Research in Turfgrass Management

- Alec Kowalewski, PhD
- Turfgrass Specialist
- Oregon State University
- alec.Kowalewski@oregonstate.edu
GRADUATE STUDENTS

• Clint Mattox
  • Fungicide Alternatives
• Brian Daviscourt
  • Synthetic and Natural Grass Fields
• Conner Olsen
  • Rain Harvesting and Grey Water
• Micah Gould
  • Low Maintenance Ground Cover
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  - Low Maintenance Ground Cover
Turf Quality Year Two
Rolling by Mineral Oil

Turfgrass Quality Rating

Mineral Oil Treatments

Civitas One

No Mineral Oil

Rolled 5 days a week
Unrolled

Turf Quality by Mineral Oil Treatment

- Civitas One
- No Mineral Oil
Turf Quality Year Two
Rolling by Mineral Oil

Civitas One
No Mineral Oil

Turfgrass Quality Rating
Mineral Oil Treatments

Rolled 5 days a week
Unrolled
Turf Quality Year Two
Rolling by Mineral Oil

Civitas One
No Mineral Oil

Turfgrass Quality Rating

Mineral Oil Treatments

Rolled 5 days a week
Unrolled
When rolling was used combination with Civitas One, abiotic damage was observed.

(Kreuser et al., 2014)
Percent Disease Year Two
Nitrogen by Iron Sulfate

Iron Sulfate (Kg FeSO₄) ha⁻¹ X 2 wks

0.00 Kg N ha⁻¹ X 2 wks
4.88 Kg N ha⁻¹ X 2 wks
9.76 Kg N ha⁻¹ X 2 wks
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• Micah Gould  
  • Low Maintenance Ground Cover
<table>
<thead>
<tr>
<th></th>
<th>Natural Grass Avg.</th>
<th>Synthetic Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget Total (20 years)</td>
<td>$2,767,796.40</td>
<td>$5,160,857.75</td>
</tr>
<tr>
<td>Player hours (20 years)</td>
<td>302,000.00</td>
<td>862,650.00</td>
</tr>
<tr>
<td>$ per hour</td>
<td>$14.00</td>
<td>$8.36</td>
</tr>
</tbody>
</table>
Synthetic: Avg. Surface Temperature (F)

Natural: Avg. Surface Temperature (F)
GRADUATE STUDENTS

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- Micah Gould
  - Low Maintenance Ground Cover
Experiment 1
Rainwater Harvesting for Turfgrass Irrigation
System 1: Intensive Rainwater Harvesting

- 5000-gallon cistern storage
- Floating-outtake and siphon-overflow systems
- Stationary bicycle for pumping water
System 2: Extensive Rainwater Harvesting

- **Subsurface Storage**
  - ~4000 gallons
  - AQUABLOX (right)

- **“Pond-less Waterfall” Recycling System**
  - Rock-lined channel
  - Submerged pump

- External pump for application to turf plots
System 2: Extensive Rainwater Harvesting

Response Variables

- Evaporative Losses
- Energy Inputs
  - Electricity used
  - Manual labor
- Construction Costs
- Operation/Maintenance Costs
Experiment 2

Irrigating Turfgrasses with Greywater
Experiment 2

Greywater Irrigation

Objectives:
- Evaluate salt-tolerant perennial ryegrass cultivars
- Test salt-relieving products
Experiment 2

Greywater Irrigation

Materials and Methods:

- Average greywater chemistry
- Perennial ryegrass cultivars exposed to three levels of greywater irrigation
  - 3 months greywater
  - 12 months greywater
  - Control (municipal water)
GRADUATE STUDENTS

- Clint Mattox
  - Fungicide Alternatives
- Brian Daviscourt
  - Synthetic and Natural Grass Fields
- Conner Olsen
  - Rain Harvesting and Grey Water
- Micah Gould
  - Low Maintenance Ground Cover
1. Creeping red fescue
2. Chewings fescue
3. Colonial Bentgrass
4. Vinca minor
5. Cotoneaster dammeri
6. Euonymus fortunei
7. Juniperus horizontalis
8. Herniaria glabra
9. Seedum spurium
10. Ceanothus ‘Point Reyes’
Survey Results

