

# **‘Tenacity’: A New Herbicide for Turfgrass Establishment**

**Washington State University  
Crop Science Seminar**

**March 31, 2008**

**Matthew W. Williams**

# Overview

- What is 'Tenacity'; Formulations available?
- What weeds does 'Tenacity' control?
- 'Tenacity' and environment Interactions
- How does 'Tenacity' work (MOA)?
- How well does 'Tenacity' work (Efficacy)?
- How can we best use 'Tenacity' in turf?

# What is 'Tenacity' and what formulations will be available?

- 'Tenacity' has the active ingredient mesotrione
- Commercially available 1<sup>st</sup> quarter of 2008
- Formulations include:
  - Soluble concentrate (SC)
    - Apply with NIS at 0.25% v/v
  - Impregnated fertilizer

# Mesotrione Impregnated Fertilizer (20-27-5)

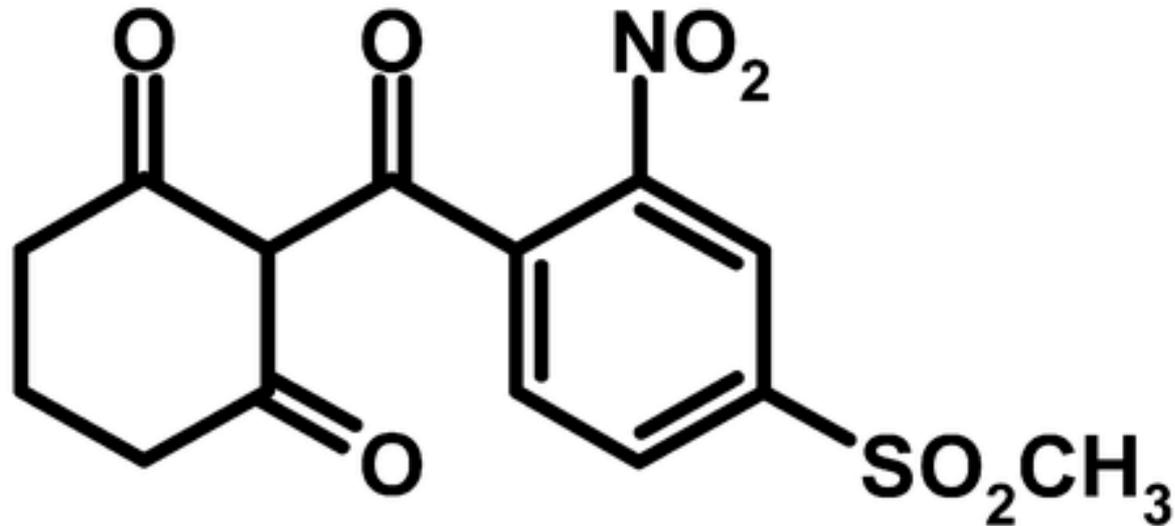


# Mesotrione

Chemical Family: Triketone

Herbicide Family: Callistemone

Group 27



**Mesotrione**

# Weeds Present

- **Pigweed**, *Amaranthus spp.*
- **Common lambsquarter**, *Chenopodium album*
- **Prickly lettuce**, *Lactuca serriola*
- **Pineappleweed**, *Matricaria matricarioides*
- **Canada thistle**, *Cirsium arvense*
- **Mayweed chamomile**, *Anthemis cotula*
- **Common groundsel**, *Senecio vulgaris*
- **Common mallow**, *Malva neglecta*
- **Shepardspurse**, *Capsella bursa-pastoris*
- **Henbit**, *Lamium amplexicaule*
- **Redstem filaree**, *Erodium cicutarium*
- **Witchgrass**, *Panicum capillare*
- **Barnyardgrass**, *Echinochloa crus-galli.*

# Weeds Controlled

- More than 50 weed species with >85% control
- Some turf weeds of interest
  - Chickweed
  - Groundsel
  - Dandelion
  - Prostrate knotweed
  - Mallow
  - Black medic

# 'Tenacity' and the environment

- Reduced Risk Pesticide
- Caution
- Degradation
  - Rapidly by microorganisms to CO<sub>2</sub>
- Half-life
  - 5-15 days for mesotrione; less than 6 days for each metabolite
- Leaching
  - Low potential

# 'Tenacity' and the environment

- Some movement observed in surface water
- Weak acid
- Adsorption to soil decreases as soil pH increases
  - more movement in alkaline soils

