Control of Cool-Season Broadleaf Weeds, Annual Bluegrass and Smooth Crabgrass Using Flumioxazin in Dormant Common Bermudagrass Turf

L. Warren, F. Yelverton and T. Gannon
North Carolina State University
Introduction

Common bermudagrass turf in NC routinely infested with...

- Various broadleaf weed species
- Annual bluegrass – most common
- Smooth crabgrass – 2nd most common

[2012 Weed Survey – Southern States (North Carolina)]
Introduction

Annual bluegrass…

Competes for space, water and nutrient resources to justify control measures (Hall and Carey 1992)

Germinates within 7 to 29 C, causing erratic PRE control due to subsequent flushes that occur within a growing season (Kaminski and Dernoeden 2007).
Introduction

Smooth crabgrass...

Problem in golf course, athletic field and landscape turf in southeastern U.S. (McCarty et al. 2005)

Reduces aesthetic and functional turf quality due to light green color, leaf texture and unsightly seedheads. Competes for light, water and nutrient resources to justify control measures (Hall et al. 1994)
Research Objectives

To evaluate efficacy of a single application of flumioxazin applied to common bermudagrass anytime after dormancy in fall and before greenup in spring on various winter annual and perennial broadleaf weed species, annual bluegrass and smooth crabgrass

Flumioxazin applied to actively growing warm and cool-season turf or during spring greenup will cause unacceptable injury. (Supplemental Label)
Procedures

- Trial parameters: RCB design with 4 reps
- Spray and plot information
  Treatments applied with 10 in spacing 4-nozzle boom containing XR 8002VS nozzles delivering 32.5 gpa at 28 psi and 3 mph
  40” spray swath x 4 to 8 ft plots
- Evaluation parameters
  Monthly weed control, bermuda green cover
  0-100% scale; data subjected to ANOVA p=.05
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Applied Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flumioxazin + NIS*</td>
<td>6, 10**, 12 oz/A</td>
</tr>
<tr>
<td>Trifloxsulforon + NIS*</td>
<td>0.45 oz/A</td>
</tr>
<tr>
<td>Applied Nov, Dec, Jan, Feb, Mar</td>
<td></td>
</tr>
<tr>
<td>Flumioxazin + NIS*</td>
<td>6, 10, 12 oz/A (Mar)</td>
</tr>
<tr>
<td>Prodiamine</td>
<td>1.5 pt/A (Mar)</td>
</tr>
<tr>
<td>Metsulfuron + NIS*</td>
<td>0.33 oz/A (Mar)</td>
</tr>
<tr>
<td>2,4-D+fluroxypyr+dicamba</td>
<td>2.5 pt/A (Mar)</td>
</tr>
</tbody>
</table>

*NIS = Induce  
**0.33 oz/A metsulfuron added
Annual Bluegrass Control Using Flumioxazin and Trifloxsulfuron at Various Timings

% Control

25

Flumioxazin 6 oz/A

Flumioxazin 12 oz/A

Trifloxysulfuron 0.45 oz/A

Check

Apr 6, 2011 evaluation date
Induce applied at 0.25%

lsd p=.05

2010-11: Lake Wheeler Field Lab

2-Nov 1-Dec 4-Jan 7-Feb 7-Mar
Annual Bluegrass Control Using Flumioxazin and Trifloxysulfuron at Various Timings

Pine Burr Golf Course: 2011-12
Mar 26 evaluation date
Induce applied at 0.25%

Flumioxazin 6 oz/A
Flumiox. + Metsulfuron 10 oz + 0.33 oz/A
Trifloxysulfuron 0.45 oz/A
Check

lsd p=.05
Smooth Crabgrass Control Using Flumioxazin and Trifloxsulfuron at Various Timings

% Control

<table>
<thead>
<tr>
<th>Date</th>
<th>Flumioxazin 6 oz/A</th>
<th>Flumiox. + Metsulfuron 10 oz + 0.33 oz/A</th>
<th>Trifloxsulfuron 0.45 oz/A</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>29-Nov</td>
<td>80</td>
<td>100</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>19-Dec</td>
<td>90</td>
<td>90</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>12-Jan</td>
<td>100</td>
<td>100</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>6-Feb</td>
<td>90</td>
<td>90</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>5-Mar</td>
<td>80</td>
<td>80</td>
<td>60</td>
<td>0</td>
</tr>
</tbody>
</table>

Pine Burr Golf Course: 2011-12
Aug 6 evaluation date
Induce applied at 0.25%

lsd p=.05

31
<table>
<thead>
<tr>
<th></th>
<th>Trifloxysulfuron 0.45 oz</th>
<th>Flumioxazin 10 oz</th>
<th>Flumioxazin 6 oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 5</td>
<td>Check</td>
<td>Feb 6</td>
<td>Feb 6</td>
</tr>
<tr>
<td>Feb 6</td>
<td></td>
<td>Check</td>
<td>Feb 6</td>
</tr>
</tbody>
</table>

Photo Dec 18, 2012
Smooth Crabgrass Control Using Flumioxazin and Trifloxysulfuron at Various Timings

