Perennial Ryegrass and Tall Fescue Reseeding Intervals after Aminocyclopyrachlor Application

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Abstract. Turfgrass managers applying aminocyclopyrachlor for annual and perennial broadleaf weed control in cool-season turfgrasses may want to reseed into treated areas. Field experiments were conducted in Georgia, Tennessee, and Texas to investigate perennial ryegrass (Lolium perenne L.) and tall fescue (Festuca arundinacea Schreb.) reseeding intervals after aminocyclopyrachlor applications. Perennial ryegrass and tall fescue establishment were similar to the non-treated control after treatments of aminocyclopyrachlor and 2,4-dichlorophenoxyacetic acid (2,4-D) + dicamba + methylchloro-phenoxypropionic acid (MCPP) at 0, 2, 4, or 6 weeks before seeding. Results demonstrate that no reseeding interval is required after aminocyclopyrachlor treatment. Perennial ryegrass and tall fescue can be safely seeded immediately after aminocyclopyrachlor treatment at 39, 79, and 158 g/ai/ha.

Synthetic auxins are popular herbicides for selective, postemergence broadleaf weed control in turfgrass management (Struckmeyer, 1951; Watson, 1950). Herbicides in this class of chemistry control susceptible weeds by disrupting hormonal balance leading to increased cell wall plasticity, nucleic acid metabolism, and uncontrolled growth in meristematic regions (Sterling and Hall, 1997). A new synthetic auxin, aminocyclopyrachlor, was registered in 2010 for annual and perennial broadleaf weed control in turfgrass (Anonymous, 2010). Aminocyclopyrachlor is the first pyrimidine carboxylic acid herbicide with structural similarities to pyridines (Bukum et al., 2010). This herbicide has both foliar and soil activity and is more effective at lower rates than 2,4-D, dicamba, monosodium acid methanearsonate (MSMA), clopyralid, and quinclorac applied 1, 2, and 4 weeks after emergence. McElroy et al. (2005) noted that prepackaged mixtures of herbicides containing 2,4-D, metsulfuron, dicamba, clopyralid, and triclopyr be used with caution when applied at seeding or before stolon development with warm-season grasses. The researchers found that low and high rates of 2,4-D + metsulfuron + dicamba and 2,4-D + clopyralid + dicamba reduced bermudagrass cover of the cultivars Yukon, Riviera, and Princess 7.21 d after initial treatment when compared with the non-treated control (McElroy et al., 2005).

Turfgrass managers may need to reseed desirable turfgrasses like perennial ryegrass and tall fescue after broadleaf weeds have been controlled by aminocyclopyrachlor or other postemergence herbicides. Thus, reseeding intervals may be critical for new herbicides introduced for postemergence broadleaf weed control in turf management regimes. Data describing reseeding intervals after aminocyclopyrachlor treatments are limited. In the transition and cool humid region of the United States, tall fescue and perennial ryegrass are widely used for residential lawns, golf courses, and commercial properties. The objective of this research was to determine reseeding intervals for perennial ryegrass and tall fescue after aminocyclopyrachlor applications.

Materials and Methods

Experiments were conducted in Griffin, GA, Knoxville, TN, and Lubbock, TX, from Aug. 2010 to Mar. 2011. Experiments at all three locations were initiated on mature, irrigated tall fescue that was mowed weekly with a rotary mower at a 6.4-cm height. Clippings were returned. Soil in Georgia was a Cecil sandy loam (fine, kaolinitic, thermic Typic Kanhapludults) with 2.5% organic matter and a pH of 5.8. Soil in Tennessee was a Sequatchie loam (fine, kaolinitic, siliceous,
semiactive, thermic humic Hapludult) with 2.1% organic matter and a pH of 6.2%. Soil in Texas was a Brownfield sand clay loam soil (loamy, mixed, superactive, thermic Aridic Paleustalfs) with 1.6% organic matter and a pH of 8.0.

Experimental design. Separate studies were conducted to determine reseeding intervals for perennial ryegrass and tall fescue. The experimental design for each was a randomized complete block with four replications. Four herbicide treatments were applied at four application timings before seeding in addition to a non-treated control. Aminocyclopyrachlor (Imprelis 2SL; DuPont, Wilmington, DE) was applied at 39, 78, or 158 g/a.i./ha and 2,4-D + dicamba + MCPP (Trimec Classic 2.72 SL; PBI Gordon Corp., Kansas City, MO) was applied at 1100 + 100 + 300 g/a.i./ha, respectively. Herbicide treatments were applied 0, 2, 4, or 6 WBS. Application dates in Georgia, Tennessee, and Texas are presented in Table 1. Aminocyclopyrachlor rates were selected from previous research evaluating broadcast applications of aminocyclopyrachlor for selective broadleaf weed control (Flesner et al., 2011). The 2,4-D + dicamba + MCPP rates were selected from label recommendations (Anonymous, 2004).