1. Sedum spurium
2. Colonial bentgrass
3. Herniaria glabra
### Survey Res. vs. Density Data

1. Sedum spurium
2. Colonial bentgrass
3. Herniaria glabra

<table>
<thead>
<tr>
<th>Plants</th>
<th>Plant Cover (0-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>col. bentgrass</td>
<td>26.9</td>
</tr>
<tr>
<td>chewings fescue</td>
<td>15.4</td>
</tr>
<tr>
<td>strong red fescue</td>
<td>17.4</td>
</tr>
<tr>
<td>sedum</td>
<td>28.9</td>
</tr>
<tr>
<td>herniaria</td>
<td>5.1</td>
</tr>
<tr>
<td>vinca</td>
<td>13.9</td>
</tr>
<tr>
<td>euonymus</td>
<td>4.4</td>
</tr>
<tr>
<td>juniperus</td>
<td>7.6</td>
</tr>
<tr>
<td>cotoneaster</td>
<td>6.3</td>
</tr>
<tr>
<td>ceonothus</td>
<td>13.4</td>
</tr>
</tbody>
</table>

July, 2015
IPM for Oregon Public Schools

- Primary Cultural Practices
  - Mowing
  - Fertilization
  - Irrigation

- Cultivation and inter-seeding

- Management of…
  - False dandelion
  - White clover
  - Annual bluegrass
IPM for Oregon Public Schools

- Primary Cultural Practices
  - Mowing
    - Once a week
    - 2 to 3 inches
  - Fertilization
    - 4 applications annually
    - 1 lbs N/1,000 sq ft per application
  - Irrigation
    - 0.25 inch
    - 3 times per week
IPM for Oregon Public Schools

- Primary Cultural Practices
  - **Mowing**
    - Once a week
    - 2 to 3 inches
  - Fertilization
    - 4 applications annually
    - 1 lbs N/1,000 sq ft per application
  - Irrigation
    - 0.25 inch
    - 3 times per week

Annual bluegrass Prograss (ethofumesate)
IPM for Oregon Public Schools

- **Primary Cultural Practices**
  - **Mowing**
    - Once a week
    - 2 to 3 inches
  - **Fertilization**
    - 4 applications annually
    - 1 lbs N/1,000 sq ft per application
  - **Irrigation**
    - 0.25 inch
    - 3 times per week

White clover
triclopyr
IPM for Oregon Public Schools

- **Primary Cultural Practices**
  - **Mowing**
    - Once a week
    - 2 to 3 inches
  - **Fertilization**
    - 4 applications annually
    - 1 lbs N/1,000 sq ft per application
  - **Irrigation**
    - 0.25 inch
    - 3 times per week

White clover
triclopyr

T Zone
triclopyr, sulfentrazone, 2,4-D, dicamba
Primary Cultural Practices

- **Mowing**
  - Once a week
  - 2 to 3 inches

- **Fertilization**
  - 4 applications annually
  - 1 lbs N/1,000 sq ft per application

- **Irrigation**
  - 0.25 inch
  - 3 times per week

False dandelion
2,4-D
Herbicide Research in Turfgrass Management

- Alec Kowalewski, PhD
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Overview

- Gly-Rye Glyphosate Rate Screening
- Glyphosate Tolerant Grasses
- Broadleaf Herbicides for Control of False Dandelion
- Effects of Mowing Height and Spreading Perennial Ryegrass on Annual bluegrass
- Methiozolin (PoaCure)
Overview

- **Gly-Rye Glyphosate Rate Screening**
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- Methiozolin (PoaCure)
Gly-Rye Glyphosate Rate Screening

- Objective
  - Effects of increasing glyphosate rates on a tolerant perennial ryegrass cultivar (‘Gly-Rye’)
Gly-Rye Recommendations

- Perennial ryegrass ‘Gly-Rye’
  - Traditional breeding
  - Genetic Engineering - GMO
Gly-Rye Recommendations

- Perennial ryegrass ‘Gly-Rye’
  - Traditional breeding
  - Genetic Engineering - GMO
Gly-Rye Recommendations

- Jacklin Seed - Research Newsletter, 2011

Question:
- What are the precautions?

