Fire Season and Frequency Effects on Native Grass Bud Banks in the Northern Great Plains

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Axillary buds located on western wheatgrass.

INTRODUCTION

- More than 99% of new tiller formation in grasslands originates from vegetative reproductive means[1]
- Characterization of belowground meristematic tissue in response to differing frequencies and seasons of fire may enhance understanding of community resiliency and species response of 3 dominant, native grass species: *Bouteloua gracilis* (blue grama), *Hesperostipa comata* (needle and thread), and *Pascopyrum smithii* (western wheatgrass)

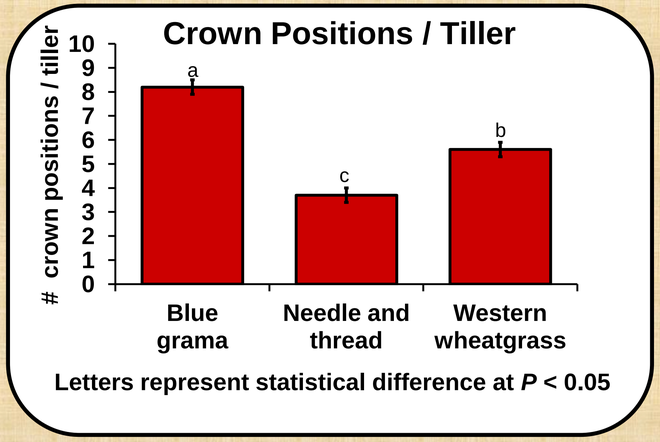
HYPOTHESES

- Blue grama will possess the most crown positions in comparison to western wheatgrass and needle and thread species due to its dominance as a C_4 species
- Western wheatgrass and blue grama axillary bud viability will increase following spring fires, and needle and thread bud viability will decrease following summer fires due to susceptibility during certain growth periods

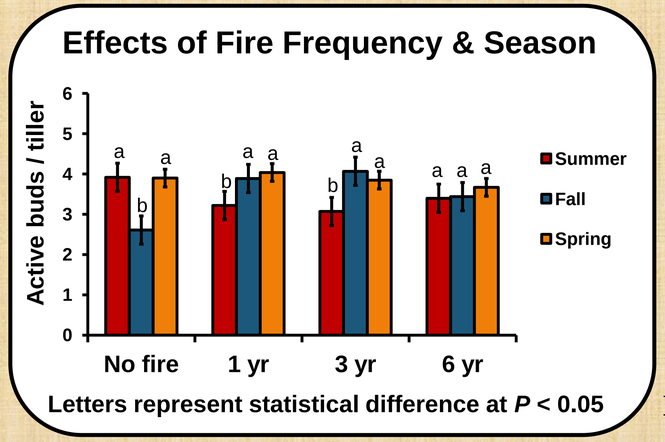
MATERIALS AND METHODS

- CRD with a factorial arrangement of fire treatments
  - Seasons of burning consisted of summer, fall, spring, and no fire and all were assessed with equal post-fire growing seasons
  - Fire frequencies consisted of 1, 3, and 6 yr and were initiated summer 2006
  - 3 replications of each frequency × season combination
- Tillers were collected from 2 individuals per species per plot annually (2010 & 2011) at Fort Keogh near Miles City, in southeastern Montana
- Tillers were processed and then stained using Tetrazolium and Evans Blue staining procedures

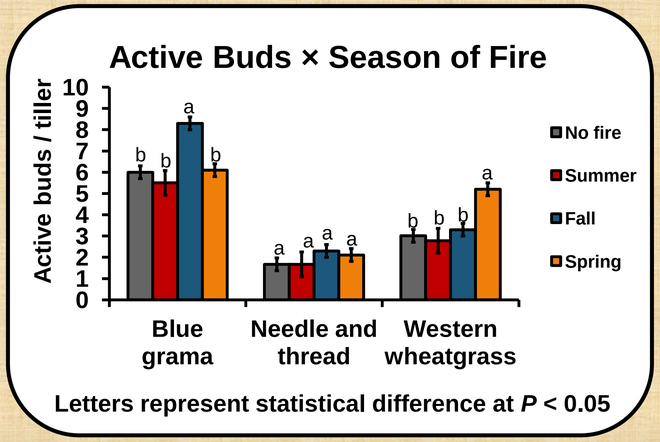
RESULTS AND DISCUSSION



- Blue grama contained the most crown positions per tiller (8.2 ± 0.3), western wheatgrass possessed (5.6 ± 0.3) and needle and thread (3.7 ± 0.3)
- Needle and thread bud viability responded similarly for summer, fall, and spring fires
- Blue grama possessed more active buds following fall fires than following spring or summer fires
- Western wheatgrass contained more active buds following spring fires



- Failed to detect a species × frequency interaction for dormant, dead, active, and total bud counts
- When species were pooled, active buds under fall and spring fires at 3 yr and 1 yr fire intervals increased compared to summer 3 yr burns
- Meristematic limitations can occur when an insufficient amount of reserve or active buds exist to contribute to aboveground tiller populations[2,3]
- Differences in bud production may influence grass responses to environmental changes such as resource availability[4]



Study site near Miles City, MT.

Tetrazolium stained axillary buds of blue grama.

IMPLICATIONS

- Results indicate needle and thread has inherently fewer buds contributing to a smaller bud bank
  - Needle and thread may be less resilient to disturbances like fire, enabling meristematic limitations, and altering community composition
- Season of fire may be selected to increase viable axillary buds for blue grama and western wheatgrass
  - Burning during a certain season may contribute to overall maintenance of belowground bud reserves, and thereby, impacting species composition
- Assessments of vegetative reproduction will equip managers with predictions of plant community responses to fire, including fire effects and community resiliency

LITERATURE

[1] Benson, E.J., D.C. Hartnett, and H. Mann. 2004. Belowground bud banks and meristem limitation in tallgrass prairie plant populations. American Journal of Botany 91:416-421.

[2] Benson, E.J. and D.C. Hartnett. 2006. The role of seed and vegetative reproduction in plant recruitment and demography in tallgrass prairie. Plant Ecology 187:163-178.

[3] Dalgleish, H.J. and D.C. Hartnett. 2009. The effects of fire frequency and grazing on tallgrass prairie productivity and plant composition are mediated through bud bank demography. Plant Ecology 201:411-420.

[4] Ott, J.P. and D.C. Hartnett. 2011. Bud production and dynamics of flowering and vegetative tillers in *Andropogon gerardii* (Poaceae): the role of developmental constraints. American Journal of Botany 98:1293-1298.