# ALTERNATIVE HERBICIDES TO DIURON IN CARBON SEEDED PERENNIAL RYEGRASS (*LOLIUM PERENNE*) GROWN FOR SEED

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## Introduction

Annual bluegrass (*Poa annua*) contamination in grass grown for seed is a major production challenge with significant economic ramifications. In the Willamette Valley, diuron applied preemergence over newly-planted seed rows protected with a narrow band of activated carbon has been the standard practice to control annual bluegrass for the past three decades. However, diuron resistant annual bluegrass is found in many grass seed fields in the Willamette Valley. Previous research by these authors has documented that indaziflam (Alion™) and pyroxasulfone (Zidua®) can provide excellent annual bluegrass control when applied preemergence to carbon seeded perennial ryegrass. In addition to evaluation of indaziflam and pyroxasulfone, rimsulfuron (Matrix®) was evaluated for annual bluegrass control in carbon seeded perennial ryegrass. None of these herbicides are registered for use in grasses grown for seed at this time.

## Methods

In the fall of 2010, four studies were initiated to evaluate annual bluegrass and California brome control and perennial ryegrass injury from applications of indaziflam, pyroxasulfone and rimsulfuron. Herbicides were applied as preemergent broadcast treatments to perennial ryegrass seeded with a 1 inch wide band of activated carbon applied over the rows at 300 lb/A. Three studies were located at the Oregon State University Hyslop Research Farm near Corvallis, OR, and one study was located in a commercial field near Jefferson, OR. All studies utilized a randomized complete block design with four replications.

Visual evaluations of annul bluegrass and California brome control along with crop injury ratings were taken in the fall (data not shown) and in January. California brome was not present at the Jefferson, OR, site. Seed was harvested, cleaned and yields were quantified.

## Results

Indaziflam treatments provided 90% or greater control of annual bluegrass at rates of 0.011 lb ai/A or greater at Hyslop Research Farm. Indaziflam did not provide acceptable control of California brome. Crop injury was acceptable at all rates and seed yields were equivalent to the standard treatments of diuron plus ethofumesate and pronamide plus ethofumesate (Table 1).

Table 1. Indaziflam in carbon seeded perennial ryegrass[1], Hyslop Farm, 2010-2011

| Treatment | Rate | Appl. timing | Annual bluegrass[2] | California brome[2] | Crop injury[3] | Seed yield |
|---|---|---|---|---|---|---|
| | (lb ai/A) | | ----- (% Control[3]) ----- | | (%) | (lb/A) |
| check | | | 0 | 0 | 0 | 1138 |
| indaziflam | 0.0054 | pre | 75 | 50 | 0 | 1176 |
| indaziflam | 0.0107 | pre | 92 | 70 | 11 | 1162 |
| indaziflam | 0.016 | pre | 90 | 68 | 4 | 1191 |
| indaziflam | 0.0214 | pre | 97 | 70 | 10 | 1190 |
| indaziflam | 0.0286 | pre | 92 | 73 | 10 | 1286 |
| diuron + | 1.0 | pre | 45 | 75 | 0 | 1290 |
| ethofumesate | 1.0 | post | | | | |
| pronamide + | 0.25 | pre | 100 | 96 | 3 | 1177 |
| ethofumesate | 1.0 | post | | | | |
| LSD (P = 0.05) | | | | | | NS |
| CV | | | | | | 8.8 |

[1]Perennial ryegrass carbon seeded 9/30/2010

[2]Diuron resistant annual bluegrass and California brome planted 10/1/2010

[3]Visual evaluations 1/5/2011

Pyroxasulfone applied at rates of 0.045 lb ai/A and above provided 90% or greater annual bluegrass control. California brome was not controlled adequately at any rate, although the 0.09 lb ai/A rate (highest rate evaluated) provided 80% control. Crop injury resulted in slightly reduced growth in the 0.09 lb ai/A treatment, but did not result in lower seed yields (Table 2).

Table 2. Pyroxasulfone in carbon seeded perennial ryegrass[1], Hyslop Farm, 2010-2011

| Treatment | Rate | Appl. timing | Annual bluegrass[2] | California brome[2] | Crop injury[3] | Seed yield |
|---|---|---|---|---|---|---|
| | (lb ai/A) | | ----- (% Control[3]) ----- | | (%) | (lb/A) |
| check | | | 0 | 0 | 0 | 1334 |
| pyroxasulfone | 0.023 | pre | 78 | 48 | 3 | 1271 |
| pyroxasulfone | 0.045 | pre | 93 | 58 | 10 | 1277 |
| pyroxasulfone | 0.09 | pre | 100 | 80 | 18 | 1333 |
| diuron + | 1.0 | pre | 38 | 68 | 0 | 1289 |
| ethofumesate | 1.0 | post | | | | |
| pronamide + | 0.25 | pre | 98 | 93 | 5 | 1284 |
| ethofumesate | 1.0 | post | | | | |
| LSD (P = 0.05) | | | | | | NS |
| CV | | | | | | 7.4 |

[1]Perennial ryegrass carbon seeded 9/30/2010
[2]Diuron resistant annual bluegrass and California brome planted 10/1/2010
[3]Visual evaluations 1/5/2011

Rimsulfuron did not provide adequate control of either the diuron resistant annual bluegrass or the California brome at Hyslop Research Farm. Crop injury resulted in slight growth reduction at the two higher rates but did not result in reduced seed yields (Table 3).