# Movement in Surface Runoff



# Movement in Surface Runoff



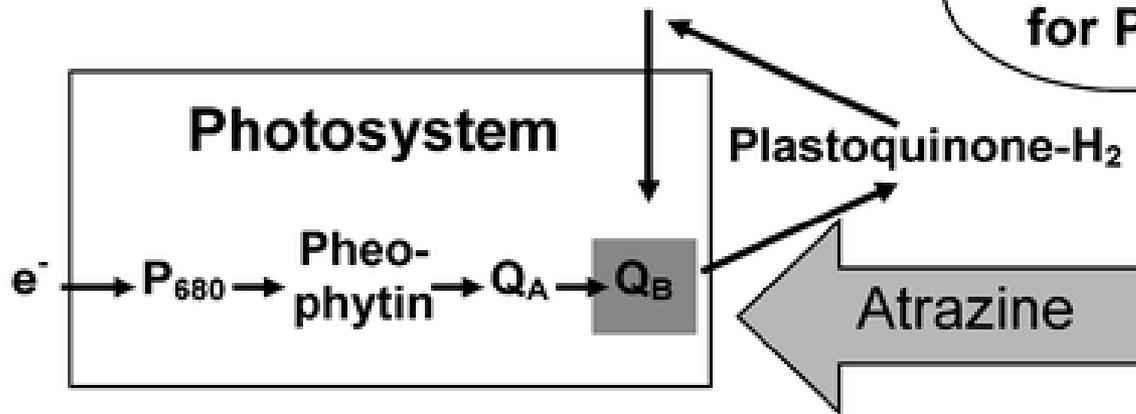
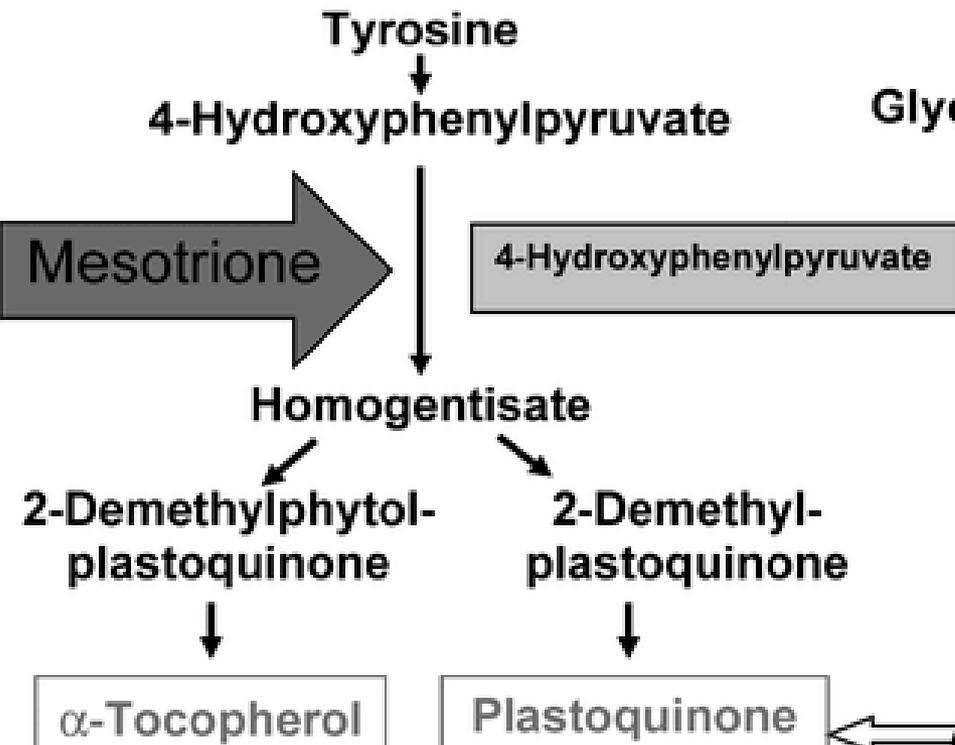
# Movement in Surface Runoff



