Post Emergence Control of *Liriope spicata*©

Kirk T. Adams and Charles H. Gilliam
Department of Horticulture, Auburn University, 101 Funchess Hall, Auburn, Alabama 36849, USA
Email: kta0002@auburn.edu

Glenn R. Wehtje
Department of Agronomy and Soils, Auburn University, 201 Funchess Hall, Auburn, Alabama 36849, USA

Stephen F. Enloe
Crop, Soil, and Environmental Science, Auburn University, 119 Extension Hall, Auburn, Alabama 36849, USA

INTRODUCTION

Liriope spicata is an evergreen groundcover classified as a perennial, popularly found in the ornamental landscape setting. *L. spicata* is commonly referred to as creeping liriope, creeping lilyturf, and creeping monkeygrass. Native to eastern Asia, creeping liriope spreads aggressively through an underground rhizome root formation. *L. spicata* is cited under at least six listings as an invasive species (Bugwood, 2010). When incorporated into the homeowner landscape, the aggressive nature of *L. spicata* can become a problematic maintenance issue when trying to contain an area of establishment. Listed as an exotic forb species by the Invasive Plant Atlas of the United States, creeping liriope has been reported to be invasive in natural areas within the U.S. (Spaulding et al., 2010). As an escaped species from cultivation, the possibility of *L. spicata* affecting the natural growth areas of our native lands and forests can have a significant impact (Swearingen, 2009). Little research has been documented on the control methods of *L. spicata* within the horticulture industry. Most available control measures recommend mechanical removal with the addition of herbicide applications such as glyphosate or impazapyr (Miller et al., 2010).

The objective of this research was to determine the efficacy of post emergence spray applications of seven different herbicide sprays for control of *L. spicata*. Herbicide treatments in this study include selective and non-selective chemistries, available to the public through homeowner, forestry, or agricultural use. Through documented research efforts to determine positive control applications, we can provide a more effective means to contain the invasive species that are problematic to the landscape setting and the natural areas of our lands.

MATERIALS AND METHODS

This study was conducted at the Paterson Greenhouse complex at Auburn University. *L. spicata* was collected and divided from a naturalized stand in September 2011. Divisions were placed into 4-in. container pots under regular irrigation in an enclosed greenhouse structure. Containers were filled with a pinebark and sand (6:1, v/v) substrate which had been amended with 8.3 kg·m^{-3} (14 lb/yd^3) of 17-5-11 Polyon® control-release fertilizer (10-12 month), 3.0 kg·m-3(5 lb/yd^3) of lime, and 0.9 kg·m^{-3} (1.5 lb/yd^3) of Micromax®. Shoots were cut back to 2 in. height from substrate surface and allowed to grow for a period of 3 months and were then potted into 3.8 L (#1, 1 gal) containers using the same substrate mixture and placed in an outdoor retractable roof shade structure. Plants received overhead irrigation daily [1.27 cm. (0.5 in.)].

In May 2012, seven herbicides were applied to *L. spicata* at two rates each. Each treatment consisted of ten single pot replications. Herbicide treatments were applied by an enclosed-cabinet sprayer equipped with a single Teejet 8002 nozzle calibrated to deliver 30 GPA (gal/acre).

Plants were placed within a retractable shade structure following a 20-hr period of no irrigation. A randomized experimental design was used. Regular irrigation was again applied twice daily at 0.5 in./day. Visual injury ratings were then collected at 30 and 60 days after treatment (DAT, Table 1). After the final rating all shoot growth was cut to a 2.5 cm (1 in.) height from the substrate surface for regrowth analysis. Fresh shoot weights were recorded and then placed into a dry oven at 77°C (170°F) . After a period of 72 h, dry shoot weights were recorded. At 90 DAT regrowth of shoots were collected and dry weights measured for five replications of each treatment. Shoot regrowth and root assessments were made by measuring each replication for dry shoot and dry root weights. Dead root tissue was excluded from living tissue measurements based on separation by color and texture. The remaining five replications of each treatment were kept in the retractable shade structure with consistent irrigation for regrowth analysis to be determined at 180 DAT. All data were subjected to analysis of variance (ANOVA). Duncan's Multiple Range Test was used for a comparison between treatment means at a p-value ≤ 0.05.

RESULTS AND DISCUSSION

At 30 DAT, only metsulfuron at both rates and sulfometuron at the higher rate had greater injury than the non-treated control liriope (Table 1). All other treatments had injury similar to the non-treated control. At 60 DAT, both rates of metsulfuron, both rates of imazapyr, and the higher rate of glyphosate had significantly injury greater than that of the non-treated control (Table 1).