Treatments were applied to 1 × 3.6-m plots in Georgia and 1.5 × 3.6-m plots in Texas and Tennessee. In Georgia, treatments were applied by making two passes in opposite directions with a single nozzle (Tejet 9504E flat fan spray nozzle; Spray- ing Systems Co., Roswell, GA) CO2-pressured sprayer calibrated to deliver 375 L·ha⁻¹. In Tennessee and Texas, treatments were applied by making one pass per plot with a four nozzle (Tejet 8002 flat fan spray nozzle; Spraying Systems Co.) CO2-pressured sprayer calibrated to deliver 280 L·ha⁻¹. Turfgrass seeding and maintenance. Seven days before seeding, each experimental site received a broadcast application of glyphosate (Roundup Pro. Monsanto Company, St. Louis, MO) at 3.3 kg/a.i./ha to kill existing vegetation and facilitate visual assessment of turfgrass seedling cover. On the day of seeding, the field was mowed to 3.8 cm with a rotary mower, debris was removed, and the seedbed received two additional passes with a vertical mower set to a depth of ≈1.3 cm. Perennial ryegrass (Manhattan IV perennial ryegrass; Pure Seed Testing, Inc., Hubbard, OR) and tall fescue (Titan tall fescue; Seed Research of Oregon, Inc., Corvallis, OR) were seeded separately and perpendicular to herbicide treatments over half of all plots at 390 kg·ha⁻¹ with a drop spreader. Herbicide treatments scheduled for the day of seeding were applied immediately after seeding each grass species. After seeding, tall fescue and perennial ryegrass were irrigated daily to promote germination and applied as needed to prevent turf wilt after germination. A 10N–10P₂O₅–10K₂O granular fertilizer was applied at 48 kg N·ha⁻¹ ≈4 weeks after seeding (WAS) at each location.

Measurements and statistical analysis. Perennial ryegrass and tall fescue cover were assessed visually, because Yelverton et al. (2009) reported that visual ratings of herbicide responses in turf were highly correlated to those measured using the line intersect method or digital image analysis. Turf cover was evaluated for each species 2, 4, 8, 12, and 20 WAS on a percent scale where 0 equaled no turf cover and 100 equaled complete turf cover.

Data were subjected to analysis of variance with main effects and all possible interactions tested using the appropriate expected mean square values as described by McIntosh (1983). Data were pooled from all three locations because location-by-treatment interactions were not detected for tall fescue or perennial ryegrass cover. Means were separated with Fisher’s protected least significant difference test at the 0.05 P level.

Results

Perennial ryegrass study. A treatment-by-application timing interaction was not detected on any date for perennial ryegrass cover. Perennial ryegrass cover after aminocyclopyrachlor and 2,4-D + dicamba + MCPP treatments was similar and was not reduced from the non-treated control on any date regardless of application timing (Table 3). At 4, 8, and 12 WAS, perennial ryegrass had 88%, 95%, and 99% cover, respectively, for all herbicides applied 0, 2, 4, or 6 WBS. At 20 WAS, no significant differences in perennial ryegrass cover were detected among application timing or herbicide treatments.

Tall fescue study. A treatment-by-application timing interaction was not detected on any date for tall fescue cover. Tall fescue cover after aminocyclopyrachlor and 2,4-D + dicamba + MCPP treatments was similar and was not reduced from the non-treated control on any date regardless of application timing (Table 2). At 4, 8, and 12 WAS, tall fescue had 77%, 94%, and 96% cover, respectively, for all herbicides applied at any of the timings. At 20 WAS, no significant differences in tall fescue cover were detected among treatment timings or herbicide treatments.

Discussion

Herbicide options are limited for turfgrass managers who are looking to control problematic weeds during establishment of cool-season grasses. Herbicides commonly used in established cool-season turfgrasses for PRE weed control such as diisopyrop, oryzalin, oxadiazon, pendimethalin, and prodiamine can injure immature and newly seeded cool-season turfgrass potentially leading to total failure of turfgrass establishment (Fermanian and Haley, 1994; Johnson and Murphy, 1991; Landschoot et al., 1993). Herbicides commonly used for post-weed control including 2,4-D, dicamba, MCPP, MSMA, or triclopyr

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Table 1. Dates of treatment application and seeding in field experiments in Griffin, GA, Knoxville, TN, and Lubbock, TX, in 2010.