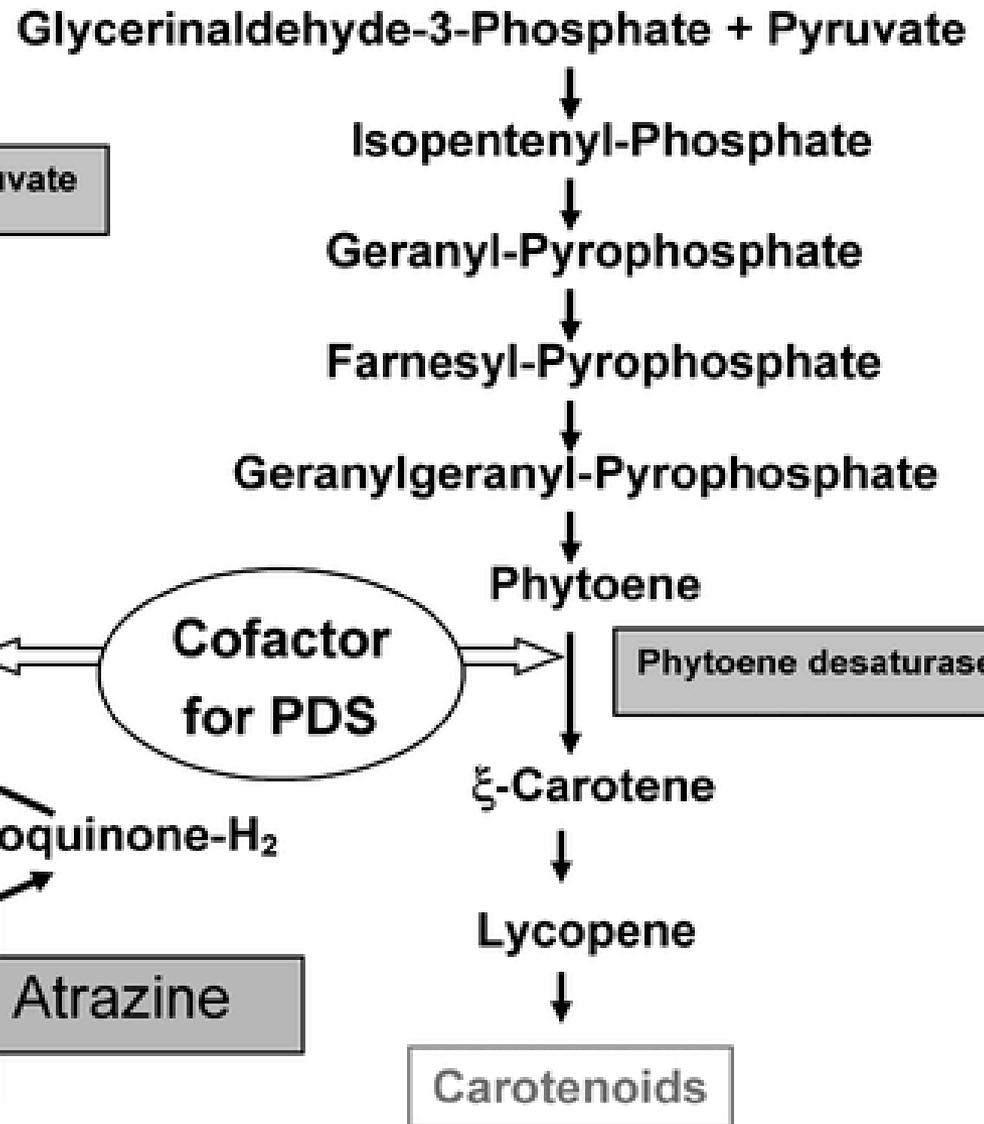
# Mode of Action

- Uptake (roots and shoots)
- Xylem and phloem mobile
- Blocks carotenoid biosynthesis
- Chlorosis and necrosis of susceptible plants
  - Bleaching

## Plastoquinone/Tocopherol Synthesis



## Carotenoid Synthesis



# Mode of Action

Plastoquinone/Tocopherol Synthesis



4-HPPD



~~α-Tocopherol~~

~~Plastoquinone~~

~~Carotenoids~~

# Symptoms



**Black medic**



**Dandelion**

# 'Tenacity' Efficacy

- 2006-2007 Research Summary
  - Mesotrione Impregnated Fertilizer (MIF) at planting
  - Mesotrione SC at planting
  - MIF pre-plant & at planting (Greenhouse)
  - Creeping bentgrass removal & overseeding program

# Research Overview - MIF

- Location: Pullman, WA Turfgrass and Agronomy Research Center (TARC)
- 5 Turfgrass stands
  - ‘Treazure’ chewings fescue
  - ‘NuDestiny’ Kentucky bluegrass
  - ‘Gallery’ perennial ryegrass
  - Three way mix (2:1:1, KBG:PRG:CF)
  - ‘Inferno’ Tall Fescue\*

# Research Objectives

- Determine if 'Tenacity' is safe to turfgrass at seeding
- Determine rate of 'Tenacity' providing best weed control and acceptable turfgrass quality
- Determine if both grass and broadleaf weeds are controlled

# Treatments

- 'Tenacity' (Mesotrione):
  - 0.144 lb ai/A
  - 0.25 lb ai/A
  - 0.30 lb ai/A
  - 0.50 lb ai/A 20-27-5
- 'Tupersan' (Siduron):
  - 5.98 lb ai/A 18-23-4
- Untreated control  20-27-5 only

# Application Information

- All Mesotrione Impregnated Fertilizer applied at 180 LB/A (4.13 lb/M; 0.83 lb/M N)
- Tupersan (Siduron) Applied at 193.5 lb/A
- Entire plot watered 0.25 inch within 24 hours

**161 g a.i./Ha**



**282 g a.i./Ha**



**'NuDestiny' Kentucky bluegrass, 10 weeks after treatment; 4 weeks after split application**

**0.30 lb a.i./A**



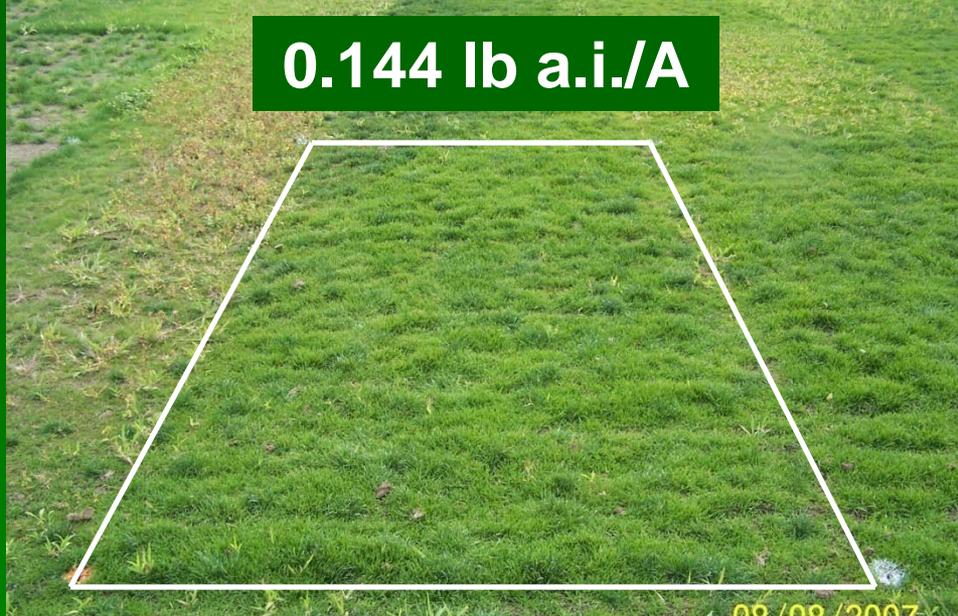
08/08/2007

**0.50 lb a.i./A**



08/08/2007

0.144 lb a.i./A



'NuDestiny' Kentucky bluegrass, 10 weeks after treatment; 4 weeks after split application