Maximum control (91%) as determined by dry weight reduction at 63 DAT, was obtained with metsulfuron at the 2 oz./acre rate. Metsulfuron at the 1 oz/acre rate provided 84% control (Table 1). All other treatments except dicamba at both rates provided some degree of control, although less control than the metsulfuron treatments.

Control of foliage regrowth at 90 DAT was consistent with both injury ratings and with dry weight reduction. Metsulfuron application at both rates had similar foliar regrowth control (97% – low rate) (100% – high rate). Imazapyr had similar control for foliar regrowth at both the low rate (85% control) and the high rate (86%). Lower control percentages were found in both rates of sulfometuron, imazapic, and the high rate of glyphosate. The remaining treatments of dicamba, low rate of glyphosate, and 2,4-D were all comparable to the non-treated control.

Root tissue control at 90 DAT again showed that metsulfuron was most effective. Metsulfuron at 1 and 2 oz./acre controlled root tissue 66 and 80%, respectively. Glyphosate at the high rate (171 oz/acre) provided 61% control. All other treatments were similar to the non-treated control. It is interesting to note that lower rates of both 2,4-D and dicamba had negative root control. 2,4-D at 1.0 lb/a and dicamba at 0.5 lb/a had 43 and 24% more root tissue than the non-treated, respectively. We speculate that the mode of action of these herbicides was reflected in root growth stimulation.

SUMMARY

Results of this study indicate metsulfuron was the most effective herbicide for *Liriope spicata* control. Registered for non-crop control of weeds and woody plants, metsulfuron demonstrated the greatest control of shoot reduction, shoot regrowth, and root formation of *L. spicata*. Imazapyr was the next most effective herbicide. Glyphosate treatment to *L. spicata* at given rates for this study was ineffective for post emergence control.

Table 1. Effects of selected herbicides on postemergence control of *Liriope spicata*[z].

Treatment[y]		Injury ratings[x]		Control % shoot reduction 63 DAT[w]	Control % regrowth 90 DAT	Control % root growth
Herbicide	Rate/acre	30 DAT	60 DAT	(Dried shoot weights)	(Dried shoot weights)	
Sulfometuron	1 oz.	1.3 cd[v]	1.1 f	59[u] b	49 b	53 abc
	2 oz.	2.3 c	1.9 def	62 b	60 b	46 a-d
Metsulfuron	1 oz.	4.6 ab	7.4 b	84 b	97 a	66 ab
	2 oz.	5.2 a	8.7 a	91 a	100 a	80 a
Imazapic	6 oz.	1.2 cd	1.1 f	58 b	48 b	40 a-d
	12 oz.	1.4 cd	1.3 ef	63 b	58 b	32 a-d
Imazapyr	32 oz.	1.7 cd	2.4 d	61 b	85 a	48 a-d
	64 oz.	1.7 cd	4.1 c	66 b	86 a	46 a-d
2,4-D	34 oz.	1.0 d	1.0 f	20 cd	18 cd	-43 c
	67 oz.	1.1 d	1.0 f	32 c	38 cd	25 bcd
Dicamba	16 oz.	1.0 d	1.0 f	0 e	6 c	-24 e
	32 oz.	1.1 d	1.0 f	11 de	15 c	3 cde
Glyphosate	85 oz.	1.2 cd	1.0 f	26 cd	12 c	37 a-d
	171 oz.	3.8 d	2.2 de	63 b	47 b	61 ab
Non-treated	~~~~~	1.0 d	1.0 f	0 e	0 c	0 ed

[u]Control percentages based on comparison = 100% - [(W_T / W_{NT}) * 100], (W_T = weight of treated plant sample in grams; W_{NT} = mean of non-treated plant sample in grams).

[v]Means separated using Duncan's Multiple Range Test at significance level ($p = 0.05$)

[w]Days after treatment. All treatments were applied on 2 May 2012.

[x]Injury ratings were based on a scale of 1 to 10; 1 = no injury. 10 = plant death.

[y]Treatments applied at 30 gal/acre with a 0.25% v/v non-ionic surfactant

[z]Data subjected to analysis of variance (ANOVA) and compared to non-treated controls.

Literature Cited

Bugwood Network. 2010. Center for Invasive Species and Ecosystem Health. http://www.invasive.org/species.cfm.

Miller, J.H., Manning, S.T. and Enloe, S.F. 2010. A mangaement guide for invasive plants in southern forests. United States Department of Agriculture. Forest Service, Southern Research Station: General Technical Report SRS-131. Asheville, North Carolina.

Spaulding, D., Barger, W. and Nesom, G.L. 2010. *Liriope* and *Ophiopogon* (*Ruscaceae*) naturalized in Alabama. Phytoneuron 55:1-10.

Swearingen, J.M. 2009. Survey of Invasive Plants Impacting National Parks in the United States. National Park Service, Center for Urban Ecology, Washington, DC 20007.