Answer:
- Mature Gly-Rye™ is safe for glyphosate application at our recommended rates as long as temperatures are above 50° F.
- Do not apply glyphosate when cold temperatures are in the long-range forecast.
- Gly-Rye™ seedlings are safe for glyphosate application, as long as the application is made within 2 weeks of emergence or after 6 week from emergence.
- Avoid glyphosate application from 3 to 5 weeks after emergence as the seedlings go through a sensitive transition period.
Gly-Rye Glyphosate Rate Screening

- Initiated Aug. 14, 2013 Lewis-Brown Turf Farm, Corvallis, OR

- ‘Gly-Rye’ perennial ryegrass
  - Seeding date: Spring 2013
  - Seeding rate: 11 lbs/1,000 sq ft
  - Fertility: 3 lbs N/1,000 sq ft
Buccaneer Plus (41% glyphosate) rates…

- 0 fl. oz./acre
- 4 fl. oz./acre
- 8 fl. oz./acre
- 12 fl. oz./acre
- 16 fl. oz./acre
- 20 fl. oz./acre
- 24 fl. oz./acre

Spray volume for all treatments 2 gallons/1,000 ft²

All treatments were applied Aug 15, 2013.
Gly-Rye Recommendations
Gly-Rye Glyphosate Rate Screening

- Control
- Buccaneer Plus 4 fl. oz./acre
Gly-Rye Glyphosate Rate Screening

- Control
- Buccaneer Plus 8 fl. oz./acre

Jacklin Seed - Recommended rate
Gly-Rye Glyphosate Rate Screening

- Control
- Buccaneer Plus 12 fl. oz./acre

Annual bluegrass control without perennial ryegrass damage
Gly-Rye Glyphosate Rate Screening

- **Control**
- **Buccaneer Plus 16 fl. oz./acre**

Perennial ryegrass damage observed
Gly-Rye Glyphosate Rate Screening

- Control
- Buccaneer Plus 20 fl. oz./acre

Perennial ryegrass damage observed
Gly-Rye Glyphosate Rate Screening

- Control
- Buccaneer Plus 24 fl. oz./acre

Perennial ryegrass damage observed
Gly-Rye Glyphosate Rate Screening

- Couple glyphosate applications with turf renovation
  - Core cultivation or vertical mowing
  - Perennial ryegrass at 11 lbs/1,000 sq ft
  - Fertilization at 1 lb N/1,000 sq ft
Overview

- Gly-Rye Glyphosate Rate Screening
- Glyphosate Tolerant Grasses
- Broadleaf Herbicides for Control of False Dandelion
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- Gly-Rye Glyphosate Rate Screening
- **Glyphosate Tolerant Grasses**
- Broadleaf Herbicides for Control of False Dandelion
- Effects of Mowing Height and Spreading Perennial Ryegrass on Annual bluegrass
- Methiozolin (PoaCure)
Glyphosate Tolerant Grasses

- **Objective:**
  - The objective of this project was to explore the glyphosate tolerance of various perennial ryegrass and fescue species.
Entries Planted on Aug 8, 2013

- Cultivars (15)
  - ‘5T20’ Tall Fescue 1
  - ‘Tarnation GT’ Tall Fescue 2
  - ‘Tar Heel II’ Tall Fescue 3
  - ‘UNO’ Perennial Ryegrass 1
  - ‘2M20’ Perennial Ryegrass 2
  - ‘224’ Perennial Ryegrass 3
  - ‘2MAX’ Perennial Ryegrass 4
  - ‘Charger II’ Perennial Ryegrass 5
  - ‘Bighorn GT’ American Sheep 1
  - ‘Enchantment’ Chewings Fescue 2
  - ‘Tiffany’ Chewings Fescue 3
  - ‘Shademaster III’ Chewings Fescue 4
  - ‘Seabreeze GT’ Slender Creeping 5
  - ‘Soil Guard’ Hard Fescue 6
  - ‘Aurora Gold’ Hard Fescue 7
Effects of subsequent glyphosate (Round-Up) applications at a rate of 8 oz/acre on April 2, 2104 and June 6, 2014, and then April 17 and Aug 20, 2015, on percent seeded turf cover (0-100%) observed Aug 28, 2015 in Corvallis, OR.
Effects of subsequent glyphosate (Round-Up) applications at a rate of 8 oz/acre on April 2, 2104 and June 6, 2014, and then April 17 and Aug 20, 2015, on percent seeded turf cover (0-100%) observed Aug 28, 2015 in Corvallis, OR.
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- **Glyphosate Tolerant Grasses**
- Broadleaf Herbicides for Control of False Dandelion
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Overview