Siduron

08/08/2007



Control

08/08/2007

**0.144 lb a.i./A**



08/08/2007

**0.25 lb a.i./A**



08/08/2007

'Treasure' chewings fescue, 10 weeks after treatment; 4 weeks after split application



08/08/2007

**0.30 lb a.i./A**



08/08/2007

**0.50 lb a.i./A**

0.144 lb a.i./A



'Treasure' chewings fescue, 10 weeks after treatment; 4 weeks after split application



**0.144 lb a.i./A**

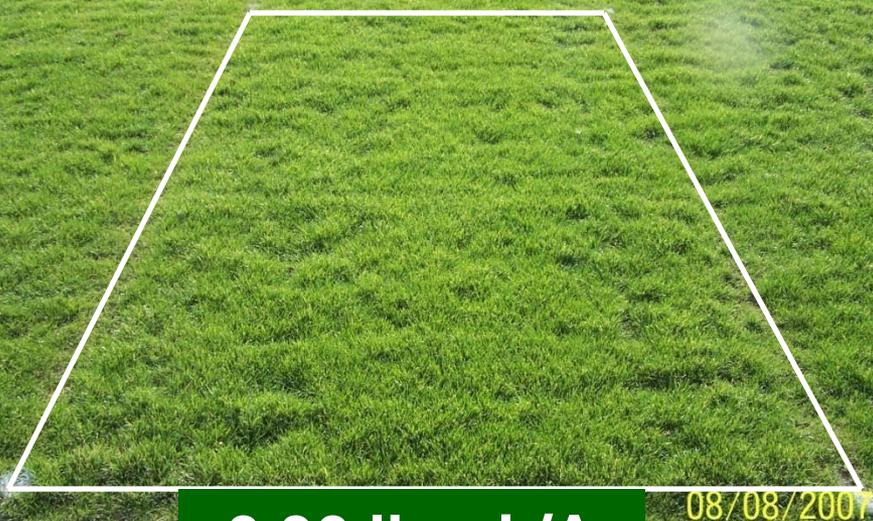


**0.25 lb a.i./A**

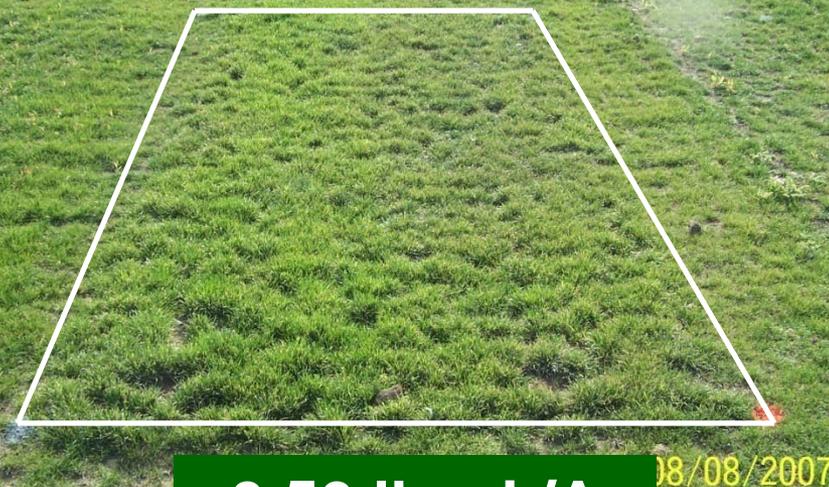


**'Gallery' perennial ryegrass, 10 weeks after treatment; 4 weeks after split application**

**0.30 lb a.i./A**



**0.50 lb a.i./A**



**0.144 lb a.i./A**

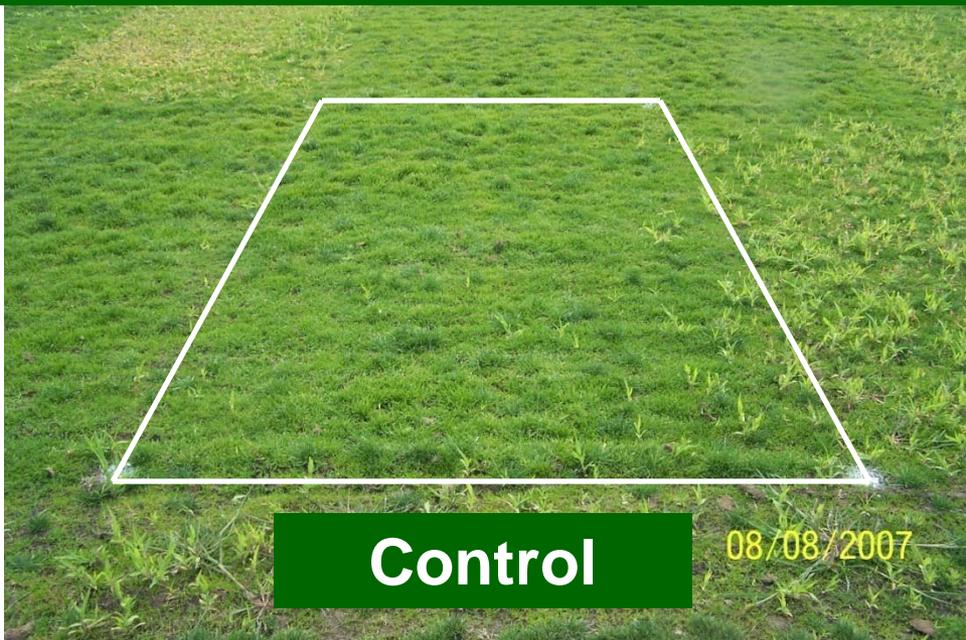


'Gallery' perennial ryegrass, 10 weeks after treatment; 4 weeks after split application



