EVALUATION OF CROP INJURY FROM SEQUENTIAL HERBICIDE APPLICATIONS FOR CHEATGRASS (*BROMUS TECTORUM*) CONTROL IN ESTABLISHED KENTUCKY BLUEGRASS, GRANDE RONDE VALLEY OF NORTHEASTERN OREGON

D.L. Walenta, A.G. Hulting, B. Merrigan, and D.W. Curtis

Introduction

"Cheatgrass" or downy brome (*Bromus tectorum*, BROTE) is a persistent annual grass weed in northeastern Oregon grass seed production systems. Current integrated pest management practices for cheatgrass include herbicide application, bale plus propane flaming postharvest residue, and hand-rogueing. Herbicide application at a single timing (preemergent or postemergent) typically does not provide adequate cheatgrass control. A study was conducted in established Kentucky bluegrass (KBG) to evaluate cheatgrass control and crop injury potential from sequential applications of selected preemergent and postemergent herbicides currently registered for use in grass seed.

Materials and Methods

The experiment was located in an established commercial field of 'Endurance' KBG in the Grande Ronde Valley of northeastern Oregon. The field was seeded in the spring of 2014, and a second seed crop was harvested in 2016. Preemergent herbicide applications (PRE) were applied on September 11, 2015. Postemergent herbicide applications were made on October 13, 2015 (EPOST) and February 25, 2016 (MPOST and LPOST). Conditions at the time of application are summarized in Table 1.

All treatments were applied with a hand-held CO_2 sprayer delivering 22 gpa at 30 psi. In order to minimize drift potential, TeeJet air induction extended range (AIXR) 11002 nozzle tips were used for all applications. Plots were 8 feet by 25 feet and were arranged in a randomized complete block design with four replications. Soil at the site consisted of an Imbler coarse sandy loam (81% sand, 15.8% silt, 3.2% clay, 2.62% OM, 5.5 pH, and CEC of 12.0 meq/100g). Visual evaluations of crop injury were taken in fall 2015 (October 2, October 13) and spring 2016 (April 19). KBG crop injury was based on a 0 to 100% scale, where 10% sets the limit of acceptable crop injury for most growers. Seed yield was not determined in this study.

Results and Discussion

Cheatgrass populations were very low throughout the growing season. Therefore, it was not possible to determine effectiveness of sequential herbicide applications for weed control.

Symptoms of injury appeared as stunted plant growth and burned-back foliage. Observations of crop injury were made for treatments including Axiom (flufenacet + metribuzin), Outlook (dimethenamid-P), and Beacon (primsulfuron). Results are summarized in Table 2. Most notable was the significant injury caused by Axiom applied in mid-October (EPOST) and late February (MPOST), but injury was expected given the use restrictions for east of the Cascade Mountains (e.g., loamy sand soil type; do not apply after late November). Injury from preemergent-applied Axiom was significant

Table 1. Conditions at time of herbicide application.

	Application timing		
	Sep. 11, 2015 (preemergent)	Oct. 13, 2015 (early postemergent)	Feb. 25, 2016 (mid- and late postemergent)
KBG growth stage	4 inches regrowth	4–7 inch height	Initiating growth
BROTE growth stage	None observed	None observed	None observed
Air temperature (°F)	90	61	59
Relative humidity (%)	31	54	43
Cloud cover (%)	Clear and sunny	Clear and sunny	Clear and sunny
Wind velocity (mph)	Calm	Calm	0–3
Soil temp at surface (°F)	92	62	70
Soil temp at 1-inch depth (°F)	84	59	60
Soil temp at 2-inch depth (°F)	82	57	56
Soil temp at 4-inch depth (°F)	78	53	45

Table 2. Cheatgrass (BROTE) control in established Kentucky bluegrass in the Grande Ronde Valley of northeastern Oregon, 2016.