- Gly-Rye Glyphosate Rate Screening
- Glyphosate Tolerant Grasses
- **Broadleaf Herbicides for Control of False Dandelion**
- Effects of Mowing Height and Spreading Perennial Ryegrass on Annual bluegrass
- Methiozolin (PoaCure)
Objective:

Evaluate the effects of single and subsequent applications of broadleaf pre- and post-emergence herbicide combinations, as well as application timing on white clover and false dandelion management in a stand of perennial ryegrass.
False dandelion

- Scouting and ID
  - Perennial weed
  - Spring seeding
  - Drought tolerant
False dandelion
Broadleaf Herbicides for Control of False Dandelion

- Objective:
  - Evaluate the effects of single and subsequent applications of broadleaf pre- and post-emergence herbicide combinations, as well as application timing on white clover and false dandelion management in a stand of perennial ryegrass.
Broadleaf Herbicides for Control of False Dandelion

- **Defendor (0.25 pt/A)**
  - Florasulam

- **Trimec Classic (4.0 pt/A)**
  - 2,4-D
  - MCPP
  - dicamba

- **Dimension (1.0 pt/A)**
  - dithiopyr
Broadleaf Herbicides for Control of False Dandelion

- Defendor (0.25 pt/A) – Post-emergence
  - Florasulam

- Trimec Classic (4.0 pt/A) – Post-emergence
  - 2,4-D
  - MCPP
  - dicambe

- Dimension (1.0 pt/A) – Pre-emergence
  - dithiopyr
Effects of Defendor and Dimension on catsear dandelion in perennial ryegrass, observed 8 weeks after treatment in Corvallis, OR on July 2, 2014.

<table>
<thead>
<tr>
<th>Trt</th>
<th>Treatments*</th>
<th>% Weed Control 8 WAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dimension 2 EW</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>Dimension 2 EW + 4Wks</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>Defendor</td>
<td>93.9</td>
</tr>
<tr>
<td>4</td>
<td>Defendor + 4 wks</td>
<td>100.0</td>
</tr>
<tr>
<td>5</td>
<td>Dimension 2 EW + Defendor</td>
<td>93.3</td>
</tr>
<tr>
<td>6</td>
<td>Rotation (See Below)**</td>
<td>100.0</td>
</tr>
<tr>
<td>7</td>
<td>Trimec Classic + Dimension 2 EW + 4 Wks</td>
<td>100.0</td>
</tr>
<tr>
<td>8</td>
<td>Trimec Classic</td>
<td>92.5</td>
</tr>
<tr>
<td>9</td>
<td>Untreated</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>LSD</td>
<td>4.6</td>
</tr>
</tbody>
</table>

**Trt 6. Rotation:**

- 1st app Dimension 2 EW + Defendor (1.0 + 0.25 pt/A)
- 2nd app Dimension 2 EW + Trimec Classic (1.0 + 4.0 pt/A)
Effects of Defendor and Dimension on catsear dandelion in perennial ryegrass, observed 8 weeks after treatment in Corvallis, OR on July 2, 2014.

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<td>93.3</td>
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<tr>
<td>6</td>
<td>Rotation (See Below)**</td>
<td>100.0</td>
</tr>
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<td>7</td>
<td>Trimec Classic + Dimension 2 EW + 4 Wks</td>
<td>100.0</td>
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<tr>
<td>8</td>
<td>Trimec Classic</td>
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<td>LSD</td>
<td>4.6</td>
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**Trt 6. Rotation:**
- 1st app Dimension 2 EW + Defendor  (1.0 + 0.25 pt/A)
- 2nd app Dimension 2 EW + Trimec Classic (1.0 + 4.0 pt/A)
Overview

- Gly-Rye Glyphosate Rate Screening
- Glyphosate Tolerant Grasses
- Broadleaf Herbicides for Control of False Dandelion
- Effects of Mowing Height and Spreading Perennial Ryegrass on Annual bluegrass
- Methiozolin (PoaCure)
Overview