**Siduron**

08/08/2007



**Control**

08/08/2007

**0.144 lb a.i./A**



**0.25 lb a.i./A**



**80% KBG, 13% CF, 7% PRG MIXTURE, 10 weeks after treatment; 4 weeks after split application**



**0.30 lb a.i./A**

08/08/2007



**0.50 lb a.i./A**

08/08/2007

0.144 lb a.i./A



80% KBG, 13% CF, 7% PRG MIXTURE, 10 weeks after treatment; 4 weeks after split application



Siduron

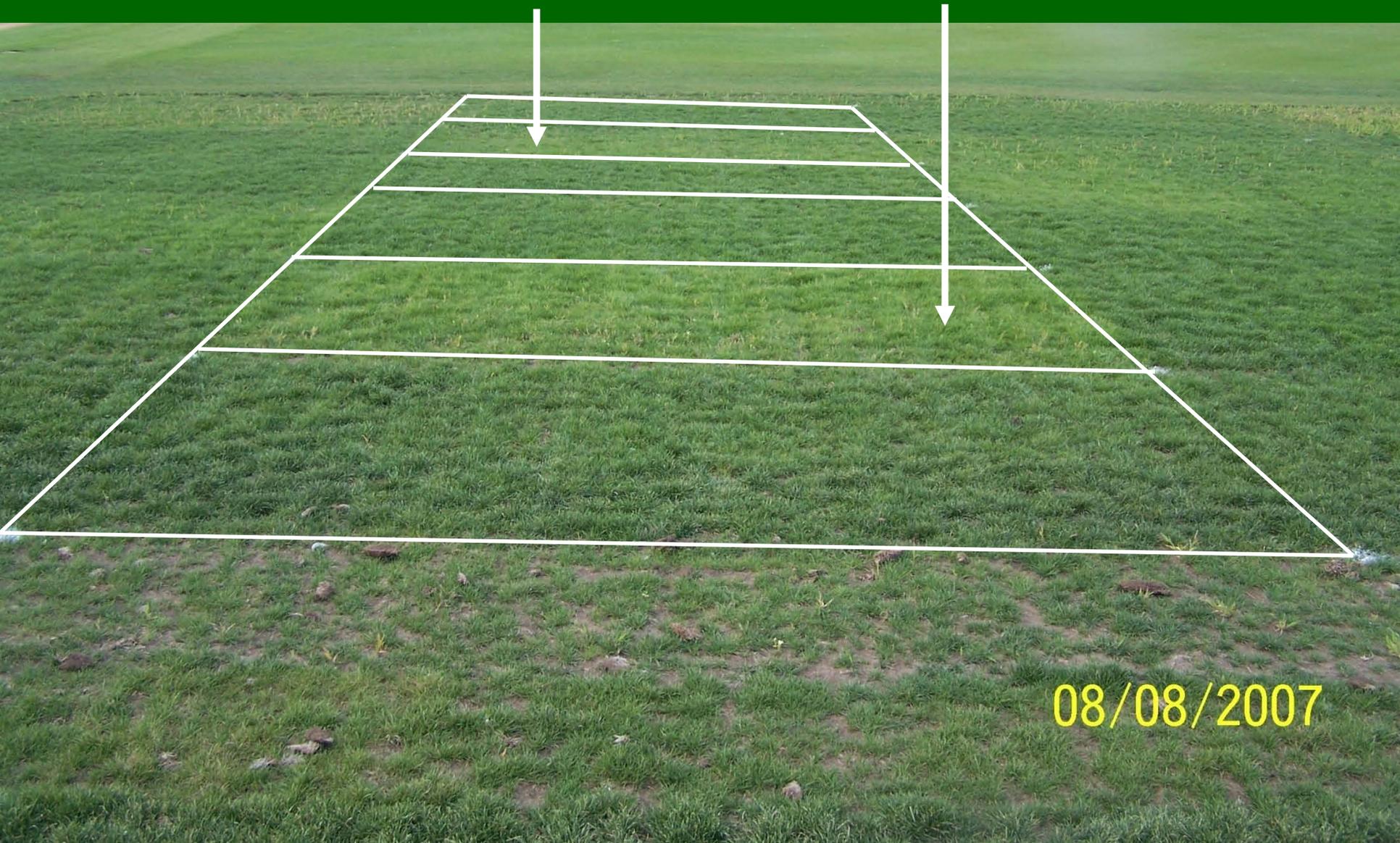
08/08/2007



Control

08/08/2007

**10 weeks after planting; note lighter green color of UTC & Siduron treatments**



08/08/2007

