 20 species of warm- and cool-season grasses have been tested for tolerance to anaeoplastic. Established grass cool have moderate tolerance to Milestone, Milestone VM, and Forefront R&P, but the maximum use rates.

Medusahead Control with Milestone
History of Efforts to Date

- UC Davis Microplot Trial 2007
- UC Davis Greenhouse studies 2008
- UC Davis trials applied via quad fall of 2009
- Cosgrave Ranch demo applied via quad 2009
- Mariposa County Ranch application Sept 2011
- Sachau Ranch application Sept 2011

Methods and Materials

- Applications pregermination/preemergence
- 3 locations
  - Bobcat Ranch, Winters
    - applied Oct 9, 2009
  - Sierra Foothills Research & Extension Center, Marysville
    - Applied Oct 8, 2009
  - Gallatin Ranch, Red Bluff
    - Applied Sept 28, 2009
- 20 GPA
**Medusahead Cover Compared with Untreated Control May 2010**

- **Graph:**
  - Y-axis: % COVER
  - X-axis: Treatments, rates (oz/acre)
  - Legend:
    - Winters
    - Marysville
    - Red Bluff
  - Data:
    - Treated: fall 2009
    - Evaluated: May 2010

**Annual grass cover taken in May following herbicide applications**

- **Graph:**
  - Y-axis: Annual grass cover, relative to untreated (%)
  - X-axis: Treatments, rates (oz/acre)
  - Data:
    - Other annual grasses (SFREC & Red Bluff)
    - Treated: fall 2009
    - Evaluated: May 2010

**Medusahead Demonstrations with Milestone at 7 oz/acre**

- **Graph:**
  - **Note:** release of annual ryegrass
  - Milestone at 7 fl oz vs Nontreated
  - Red Bluff
  - Other annual grasses (SFREC & Red Bluff)
  - Medusahead Treated in October with 7 oz Milestone
  - Grass Release Following April In Treated Areas
Cosgrave Ranch, Calaveras County
Treated 10/19/2009; photo 4/27/2010 – re
Release of soft brome, annual ryegrass and
other desirable grasses

Supplemental Label for Medusahead
Control Issued in 2011

Product Bulletin
Dow AgroSciences

Milestone®
EPA Reg. No. 62711-519
2way Recommendation

For Control of Medusahead and Other Winter Annual Grasses

ATTENTION
This recommendation is permitted under FIFRA 3(c)(4) and has not been submitted to or approved by the EPA.

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

Sachau Ranch, Livermore, CA
Treated with 7 oz Milestone via Spray Service on September 12, 2011

Flowering grasses collected from the Sachau Ranch on April 18, 2012: Bromus sp. (upper specimen) and Hordeum murinum (wild barley, lower specimens).
Medusahead in untreated section of the Sachau Ranch on May 25, 2012

Sachau Ranch 19 months after Treatment 7 oz/acre Milestone

Medusahead Control at the Vineyard Mountain Ranch
April 11, 2013
San Miguel, CA

Rye Grass Release with 7 oz Milestone
Spray Skips Tell the Story

Medusahead Stunts Production inside a spray skip, fiddleneck at back of skip

Fiddleneck and Medusahead Dominate a Spray Skip

Nathan Sanders and Mike Hollarman
Rye Grass Release with 7 oz Milestone

Vineyard Mountain Ranch Spray Skips Tell the Story

Vineyard Mountain Ranch Treated with 7 oz Milestone Oct 2012 -- Photo April 2013
Vineyard Mountain Ranch
May 17, 2013

Grass Release with 7 oz Milestone

Medusahead in untreated skip

Capstone – Post Clean up and Selective Woody Plant Removal

May 25, 2013
Day of Application
August 4, 2013
71 DAT

Vineyard Mountain Ranch
May 25, 2013

Spray Skip With Medusahead

Vineyard Mountain Ranch
May 17, 2013

Spray Skip With Medusahead

Poison Hemlock 21 DAT with Capstone 9 pts/acre

August 4, 2013
71 DAT
Tree of Heaven Demo in Visalia
Foliar treatment
9 pints of Capstone/acre

