Tiller Development of Three Bromegrass (*Bromus*) Species Following Defoliation

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Introduction Bromegrass is widely grown for hay and pasture production in North America. Smooth bromegrass (*Bromus inermis Leyss*) and meadow bromegrass (*Bromus riparius* Rehm.) are the most commonly cultivated species and hybrid bromegrass (*B. riparius X B. inermis*) was recently developed in Canada. Meadow bromegrass has lower first growth yield than smooth, but higher regrowth yields (Knowles et al., 1993). The number of axillary bud and tillering ability were closely associated with smooth bromegrass regrowth (Paulsen et al., 1969) and this may be the main reason for regrowth yield differences of bromegrass species following defoliation. The objective of this study was to determine tiller development in three bromegrass species following defoliation at two developmental stages.

Materials and Methods Field plots were located at the Agriculture and Agri-Food Canada Research farm in Saskatoon, SK, Canada (52°07′ lat, 106°38′ long). The soil type was a dark brown chernozem. The trial was established in a four replicate randomized complete block design consisting of meadow, smooth and hybrid bromegrass. Rainfall during the experiment (May 1-Aug 2) was 201.5 and 145.5 mm and number of Growing Degree Days (GDD) was 1786 and 1704 in 2006 and 2007. Initial and final tiller numbers were determined in eight 15X20 cm^2 fixed quadrats for each species after defoliation to 5 cm at the vegetative and stem elongation stages. Within each growth stage defoliation treatment, final tiller number was measured when equal numbers of Growing Degree Days had accumulated for each species. Percentage of reproductive tillers in undefoliated plants was also measured in the reproductive stage. Data were analyzed using SAS.9.1.3 mixed model and final tiller number comparison was adjusted using Analysis of Covariance.

Results and discussions When defoliated at the vegetative stage, the final tiller number of the three bromegrass species was increased from initial counts as the defoliated tillers were continuing their regrowth as their apical meristem were not removed and many new tillers also were produced from stem base axillary buds. For defoliation at the stem elongation stage, live tiller number was reduced in all three bromegrasses (Table 1). This was due to the senescence of elongated tillers after defoliation and tiller recruitment was mainly dependent upon active axillary buds. The final tiller counts were significantly ($p<0.001$) higher in meadow brome than smooth and hybrid brome in all treatments except there was no difference between meadow and hybrid bromegrass at the stem elongation stage defoliation in 2007. Hybrid bromegrass also had significantly higher final tiller numbers than smooth bromegrass in all three treatments ($p<0.05$) except the stem elongation stage in 2006. Final tiller number was not significantly different between undefoliated controls and defoliated at vegetative stage treatments for all three bromegrass except for smooth bromegrass in 2006. These two treatments had significantly higher final tiller counts than defoliation treatment at stem elongation stage in all three bromegrass ($p<0.05$) except there is no difference between vegetative and stem elongation stages for smooth bromegrass in 2006. When a tiller remains vegetative, it appears to have the capacity for more rapid tiller regrowth from apical meristems than new tillers formed from axillary buds. When not defoliated, meadow brome had a lower percentage of reproductive tillers (61%, 66%) than smooth (72%, 89%) and hybrid (77%, 76%) bromegrass in 2006 and 2007; however meadow brome produced the highest number of total tillers (data not shown).

Table 1 *Tiller number (tiller/0.03m^2) of three bromegrass species undefoliated or defoliated at the vegetative and elongation stages.*

	2006							2007						
	Undefoliated control		Defoliated at vegetative stage		Defoliated at elongation stage			Undefoliated control		Defoliated at vegetative stage		Defoliated at elongation stage		
	Initial	Final	Initial	Final	Initial	Final	SEM	Initial	Final	Initial	Final	Initial	Final	SEM
Meadow	69	$156^{a(A)}$	62	$143^{a(A)}$	128	$88^{a(B)}$	5.08	98	$214^{a(A)}$	98	$183^{a(A)}$	104	$85^{a(B)}$	11.40
Smooth	56	$84^{c(A)}$	56	$63^{c(B)}$	90	$53^{b(B)}$	4.52	85	$85^{c(A)}$	89	$95^{c(A)}$	68	$48^{b(B)}$	3.46
Hybrid	64	$110^{b(A)}$	59	$96^{b(A)}$	120	$59^{b(B)}$	9.07	88	$119^{b(A)}$	89	$133^{b(A)}$	74	$67^{a(B)}$	8.03
SEM		9.94		10.72		7.13			10.02		10.18		6.04	

* Means within a column with the same lower case letter are not significantly different. ($p=0.05$)
* Means within a row in the same year with the same upper case letter are not significantly different. ($p=0.05$)
SEM=standard error of the mean

Conclusions Tiller production following defoliation was highest in meadow bromegrass, intermediate in hybrid and lowest in smooth bromegrass. New tiller production throughout the growing season and a lower percentage of reproductive tillers was an important strategy for rapid regrowth. Defoliation at the stem elongation stage had a negative effect on tiller production of all three bromegrasses while vegetative stage defoliation had no effect.