# Results

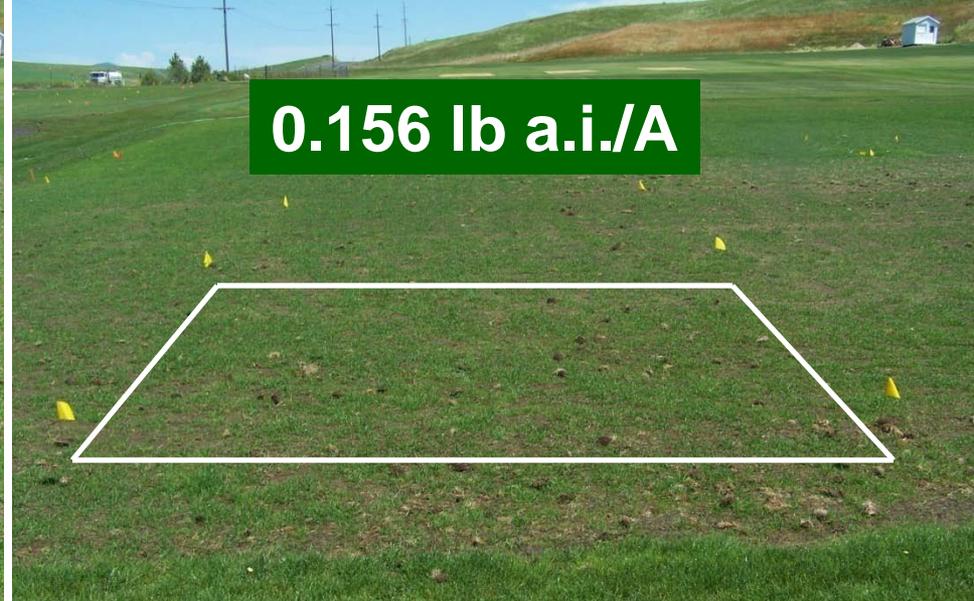
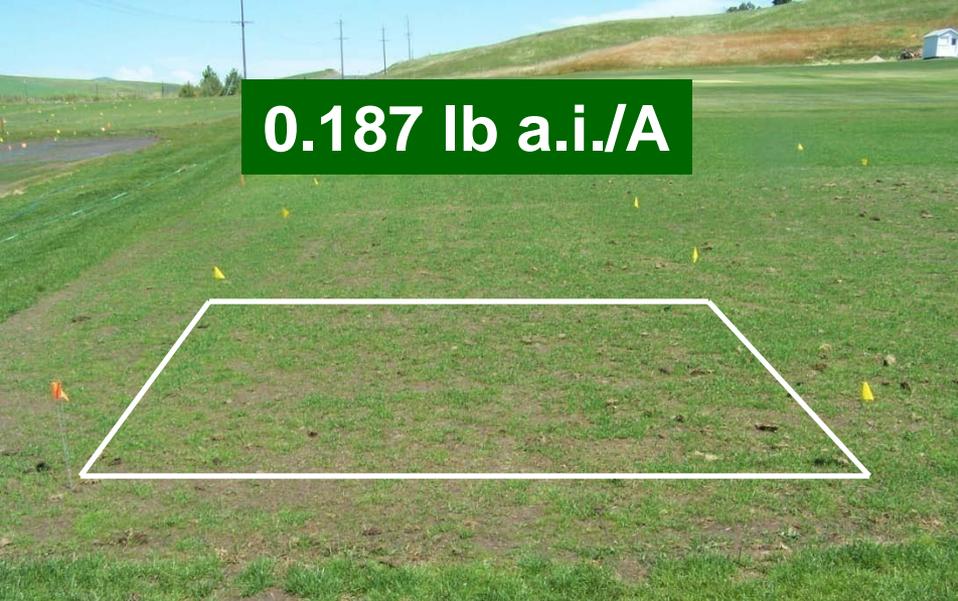
- Not safe to use on fine fescue
- Rates below 0.25 lb a.i./A appear to be safe to PRG and provide excellent weed control
- Rates below 0.50 lb a.i./A appear to be safe to KBG
- Mix performs similarly to PRG

# Results

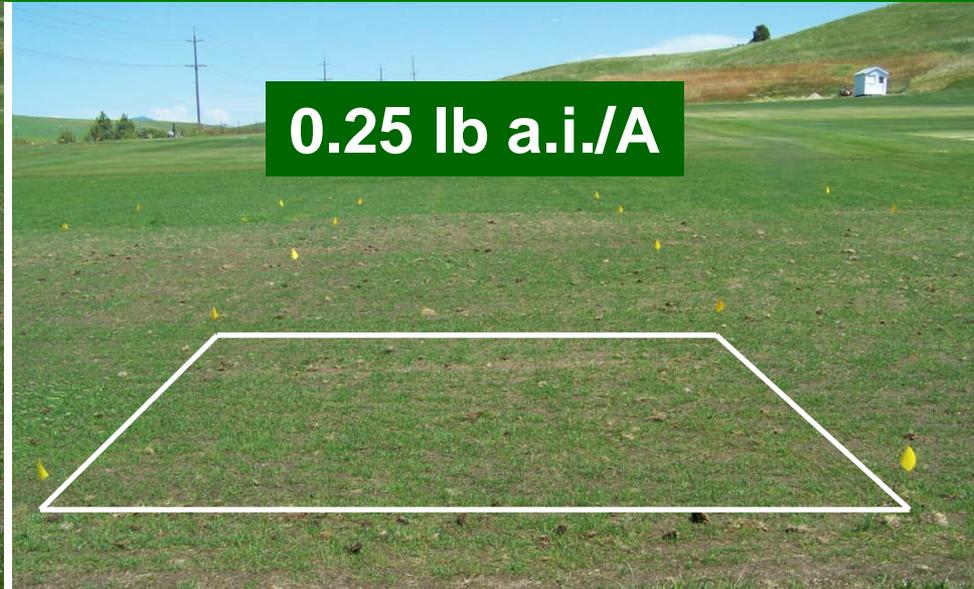
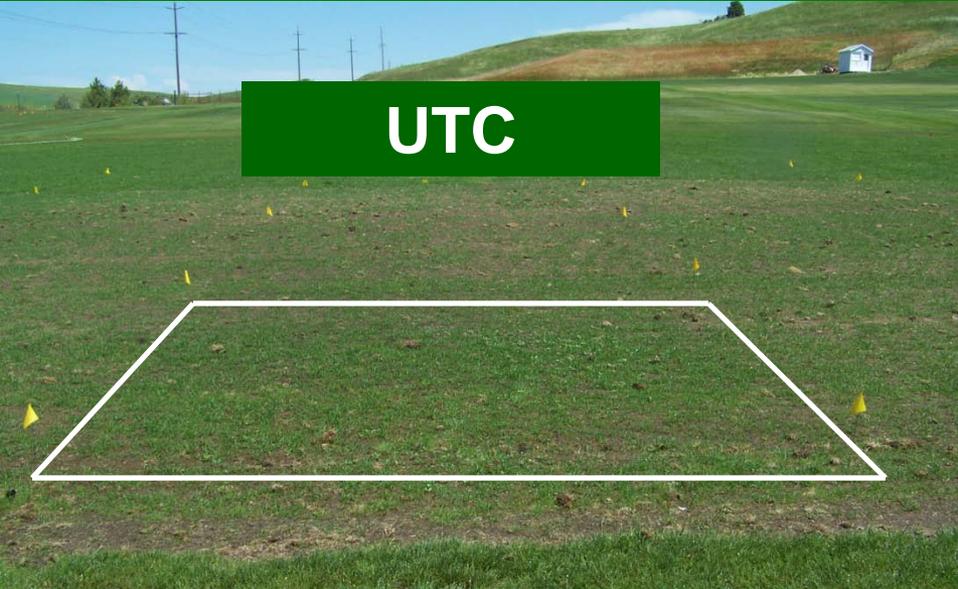
- Mix turf plots had higher % fescue using low rates of mesotrione
- Fertilizer impregnated with mesotrione provided excellent weed control and turf quality
- Split applications appear to be safe

