Selective *Agrostis stolonifera* Removal from *Lolium perenne* with Mesotrione

Charles T. Golob[1], William J. Johnston[1], Christopher A. Proctor[2], and Matthew W. Williams[3]

[1]Department of Crop and Soil Sciences, Washington State University, Pullman, WA, [2]Department of Agronomy and Horticulture, University of Nebraska, Lincoln, NE, [3]Walla Walla Community College, Walla Walla, WA

Introduction

Unwanted infestations of *A. stolonifera* can occur in many situations where *L. perenne* is grown: golf courses, athletic fields, homelawns, etc. When *A. stolonifera* invades such areas it can easily dominate due to its aggressive stoloniferous growth habit resulting in patches that are hard to manage and look unattractive (Branham et al., 2005). In addition to poor aesthetic quality, bentgrass that escapes from golf course putting greens into surrounding turf can negatively affect playability.

Prior to 2008, there were no herbicides available to selectively remove *A. stolonifera* without adversely affecting *L. perenne*. However, mesotrione (2-[4-(methylsulfonyl)-2-nitrobenzoyl]-1, 3-cyclohexanedione) (Tenacity®) selectively controls, both pre- and post-emergence, a number of grass (including *A. stolonifera*) and broadleaf weeds in established turfgrass stands (Branham et al., 2005; Beam et al., 2006; Jones and Christians, 2007; Dernoeden et al., 2008; Anonymous, 2012). Susceptible plants show symptoms of leaf whitening due to the inhibition of the enzyme 4-hydroxyphenylpyruvate dioxygenase (HPPD), which interferes with the pathway for carotenoid biosynthesis (Mitchell et al., 2001). The objective of this study was to assess the effectiveness of a long-term program for the selective removal of *A. stolonifera* from a *L. perenne* stand using mesotrione.

Materials and Methods

A 4-yr study was conducted at the Washington State University Turfgrass and Agronomy Research Center, at Pullman, WA. The plot area was a mixed stand of *L. perenne* (cv. 'Gallery') infested with *A. stolonifera* (cv. 'T-1') surrounding an *A. stolonifera* green. Soil was a Palouse silt loam (Pachic Ultic Haploxerolls, fine silty, mixed, mesic). Mesotrione treatments were applied with a bicycle-wheeled, CO_2 pressurized sprayer with TeeJet (TeeJet Technologies, Wheaton, IL) 11002 flat fan spray nozzles at 233 L ha^{-1}. A nonionic surfactant (NIS), 'Activator 90', was tank mixed at 0.25% v/v with all mesotrione treatments. Irrigation was applied 16 hr following each mesotrione application and routinely thereafter to prevent turfgrass drought stress. The percentage of *A. stolonifera* in the stand prior to initiating the study was visually estimated to be 70% and was uniformly distributed. Mesotrione treatments were applied as three or four sequential applications at 140 g a.i. ha^{-1} per application. These multiple sequential applications were either applied in a single year (2007 only) or repeated multiple years (2007, 2008, and 2010) over the same plots. The three application treatments were applied on 25 July, 8 Aug., and 29 Aug. 2007; 27 May, 12 June, and 8 July 2008; and 8 June, 23 June, and 8 July 2010. The four application treatments were applied on the same dates as the three application treatments with additional treatments made on 12 Sept. 2007, 18 July 2008, and 22 July 2010. In 2007, 2 wk after the first application of mesotrione, plots were mowed low (scalped), verticut, aerified, and overseeded with an equal blend of three *L. perenne* ('Auburn Trilogy') at 490 kg ha^{-1}. An untreated check was overseeded. Percentage of *A. stolonifera* cover and *L. perenne* phytotoxicity were rated visually beginning 1 wk after initial treatment (WAIT) to 14 WAIT in each year. Evaluation of *L. perenne* phytotoxicity was rated using a scale of 0 to 10, with 10 = dead turf and ≤ 2 considered acceptable injury. Standard errors were calculated for each mean at each rating date.