Capstone on Tree of Heaven
7 months after treatment
Visalia Highway 198

Capstone on Tree of Heaven
2+ years after treatment
Visalia Highway 198
Photo Taken Nov 2nd, 2010
Capstone on Tree of Heaven
4+ years after treatment
Visalia Highway 198
Photo Taken Oct 24th, 2012

Capstone on Tree of Heaven
4.5 years after treatment
Visalia Highway 198
Photo Taken March 2013

Milestone as a Pre-emergent for Medusahead Control:
Technical Update
Rick Miller
Dow AgroSciences

Milestone can affect newly germinating grasses

Grass Planting Guidelines

Milestone®, Milestone VM, and ForeFront® RSDP herbicides are registered for use to control broadleaf weeds in areas with established grasses. These guidelines answer questions about the use of these triazines with existing products in areas where grass seed may be planted either before or after application of an anticosynthetic containing product.

When can post-emergence applications of anticosynthetic containing products be applied to minimize injury to newly seeded perennial grass stands?

- Early Postemergence Applications: Do not apply Milestone, Milestone VM, or ForeFront RSDP until seeded grasses have an established secondary (adventitious) root system. A secondary root system is usually sufficiently developed by the time the grass seeding produces a second flush. Depending on environmental conditions and grass species planted, a secondary root system usually develops by 45 to 60 days after planting. Most perennial grasses show improved tolerance to post emergence applications at this stage of development.
- Increased injury to grass seedlings may result when Milestone and Milestone VM are applied in areas with other herbicides such as 2,4-D. Consult labels of other herbicides for guidance on their use on recently seeded grass stands.
- Over 20 species of warm- and cool-season grasses have been tested for tolerance to anticosynthetic. Established
grass stands have medium tolerance to Milestone, Milestone VM and ForeFront RSDP at the rates shown on page.
**Medusahead Control with Milestone**  
**History of Efforts to Date**

- UC Davis Microplot Trial 2007
- UC Davis Greenhouse studies 2008
- UC Davis trials applied via quad fall of 2009
- Cosgrave Ranch demo applied via quad 2009
- Mariposa County application Sept 2011
- Sachau Ranch application Sept 2011
- Vineyard Mountain Ranch Oct 2012

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**Medusahead trials in CA**  
Joe DiTomaso and Guy Kyser, UC Davis

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**Medusahead Cover Compared with Untreated Control**  
May 2010

![Graph showing Medusahead Cover Compared with Untreated Control May 2010](image)

- **Milestone at 7 fl oz vs Nontreated**
- **Note:** release of annual ryegrass

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**Red Bluff**

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**Treated: fall 2009**  
**Evaluated: May 2010**
**Annual grass cover taken in May following herbicide applications**

![Graph showing annual grass cover relative to untreated.

**Medusahead Demonstrations with Milestone at 7 oz/acre**

- **Medusahead Treated in October with 7 oz Milestone**
- **Grass Release Following April in Treated Areas**

**Cosgrave Ranch, Calaveras County**
**Treated 10/19/2009; photo 4/27/2010 – re Release of soft brome, annual ryegrass and other desirable grasses**

**Supplemental Label for Medusahead Control Issued in 2011**
Sachau Ranch, Livermore, CA
Treated with 7 oz Milestone via Spray Service on September 12, 2011

Dan Sachau, Sachau Ranch
Livermore, CA 3.5” rain season to date

Sachau Ranch 19 months after Treatment 7 oz/acre Milestone

Cow Pie Check (closeup)
Medusahead Control at the Vineyard Mountain Ranch
Medusahead infestations treated with 7 oz/acre
Milestone October 2012
Photos taken April 11, 2013
San Miguel, CA

Rye Grass Release with 7 oz Milestone

Spray Skips Tell the Story

Medusahead Stunts Production inside a spray skip, fiddleneck at back of skip
Fiddleneck and Medusahead Dominate a Spray Skip

Nathan Sanders, Ranch Manager
Mike Hollarman, CPS

Vineyard Mountain Ranch
May 17, 2013

Plant growth stages for timings of herbicide applications

Feekes's Scale
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

Greenhouse results-Medusahead

Different letters on the bars indicate the means are statistically different.