- Gly-Rye Glyphosate Rate Screening
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- Broadleaf Herbicides for Control of False Dandelion
- **Effects of Mowing Height and Spreading Perennial Ryegrass on Annual bluegrass**
- Methiozolin (PoaCure)
Effects of Mowing Height and Spreading Perennial Ryegrass on Annual bluegrass

- **Objective**
  - Evaluate the effects of spreading perennial ryegrass cultivar on annual bluegrass encroachment.
Spreading ryegrass trial

- Initiated Summer 2010
- Lewis Brown Turf Farm, Corvallis, OR
Spreading ryegrass trial

- Perennial ryegrass cultivars
  - ‘Natural Knit’
    - Ledeboer Seed
  - ‘Fiesta 4’
    - Pickseed
  - ‘RPR’
    - Barenbrug Seed
  - ‘SR4600’
    - Seed Research
Spreading ryegrass trial

- Seeding date: June 15, 2010
- Seeding rate: 6 lbs/1,000 ft²
- Fertility rate: 4 lbs N/1,000 ft²
Spreading ryegrass trial

- Spreading perennial ryegrass
  - Lower seeding rates
  - Higher fertility rates
  - Lower mowing height

- Traditional perennial ryegrass
  - 9 to 11 lbs/1,000 sq ft
  - 2 to 4 lbs N/1,000 sq ft
  - 1.5 to 3 inches
Spreading ryegrass trial

- Mowing height
  - 0.625"
  - 1.25"
  - 2.0"
Effects of perennial ryegrass cultivar and mowing height on percent (0-100%) of perennial ryegrass and annual bluegrass cover 4 years after establishment from seed, Corvallis, OR July 2014

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>% Perennial ryegrass</th>
<th>% Annual bluegrass</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Fiesta 4’</td>
<td>70.2 b</td>
<td>29.9 b</td>
</tr>
<tr>
<td>‘Natural Knit’</td>
<td>89.9 a</td>
<td>10.1 a</td>
</tr>
<tr>
<td>‘RPR’</td>
<td>72.2 b</td>
<td>27.8 b</td>
</tr>
<tr>
<td>‘SR4600’</td>
<td>64.6 b</td>
<td>35.4 b</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mowing height</th>
<th>% Perennial ryegrass</th>
<th>% Annual bluegrass</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.625”</td>
<td>58.9 b</td>
<td>41.2 b</td>
</tr>
<tr>
<td>1.25”</td>
<td>77.4 ab</td>
<td>22.7 ab</td>
</tr>
<tr>
<td>2.0”</td>
<td>86.5 a</td>
<td>13.6 a</td>
</tr>
</tbody>
</table>
Annual bluegrass encroachment

- ‘Natural Knit’
- ‘SR 4600’
- ‘RPR’
- ‘Fiesta 4’

0.625”
Annual bluegrass encroachment

‘Natural Knit’

‘SR 4600’

1.25”

‘RPR’

‘Fiesta 4’
Annual bluegrass encroachment

‘Natural Knit’

‘SR 4600’

2.0"

‘RPR’

‘Fiesta 4’
Annual bluegrass encroachment

0.625”

‘SR 4600’

1.25”

2.0”
Lorenz Soccer Field, Corvallis, OR

‘SR4600’ maintained at 0.625”. Seeded 2011.
Lorenz Soccer Field, Corvallis, OR

‘SR4600’ maintained at 0.625”.
Seeded 2011.
Some preemergence herbicides effective on annual bluegrass include…

<table>
<thead>
<tr>
<th>Common name</th>
<th>Active ingredient</th>
</tr>
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<tbody>
<tr>
<td>Pendulum</td>
<td>pendimethalin</td>
</tr>
<tr>
<td>Prograss</td>
<td>ethofumesate</td>
</tr>
<tr>
<td>Balan</td>
<td>benefin</td>
</tr>
<tr>
<td>Bensumec</td>
<td>bensulide</td>
</tr>
<tr>
<td>Dimension</td>
<td>dithiopyr</td>
</tr>
<tr>
<td>Quali-Pro Prodiamine</td>
<td>prodiamine</td>
</tr>
</tbody>
</table>
Estimated costs of a Pre/Postemergence Chemical Control Program of Annual bluegrass on a 54,000 ft$^2$ field. It is important to note that cost can vary considerably according to product and control is often variable.