Results and Discussion

Mesotrione applied three or four times at 140 g a.i. ha^{-1} in 2007 reduced the percentage of *A. stolonifera* in the stand by September 2007 (Fig. 1). Even though the 140 g a.i. ha^{-1} rate was less than the recommended single, post-application label rate of 175 g a.i. ha^{-1} for use on *L. perenne* (Anonymous 2012), this lower rate was used to minimize potential phytotoxicity on *L. perenne*. Also, 560 g a.i. ha^{-1} is the yearly total amount that can be applied (Anonymous, 2012). Mesotrione applied four times reduced *A. stolonifera* cover to 6% compared to three applications, which reduced *A. stolonifera* cover to 15%. Therefore, although reduced from the initial 70%, not all of the *A. stolonifera* was eliminated in 2007. Dernoeden et al. (2008) showed that three or four sequential applications of mesotrione at 140 g a.i. ha^{-1} provided excellent control of *A. stolonifera* (reduced to ≤ 3% *A. stolonifera* cover) in a *Festuca arundinacea* Schreb. (tall fescue) stand with approximately 60% *A. stolonifera* initially. Additionally, Jones and Christians (2007) reported similar results with three or four applications of mesotrione at 140 g a.i. ha^{-1} providing 95% and 100% *A. stolonifera* control, respectively, 56 days after initial treatment (DAIT). Furthermore, even though three or four sequential applications of mesotrione greatly reduced *A. stolonifera* in the turfgrass stand it was for the most part not totally eliminated.

Prior to June 2008 mesotrione treatments, the three applications in 2007 at 140 g a.i. ha^{-1} had a higher percentage of *A. stolonifera* (28%) than four applications (9%) (Fig. 1). After June 2008 applications, by mid-July 2008, complete *A. stolonifera* control was achieved with four applications. Branham et al. (2005) showed that sequential applications of mesotrione over a 2-yr period can result in complete control of *A. stolonifera*; however, the rates used to achieve this were higher (three applications at 280 or 420 g a.i. ha^{-1}) than was used in our study.

When mesotrione treatments were only applied in 2007 the percentage of *A. stolonifera* in the stand increased through the end of the study (Fig. 1). It is apparent that three or four sequential applications in a single year will not control high percentages of *A. stolonifera* in a *L. perenne* turfgrass stand. As suggested by Branham et al. (2005), *A. stolonifera* not controlled with mesotrione can rapidly repopulate a turfgrass stand.

Agrostis stolonifera increased in all plots during 2009; however, the percentage of *A. stolonifera* was 8% and 30%, by June of 2010, in plots treated four or three times, respectively, in 2007 and 2008 (Fig. 1). It was difficult to determine, but recovery appeared to come from *A. stolonifera* plants not totally controlled by mesotrione and not from mowed stolons revegetating the area. Following the four application treatment, which resulted in complete control in 2008, the *A. stolonifera* came back. This suggests that repeat applications are needed to keep *A. stolonifera* from reinfesting a stand.

In 2010, four applications of mesotrione resulted in complete *A. stolonifera* control by mid-July 2010, which continued through the end of the study (Fig. 1). Even though three applications of mesotrione in 2007, 2008, and 2010 did not result in complete *A. stolonifera* control, *A. stolonifera* cover was reduced from 75% (received 2007 only treatments) to < 5%. Following applications of mesotrione at 140 g a.i. ha^{-1}, in each year, there was a slight increase in phytotoxicity to *L. perenne*, but these levels were rated ≤ 2, and considered to be acceptable (data not presented).

Conclusions

Not all of the *A. stolonifera* in the overseeded *L. perenne* stand was eliminated in the first year (Fig. 1). Mesotrione applied four times at 140 g a.i. ha^{-1} in 2007 was more effective at reducing the amount of *A. stolonifera* than three applications of mesotrione when rated June 2008. Subsequent multiple applications of mesotrione in 2008 reduced *A. stolonifera*, with complete *A. stolonifera* control being achieved with mesotrione applied four times each year (2007 and 2008). During 2009 *A. stolonifera* increased in all plots prior to reapplication of mesotrione in June 2010; however, it remained < 8% with four applications in 2007 and 2008. Following treatments in 2010, four applications of 140 g a.i. ha^{-1} again resulted in complete *A. stolonifera* control by mid-July 2010. Although *A. stolonifera* was observed at low levels in 2011, a multiple-year control program with four applications of mesotrione at 140 g a.i. ha^{-1} in year one and two, skipping a year, and then applying mesotrione again, should achieve nearly complete *A. stolonifera* control. Overseeding with *L. perenne* the first year may be necessary if there is a high amount of *A. stolonifera* (>70%) initially in the stand. Subsequent mesotrione applications in following years, possibly every other year, may be needed to maintain *A. stolonifera* at low levels (< 8%) in a *L. perenne* stand.