Table 3. Rimsulfuron in carbon seeded perennial ryegrass[1], Hyslop Farm, 2010-2011

| Treatment | Rate | Appl. timing | Annual bluegrass[2] | California brome[2] | Crop injury[3] | Seed yield |
|---|---|---|---|---|---|---|
| | (lb ai/A) | | ----- (% Control[3]) ----- | | (%) | (lb/A) |
| check | | | 0 | 0 | 0 | 1148 |
| rimsulfuron | 0.031 | pre | 35 | 30 | 0 | 1351 |
| rimsulfuron | 0.047 | pre | 55 | 35 | 9 | 1280 |
| rimsulfuron | 0.063 | pre | 68 | 33 | 11 | 1273 |
| diuron + | 1.0 | pre | 28 | 50 | 0 | 1217 |
| ethofumesate | 1.0 | post | | | | |
| pronamide + | 0.25 | pre | 100 | 93 | 4 | 1210 |
| ethofumesate | 1.0 | post | | | | |
| LSD (P = 0.05) | | | | | | NS |
| CV | | | | | | 6.7 |

[1]Perennial ryegrass carbon seeded 9/30/2010
[2]Diuron resistant annual bluegrass and California brome planted 10/1/2010
[3]Visual evaluations 1/5/2011

The study near Jefferson, OR, was located in a commercial field that had areas of poor drainage. The study area was impacted by high equipment traffic causing localized compaction which led to water ponding during the winter months. Initial perennial ryegrass injury was severe following the pyroxasulfone and indaziflam treatments (Table 4). We speculate that the application rates of these herbicides were too high for the poor drainage. However, at grass seed harvest, the only treatment that reduced seed yield was the highest rate of indaziflam. Initial annual bluegrass control was 90% or greater with the pyroxasulfone treatments. Rimsulfuron treatments provided better crop safety than the pyroxasulfone and indaziflam treatments. The two highest rates of rimsulfuron resulted in perennial ryegrass injury greater than the diuron standard, and provided less annual bluegrass control.

Table 4. Alternatives to diuron in carbon seeded perennial ryegrass[1], Jefferson, OR, 2010-2011.

| | | Annual bluegrass control[3] | | | Crop injury[3] | | | Seed |
|---|---|---|---|---|---|---|---|---|
| Treatment[2] | Rate | 1/6/11 | 2/25/11 | 4/13/11 | 1/6/11 | 2/25/11 | 4/13/11 | yield |
| | (lb ai/A) | ----------(%)---------- | | | ----------(%)---------- | | | (lb/A) |
| check | | 0 | 0 | 0 | 0 | 0 | 0 | 436 |
| rimsulfuron | 0.031 | 70 | 53 | 48 | 4 | 3 | 0 | 581 |
| rimsulfuron | 0.047 | 83 | 58 | 48 | 18 | 18 | 13 | 526 |
| rimsulfuron | 0.063 | 90 | 75 | 60 | 30 | 30 | 30 | 563 |
| pyroxasulfone | 0.09 | 97 | 96 | 78 | 30 | 30 | 33 | 658 |
| pyroxasulfone + ethofumesate | 0.09 1.88 | 100 | 99 | 73 | 38 | 48 | 43 | 631 |
| pyroxasulfone | 0.18 | 100 | 100 | 83 | 58 | 78 | 68 | 505 |
| indaziflam | 0.014 | 90 | 80 | 68 | 35 | 43 | 48 | 426 |
| indaziflam | 0.028 | 98 | 88 | 85 | 58 | 78 | 85 | 98 |
| diuron + ethofumesate | 2.4 1.88 | 98 | 89 | 79 | 10 | 13 | 8 | 585 |
| pronamide + diuron | 0.25 1.6 | 46 | 45 | 48 | 3 | 3 | 0 | 527 |
| LSD (P = 0.05) | | | | | | | | 202 |
| CV | | | | | | | | 28 |

[1]Perennial ryegrass planted 10/5/2010
[2]Applications made on 10/6/2010
[3]Visual evaluations

**Summary**
Indaziflam and pyroxasulfone have the potential to replace diuron in carbon seeding for the establishment of grasses grown for seed. Both indaziflam and pyroxasulfone provided good control of annual bluegrass at rates safe to the crop. Rimsulfuron has crop safety but will have to be combined with other herbicides to provide adequate annual bluegrass control. Further studies will be conducted to refine application rates to minimize the potential for crop injury and enhance annual bluegrass control with these three herbicides.