# Tenacity 4SC at Planting

- 0.156, 0.187, 0.25, 0.156 x 2, & 0.187 x 2 lb a.i./A
- 2:1:1 (KBG:PRG:FLF) mixture
- Safety of applications
- Weed control
- Effect on establishment



**3 weeks after planting**



**0.187 lb a.i./A**



**0.156 lb a.i./A**



**8 weeks after planting**

**UTC**



**0.25 lb a.i./A**



**Note lighter green color of UTC and siduron plots**



**8 weeks after planting**



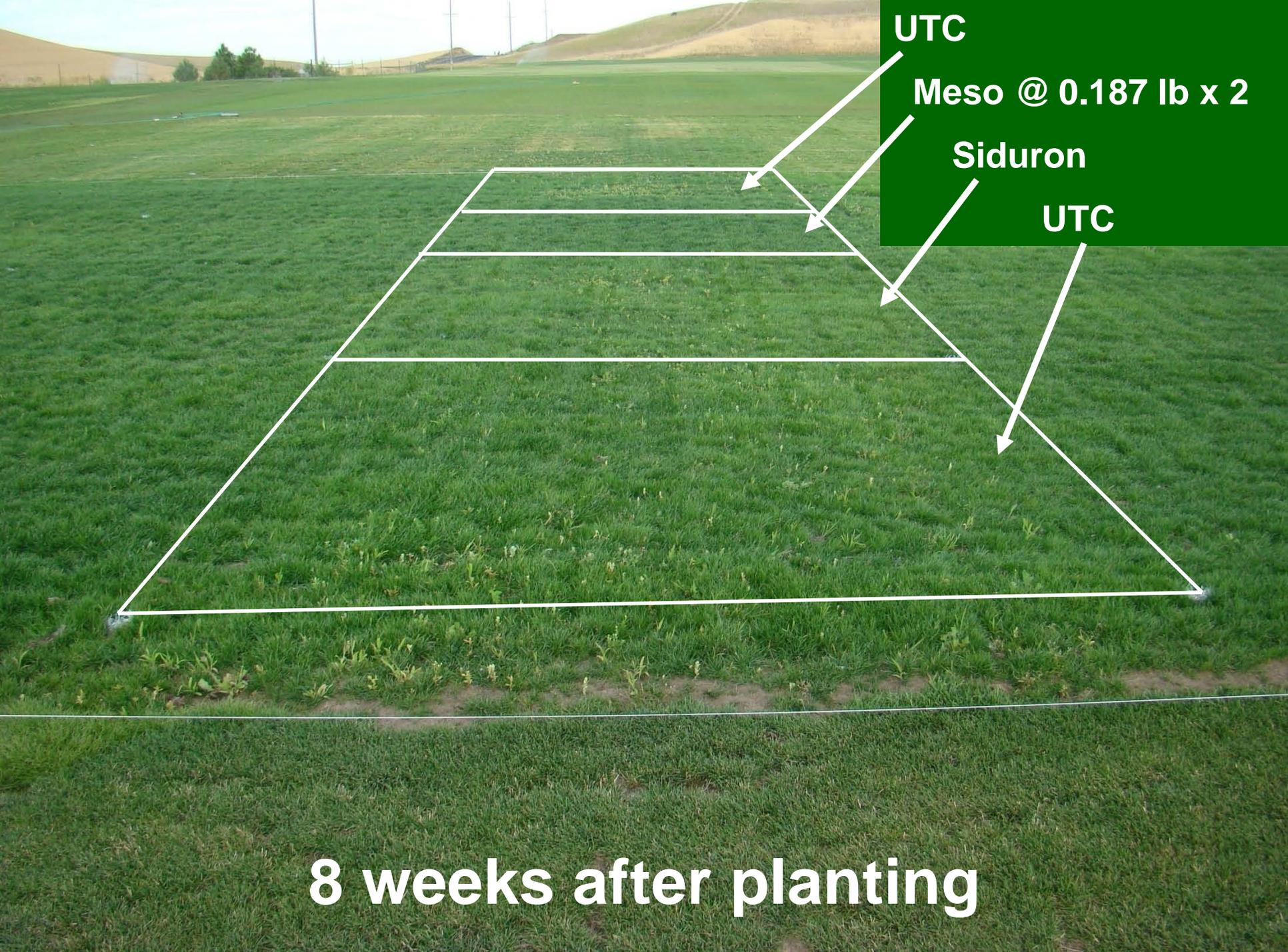
**Meso @ 0.25 lb ai/A**

**Meso @ 0.187 lb ai/A**

**UTC**

**Siduron**

**8 weeks after planting**



UTC

Meso @ 0.187 lb x 2

Siduron

UTC

8 weeks after planting

# Tenacity 4SC at Planting

- Excellent weed control with minimal phytotoxicity on a mixed turfgrass stand
- Mesotrione treatments were darker green in color (chewings fescue?)
- Split applications phytotoxic and did not appear necessary

# Greenhouse Study

- Determine if pre-plant applications of MIF reduce phytotoxic effects to perennial ryegrass and chewings fescue
- Determine if MIF affects emergence of perennial ryegrass or chewings fescue
- Four timings; 4, 2, 1, and 0 weeks pre-plant
- Five rates; 0, 0.144, 0.25, 0.30, and 0.50 lb a.i./A

**PRG 4 week pre-plant mesotrione application 35 DAP**



0

0.144

0.25

0.30

0.50

lb a.i./A

**FLF 4 week pre-plant mesotrione application 35 DAP**



# PRG 2 week pre-plant mesotrione application 35 DAP



0

0.144