| Application | Week before seeding | Georgia | Tennessee | Texas |
|-------------|---------------------|---------|-----------|-------|
| Treatments  |                     |         |           |       |
| 6           | 17 Aug.             | 16 Aug. | 24 Aug.   |       |
| 4           | 1 Sept.             | 30 Aug. | 7 Sept.   |       |
| 2           | 14 Sept.            | 13 Sept.| 21 Sept.  |       |
| 1           | 29 Sept.            | 20 Sept.| 28 Sept.  |       |
| Glyphosate  | 1                   | 21 Sept.| 20 Sept.  |       |
| Seeding     | 29 Sept.            | 28 Sept.| 5 Oct.    |       |

Table 2. ‘Manhattan IV’ perennial ryegrass cover after herbicide treatments at four application timings before seeding in field experiments conducted in 2010–2011. a, b

| Treatment* | Rate (g/a.i./ha) | 2       | 4       | 8       | 12      | 20      |
|------------|-----------------|---------|---------|---------|---------|---------|
| Aminocyclopyrachlor | 39               | 54      | 88      | 96      | 99      | 99      |
|              | 79               | 54      | 88      | 96      | 99      | 99      |
|              | 158              | 54      | 88      | 95      | 99      | 99      |
| 2,4-D + dicamba + MCPP | 1100 + 100 + 300 | 54      | 89      | 96      | 99      | 99      |

| Application timing (WBS) | 0 | 2 | 4 | 6 | 8 | 12 | 20 | LSD0.05 |
|--------------------------|---|---|---|---|---|----|----|---------|
| Perennial ryegrass cover (WAS) | 54 | 88 | 96 | 99 | 99 | 99 | 99 | NS* |

| LSD0.05 | 54 | 88 | 96 | 99 | 99 | 99 | 99 | NS* |
|---------|----|----|----|----|----|----|----|------|
| Non-treated control | 54 | 88 | 96 | 99 | 99 | 99 | 99 | NS* |

aMeans are combined for experiments conducted in Griffin, GA, Knoxville, TN, and Lubbock, TX.

bWAS = weeks after seeding.

cInitial applications were applied on 17 Aug., 16 Aug., and 24 Aug. in Georgia, Tennessee, and Texas, respectively. Seeding dates were 29 Sept., 28 Sept., and 5 Oct. in Georgia, Tennessee, and Texas, respectively.

dMeans are combined for experiments conducted in Griffin, GA, Knoxville, TN, and Lubbock, TX.

*eWAS = weeks before seeding.

fMCPP = methylchlorophenoxypropionic acid; LSD = least significant difference.
Table 3. ‘Titan II’ tall fescue cover after herbicide treatments at four application timings before seeding in field experiments conducted in 2010–2011.\

| Treatment | Rate (g/a.i./ha) | 2 | 4 | 8 | 12 | 20 |
|-----------|-----------------|---|---|---|----|----|
| Aminocyclopyrachlor | 39 | 36 | 77 | 94 | 96 | 99 |
| | 79 | 36 | 77 | 94 | 96 | 99 |
| | 158 | 36 | 76 | 94 | 97 | 99 |
| 2,4-D + dicamba + MCPP | 1100 + 100 + 300 | 36 | 77 | 95 | 96 | 99 |

Application timing (WBS)\(^a\)

| Treatment | Rate (g/a.i./ha) | 2 | 4 | 8 | 12 | 20 |
|-----------|-----------------|---|---|---|----|----|
| Aminocyclopyrachlor | 39 | 36 | 77 | 94 | 96 | 99 |
| | 79 | 36 | 77 | 94 | 96 | 99 |
| | 158 | 36 | 76 | 94 | 97 | 99 |

Non-treated control

\(^a\)Means are combined for experiments conducted in Griffin, GA, Knoxville, TN, and Lubbock, TX.

\(^b\)WAS = weeks after seeding.

\(^c\)Non-treated control.

\(^d\)LD\(_0\) = least significant difference.

are recommended for use after seedlings have begun tillering or after mowing three to four times (Askew and Hipkins, 2005).

Results from this study demonstrate that perennial ryegrass and tall fescue can be safely treated with aminocyclopyrachlor applied at 39, 79, and 158 gcdot ha\(^{-1}\) immediately after seeding. Perennial ryegrass and tall fescue establishment appears uninhibited from aminocyclopyrachlor application; thus, no reseeding interval is required. Practitioners could selectively control broadleaf populations with aminocyclopyrachlor in the fall and safely reseed perennial ryegrass or tall fescue immediately after application. These results are comparable to similar studies that have shown certain herbicides including isoxaflutole, mesotrione, and quinclorac to be safe when applied during establishment of cool-season turfgrasses (Askew et al., 2004; Willis et al., 2006). Further research should investigate application rates and intervals for use of aminocyclopyrachlor after turfgrass seedling emergence in perennial ryegrass and tall fescue stands as well as reseeding intervals with aminocyclopyrachlor application on warm-season turfgrass seed and vegetative material.

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