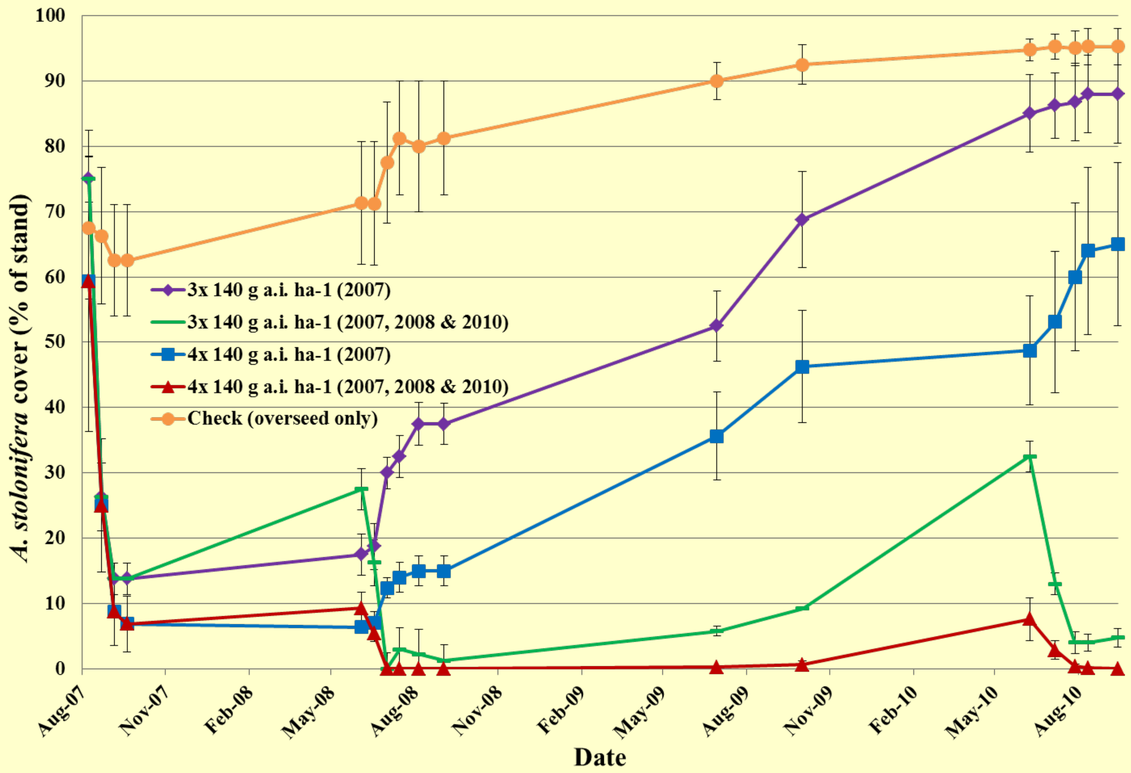

Fig. 1. Bentgrass cover, as percent of stand, following multiple applications of mesotrione in conjunction with overseeding in 2007, and with or without multiple applications of mesotrione in 2008 and 2010 at Pullman, WA.

Fig. 2. Bentgrass control following 4 mesotrione applications in 2007 and 2008 versus 2007 only.

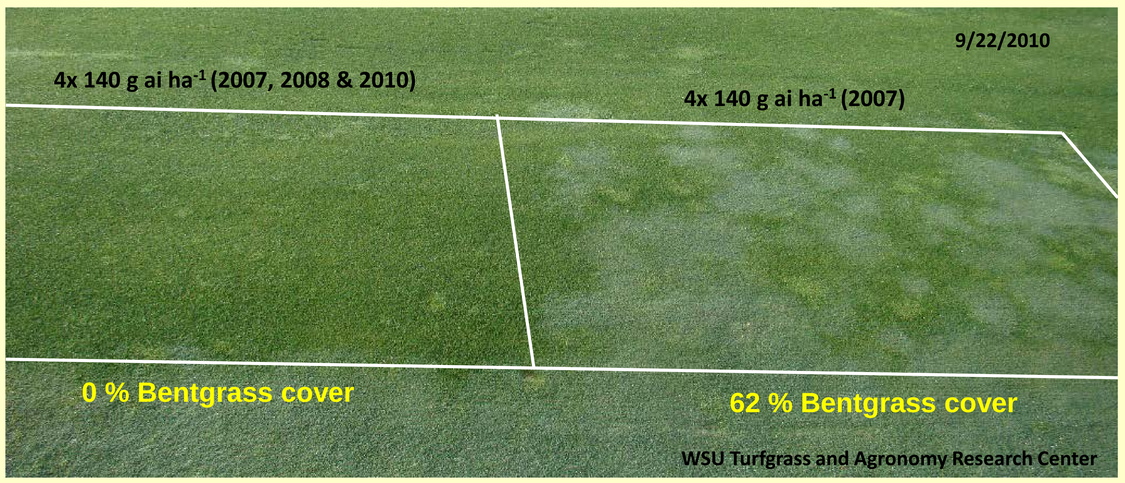

Fig. 3. Bentgrass control following 4 mesotrione treatments in 2007, 2008, and 2010 versus 2007 only.