Treatment[2]	Applicate rate	Application timing	Crop injury[1] Oct. 2, 2015	Crop injury[1] Oct. 13, 2015	Crop injury[1] April 19, 2016	BROTE April 19, 2016
	(per acre)		(%)	(%)	(%)	(number of plants/plot)
Check	—	—	0 d	0 c	0 e	8
Prowl H2O	5 pt	PRE	0 d	0 c	0 e	1
Axiom	10 oz	PRE	13 a	29 a	8 d	<1
Outlook	21 oz	PRE	8 c	11 b	1 e	<1
Prowl H20 /	5 pt	PRE	0 d	0 c	0 e	2
Goal 2XL +	8 oz	EPOST				
metribuzin	4 oz					
Axiom	10 oz	EPOST	0 d	0 c	16 b	3
Prowl H2O /	5 pt	PRE	0 d	0 c	0 e	2
Goal 2XL +	8 oz	MPOST				
Sinbar	0.5 oz[3]					
Prowl H2O /	5 pt	PRE	0 d	0 c	0 e	3
Goal 2XL +	16 oz	MPOST				
metribuzin	4 oz					
Prowl H2O /	5 pt	PRE	0 d	0 c	10 cd	3
Beacon +	0.38 oz	MPOST				
Sinbar	0.5 oz[3]					
Prowl H2O /	5 pt	PRE	0 d	0 c	0 e	1
Callisto +	6 oz	MPOST				
Sinbar	0.5 oz					
Outlook /	21 oz	PRE	8 c	9 b	65 a	1
Axiom	10 oz	MPOST				
Outlook /	21 oz	PRE	10 b	8 b	0 e	1
Goal 2XL +	8 oz	MPOST				
Sinbar	0.5 oz[3]					
Prowl H2O /	5 pt	PRE	0 d	0 c	15 bc	3
Beacon /	0.38 oz	EPOST				
Beacon +	0.38 oz	MPOST				
Sinbar	0.5 oz[3]					
Prowl H2O /	5 pt	PRE	0 d	0 c	8 d	1
Outlook /	21 oz	EPOST				
Beacon	0.38 oz	LPOST[4]				
Goal 2XL +	5 pt	EPOST	0 d	0 c	9 d	1
metribuzin /	4 oz	MPOST				
Beacon +	0.38 oz					
Sinbar	0.5 oz[3]					
LSD ($P = 0.05$)			1.8	4.0	5.0	NS

[1]Means with the same letter are not statistically different.
[2]Axiom = flufenacet + metribuzin; Prowl H2O = pendimethalin; Goal 2XL = oxyfluorfen; Callisto = mesotrione; Sinbar = terbacil; Outlook = dimethenamid-P; Beacon = primsulfuron
[3]Sinbar rates should have been applied at 0.5 lb product/acre.
[4]LPOST treatment was applied at time of MPOST (February 25, 2016).

in fall 2015; however, symptoms diminished to visually acceptable levels by April 19, 2016. Visual observations suggested a reduction in the number of seed heads, but neither head counts nor yield data were collected in this study.

PRE and EPOST applications of Outlook demonstrated greater crop safety than Axiom, but still caused 8 to 10% crop injury in early fall; however, the injury symptoms dissipated by mid-April. Unacceptable crop injury (15%) was observed on April 19 from sequential applications of Prowl H20 at 5 pt/a applied PRE, followed by a full rate of Beacon split-applied between mid-October (0.38 oz/acre EPOST) and late February (0.38 oz/acre LPOST). All other Beacon treatments (0.38 oz/acre) were applied at MPOST and resulted in 8 to 10% crop injury, whether tank-mixed with Sinbar or not. Please note that all Sinbar rates should have been applied at 0.5 lb product/acre.

Note: Flufenacet + metribuzin (Axiom) and metribuzin active ingredients are not registered for use in eastern Oregon Kentucky bluegrass seed production and are being evaluated on an experimental basis only. Mention of products used in this trial should not be considered a recommendation for commercial use.

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