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Abstract

Old world bluestems (OWB) are perennial warm-season grasses introduced into the U.S. from parts of Asia, eastern Europe, Africa, and Australia. The two most common old world bluestem species found in Kansas are yellow bluestem (*Bothriochloa ischaemum*), otherwise known as King Ranch bluestem, and Caucasian bluestem (*Bothriochloa bladhii)*. These grasses were introduced for soil conservation and forage production in arid regions of the southern Great Plains; however, in Kansas and elsewhere, they have escaped areas where planted and have been invading native rangelands and pastures that were old crop fields seeded back to native grasses. Efforts to control OWB in native rangelands and native seeded pasture have had short term success, but the abundant seed produced from mature OWB plants has resulted in a soil seedbank capable of producing high populations of new seedlings. However, the length of time that this seedbank is capable of producing new seedlings has received relatively little investigation. The goal of this project was to evaluate new OWB seedling emergence from the soil seedbank for two years following OWB control with glyphosate.

Keywords

weed science

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Introduction

Old world bluestems (OWB) are perennial warm-season grasses introduced into the U.S. from parts of Asia, eastern Europe, Africa, and Australia. The two most common old world bluestem species found in Kansas are yellow bluestem (*Bothriochloa ischaemum*), otherwise known as King Ranch bluestem, and Caucasian bluestem (*Bothriochloa bladhii*). These grasses were introduced for soil conservation and forage production in arid regions of the southern Great Plains; however, in Kansas and elsewhere, they have escaped areas where planted and have been invading native rangelands and pastures that were old crop fields seeded back to native grasses. Efforts to control OWB in native rangelands and native seeded pasture have had short term success, but the abundant seed produced from mature OWB plants has resulted in a soil seedbank capable of producing high populations of new seedlings. However, the length of time that this seedbank is capable of producing new seedlings has received relatively little investigation. The goal of this project was to evaluate new OWB seedling emergence from the soil seedbank for two years following OWB control with glyphosate.

Experimental Procedures

A pasture in southern Marion County, KS invaded with Caucasian OWB was targeted for herbicide control. The OWB invasion was believed to have started from contaminated seed when the pasture was over seeded nearly 50 years prior. Isolated plants eventually developed into large patches, more than 100 feet × 50 feet in size, throughout the pasture. To control OWB in these patches, patches were broadcast sprayed by a commercial ATV delivery system at the rate of 2 lb glyphosate/acre when plants had started stem elongation during the 2005 growing season. Ammonium sulfate was first added to the solution to prevent high solute concentrations in the water from deactivating the glyphosate. Five sprayed patches had transects placed through the middle of the patch for monitoring OWB seedling emergence and the survival and cover of any other plants. Five transects adjacent to OWB sprayed patches were also located in non-sprayed areas outside of the OWB invasion for monitoring. In spring of 2006, 10 Daubenmire cover frames, each 2 ft^2, were placed along each transect and were evaluated for counts of new OWB seedlings and estimated ground cover of living plant species. Sprayed OWB patches from 2005 were sprayed again with 2 lb glyphosate/acre in 2006 to control new OWB seedlings after transects were monitored. Transects

were evaluated again in the spring of 2007 for new OWB seedlings and plant cover. In addition, at the end of the 2008 growing season, three of the original paired sprayed and unsprayed transects were monitored.

Results and Discussion

The areas sprayed with glyphosate in 2005 were near solid patches and were comprised of more than 50% OWB cover before being treated. One year after treatment in mid-June 2006, cover of OWB in sprayed patches was 2.9%, while cover of OWB was 0.3% in adjacent unsprayed transects (Table 1). Control of OWB reduced vegetative cover and resulted in an 85% bare soil cover. In the sprayed areas, the open canopy allowed OWB seedlings to emerge at a density of 4.5 seedlings/ft^2. Total vegetative cover of the sprayed transects was 14.6%, while unsprayed transects averaged 61.0%. A simple t-test analysis of the 29 most abundant species in sprayed and unsprayed transects showed that 9 species had different frequencies between sprayed and unsprayed transects. The most notable species, big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and western ragweed (*Ambrosia psilostachya*), all had lower frequency in sprayed transects. Sideoats grama (*Bouteloua curtipendula*) had similar frequency. Annual lespedezas (*Kummerowia* sp.), witchgrass (*Panicum capillare*), and OWB had greater frequency along sprayed transects.

At the time of sampling in late spring 2007, OWB cover in areas sprayed in two consecutive years was 1.3%, and OWB cover in adjacent unsprayed areas was 0.4%. New OWB seedling density along sprayed transects was 0.4 seedlings/ft^2. Total ground cover of sprayed areas was 25.7%, of which native grasses and forbs provided 14.2% cover. Average total ground cover along adjacent unsprayed areas was 43.5%, of which 39.8% was attributed to native species.

In the three transects monitored in 2008, OWB seedling density was less than 0.1 seedlings/ft^2, but some OWB seedlings were still present. Desirable native grass cover averaged 27.2% along transects sprayed in two consecutive years, while desirable native grass cover along the unsprayed transects averaged 78.7%. Sideoats grama appeared to retain its cover well when sprayed, having a similar cover in sprayed and unsprayed patches. In the third year after initial spray treatments, native perennial forbs provided a greater plant cover along sprayed transects (19.0%) than unsprayed transects (3.1%). Most of the forb cover along sprayed transects was western ragweed.

Implications

Using glyphosate to control OWB in pasture can greatly reduce OWB populations, but will likely injure key dominant native grass species. Desirables such as big bluestem, little bluestem, indiangrass, and switchgrass will decline in composition, but small populations may persist. Of desirable grass species in native pasture, sideoats grama appears to be the most resistant to population decline from repeated glyphosate applications. After initial OWB control with herbicides in pasture, OWB seedlings may establish from the untilled soil seed bank for up to three growing seasons.

Table 1. In Marion County, KS pasture, old world bluestem (OWB) seedling density and vegetative cover in OWB patches sprayed with one (2006) or two (2007 and 2008) years of glyphosate application or adjacent unsprayed native grass stands

	2006		2007		2008	
	Sprayed	Unsprayed	Sprayed	Unsprayed	Sprayed	Unsprayed
OWB seedling density (no./ft^2)	4.5	0.0	0.1	0.0	<0.1	0.0
OWB cover (%)	2.9	0.3	1.3	0.4	0.6	0.0
Native grass cover (%)	5.6*	53.5*	10.8*	37.7*	27.2*	78.7*
Native forb cover (%)	2.4	5.7	3.4	2.1	19.0*	3.1*
Total cover (%)	14.6*	61.0*	25.7	43.5	66.0*	85.5*
Bare soil (%)	85.4*	39.0*	74.3	56.5	44.0*	14.5*

* Within a row and year, asterisks indicate a significant difference ($P < 0.10$) between glyphosate sprayed and unsprayed vegetation.