0.25

0.30

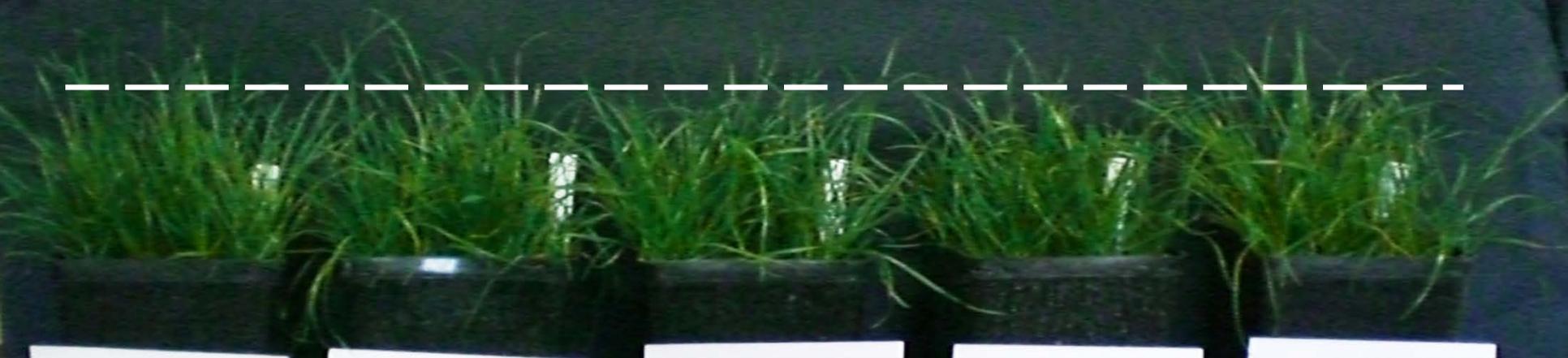
0.50

lb a.i./A

# FLF 2 week pre-plant mesotrione application 35 DAP



# PRG 1 week pre-plant mesotrione application 35 DAP



0

0.144

0.25

0.30

0.50

lb a.i./A

# FLF 1 week pre-plant mesotrione application 35 DAP



# PRG 0 week pre-plant mesotrione application 35 DAP



0

0.144

0.25

0.30

0.50

lb a.i./A

# FLF 0 week pre-plant mesotrione application 35 DAP



# Results

- Chewings fescue biomass reduced with all treatments, at all timings
- Perennial ryegrass biomass not affected
- Unacceptable phytotoxicity to chewings fescue
- Plant number generally not affected, only vigor and size

# How can 'Tenacity' best be used?

- Use 4SC or MIF at planting of cool-season turfgrass stands (<20% fescue)
- Use on mature turf stands for broadleaf weed control
- IPM rotational herbicide (Group 27)
- Best used on Kentucky bluegrass and perennial ryegrass
- Avoid using in close proximity to stands of bentgrass

# 'Tenacity' Use

- Use SC and MIF at rates of 0.125 – 0.25 lb ai/ha on PRG, KBG, and mixed stands
- Maximum use of 0.50 lb ai/ha/year
  - Lower rates = multiple applications
- **Reduce weed competition during turfgrass establishment**

# Labeling

- Max single application rates:
  - KBG / TF – 280 g a.i./ha
  - PRG/FLF/blends – 175 g a.i./ha
    - Up to 20% FLF in blend
  - FLF not on label for use at seeding