Lake Wheeler Turf Lab: 2011-12

Induce applied at 0.25%

Aug 7 evaluation date

lsd p=.05
## Discussion

Rainfall amts / irrigation timings per location

<table>
<thead>
<tr>
<th>Pine Burr Golf Club</th>
<th>Lake Wheeler Field Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 0.61”</td>
<td>Apr 1.48”</td>
</tr>
<tr>
<td>May 3.62”</td>
<td>May 4.18”</td>
</tr>
<tr>
<td>Jun 1.81”</td>
<td>Jun 2.56”</td>
</tr>
<tr>
<td>Jul 4.71”</td>
<td>Jul 5.29”</td>
</tr>
<tr>
<td>Aug 3.26”</td>
<td>Aug 2.71”</td>
</tr>
<tr>
<td>(No irrigation)</td>
<td>(3X per wk May – Aug)</td>
</tr>
<tr>
<td>Sandy loam</td>
<td>Clay loam</td>
</tr>
</tbody>
</table>
Pre Smooth Crabgrass Control in Common Bermuda Using Flumioxazin and Prodiamine

<table>
<thead>
<tr>
<th>Date</th>
<th>Flumioxazin + Induce 12 oz/A + 0.25%</th>
<th>Flumioxazin + Induce 6 oz/A + 0.25%</th>
<th>Prodiamine 1.5 pt/A</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-Jun</td>
<td>100</td>
<td>70</td>
<td>90</td>
<td>50</td>
</tr>
<tr>
<td>2-Jul</td>
<td>100</td>
<td>80</td>
<td>85</td>
<td>55</td>
</tr>
<tr>
<td>3-Aug</td>
<td>80</td>
<td>75</td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>3-Sep</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>65</td>
</tr>
</tbody>
</table>

Thorndale Country Club - 2012
Applied Mar 9

Lsd p = .05
Flumioxazin 6 oz/A
Applied Mar 9, 2012

Flumioxazin 12 oz/A

Prodiamine 1.5 pt/A

Check

Photo Jul 2, 2012
Post APHAR and CERVU Control in Common Bermuda Using Flumioxazin and Prodiamine

<table>
<thead>
<tr>
<th>% Control</th>
<th>APHAR 1 WAT</th>
<th>APHAR 2 WAT</th>
<th>CERVU 1 WAT</th>
<th>CERVU 2 WAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Lsd p = .05

- **Flumioxazin + Induce**
  - 12 oz/A + 0.25%
- **Flumioxazin + Induce**
  - 6 oz/A + 0.25%
- **Prodiamine**
  - 1.5 pt/A
- **Check**

Thorndale Country Club - 2012

Applied Mar 9
Flumioxazin + NIS
12 oz/A + 0.25%
Applied Mar 9, 2012
Photo Mar 22, 2012

Check
VERAR and CERVU Control in Princess Bermuda Using Flumioxazin, Metsulfuron and 2,4-D amine+fluroxypyr+dicamba

![Graph showing control percentages for VERAR and CERVU with different herbicides.]

- Flumioxazin + Induce 10 oz/A + 0.25%
- Metsulfuron + Induce 0.33 oz/A + 0.25%
- 2,4-D+fluroxy.+dicam. 2.5 pt/A
- Check

2011: Lake Wheeler Field Lab

Applied Mar 25
Discussion

Not effectively controlled by standard 3-way herbicides when applied in the spring (2,4-D + mecoprop + dicamba)
Flumioxazin, Metsulfuron and 2,4-D+fluroxypyr+dicamba Applied to Princess Bermudagrass at 40% Greenup

2011: Lake Wheeler Field Lab

Applied Mar 25

Flumioxazin + Induce 10 oz/A + 0.25%
Metsulfuron + Induce 0.33 oz/A + 0.25%
2,4-D+fluroxy.+dicam. 2.5 pt/A
Check

lsd p=.05
Conclusions

In two locations, 6 oz/A flumioxazin provided similar annual bluegrass control as 0.45 oz/A trifloxsulfuron (84-99%) from Nov through Jan timings; 12 oz/A flumioxazin provided similar control as 0.45 oz/A trifloxsulfuron (89-100%) from Nov through Feb timings

On a nonirrigated sandy loam site, 6 and 10 oz/A flumioxazin controlled smooth crabgrass 70 to 94% through early Aug when applied in early Mar; on an irrigated clay loam site, control was only 54 to 59%
Conclusions

On a nonirrigated sandy clay loam site, 6 oz/A flumioxazin controlled smooth crabgrass 56% through early Sep when applied in early Mar; 12 oz/A flumioxazin provided better control (85%) which was similar to prodiamine (88%).

6 oz/A Flumioxazin applied in Mar provided excellent control (95 to 100%) of parsley-piert, mouseear chickweed and corn speedwell; 0.33 oz/A metsulfuron provided poor control of corn speedwell (46%) and excellent control of mouseear chickweed (99%); 2,4-D amine+fluroxypyr+dicamba did not control corn speedwell (0%) and provided good control of mouseear chickweed (88%).
Conclusions

Four weeks after treatment, green coverage of Princess bermuda was reduced 32% compared to the nontreated check when treated with 10 oz/A flumioxazin during spring transition (40% greenup at application).

Applied in Feb or early Mar, one application of flumioxazin at 10 to 12 oz/A provides excellent control of various common winter broadleaf weeds and annual bluegrass, and only fair to good control of smooth crabgrass (similar to 1.5 pt/A prodiamine), probably due to summer rainfall or irrigation totals and high temperatures.