<table>
<thead>
<tr>
<th>Product</th>
<th>Cost of Product</th>
<th>Apps</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pendulum</td>
<td>$54.00</td>
<td>2</td>
<td>$108.00</td>
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<tr>
<td>Prograss</td>
<td>$297.00</td>
<td>3</td>
<td>$891.00</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td>$999.00</td>
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</table>
Mixed stand of perennial ryegrass and annual bluegrass, 10 years plus
Mixed stand of perennial ryegrass and annual bluegrass, 10 years plus
Mixed stand of perennial ryegrass and annual bluegrass, 10 years plus
Annual bluegrass encroachment

Lorenz field
Seeded 2011

OSU Softball
Seeded 2000
Annual bluegrass encroachment

Lorenz field
Seeded 2011

OSU Softball
Seeded 2000
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- **Methiozolin (PoaCure)**
Methiozolin (PoaCure)

- **Objective**
  - Determine the best rate and irrigation practices to control annual bluegrass in the Pacific Northwest
Methiozolin (PoaCure)

- 5-(2,6-difluorobenzyl)oxymethyl-5-methyl-3,3(3-methylthiophen-2-yl)-1,2-isoxazoline

- Mode of action
  - Cell wall biosynthesis

- Moghu USA, LLC
  - Palisades Park, NJ
Methiozolin (PoaCure)

- State experimental use permit (EUP)
  - Testing pesticides under development
  - State experimental use permit
  - Testing on area less than 10 acres
  - 27 hour notice to ODA
  - Can’t distribute crop after treatment

- Contacts
  - Oregon Department of Agriculture
    - Laurie Gordon, Pesticide Certification & Licensing Specialist
  - Moghu USA, LLC
    - Kyung-min Han, PoaCure Development Manager
Methiozolin (PoaCure)

- June 18, 2014
- Selective herbicide
  - PoaCure

- Plant growth regulators
  - Type II (Gibberellin Biosynthesis Inhibitor) - Class B (early GA)
    - Trimmit
      - paclobutrazol
    - Cutless MEC
      - flurprimidol
  - Type II - Class A (late GA)
    - Primo Maxx
      - trinexapac-ethyl
  - Class E (promotes ethylene)
    - Proxy
      - ethephon
Percent change in Annual bluegrass populations recorded on August 26, 2014 (trial initiated June 18, 2014).

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<th>% change in Poa annua</th>
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<tr>
<td>Trimmit</td>
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<td>4 weeks</td>
<td>Water .25&quot;</td>
<td>-62.3 %</td>
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Bandon EUP Project using PoaCure (Methiozolin)

- Bandon Dunes, Bandon, OR
  - Site 1 – Large Chipping Green
  - Site 2 – Par 3 Green
- 6 applications or PoaCure were made to both sites applying 0.6 fl. oz./1,000 ft$^2$ per application for a total of 3.6 fl. oz. per 1,000 sq. ft. per site.
- For both sites, the total amount of PoaCure applied was 7.2 fl. oz. of concentrated product.
- Site Visit - August 25, 2015
BANDON DUNES GRASS SEED MIXTURE

PURE SEED

29.32% BRIDGEPORT II CHEWINGS FESCUE
19.86% BARCROWN II CREEPING RED FESCUE
0.00% OTHER CROP SEED
0.00% INERT MATTER
0.00% WEED SEED
50.00% COATING MATERIAL

GERM ORIGIN

85% OR
85%
AMS 480

NET WT.: 50 LBS

NOXIOUS WEED SEED per pound: NONE FOUND

TEST DATE: 4/14
IN MN, MD, NJ, IN, IL, PA, CA, NH, WI, VA
SELL BY: 7/15

LOT: 650001-NC
Trial Site 1 – Close up showing perennial bio-type annual bluegrass still present
Trial Site 2 – with voids where annual bio-types were controlled and the perennial bio-types are unaffected.
Questions?

- Alec Kowalewski, PhD
- Turfgrass Specialist
- Oregon State University
- alec.Kowalewski@oregonstate.edu