Impacts of Different Disturbances on the Performance of the Clonal Plant Buffalograss

Luke Zilverberg*, Jake Comer, and Lan Xu

lucas.zilverberg@sdstate.edu and lan.xu@sdstate.edu

South Dakota State University
Department of Natural Resource Management

Introduction

- Clonal growth is one of the universal traits of plants and is achieved by various morphological forms, such as stolons, rhizomes, and roots.
- They play critical roles in vegetation recovery, colonization and resilience following disturbances by resource sharing and clonal integration among connected ramets.
- Northern Great Plains (NGP) evolved under fire and grazing regimes.
- Buffalograss is one of the two dominant short grass species in the NGP.
- Buffalograss is a dioecious, stoloniferous, and perennial C4 (warm season) species.
- Understanding the clonal performance under difference disturbances will provide scientific-based knowledge to develop management strategies for long-term population sustainability.

Research Question

- Does buffalograss perform differently on alternative grazing strategies such as winter-patch grazing (WPG) and fire (PBG), compared to continuous season long grazing (CG) after two years post disturbance?

Objectives

- Assess the impact disturbances (WPG, PBG, and CG) have on clonal growth traits of *Bouteloua dactyloides*
  - Crown buds vs stolon buds
  - Stolon reproduction and tiller recruitment
  - Relationship between no. of buds to tiller height

Hypotheses

- PBG will have the largest impact on clonal growth traits followed by WPG and CG respectively
- PBG will have the highest number of stolons, tillers, and buds than WPG followed by CG for all three sampling dates

Site Description

- Cottonwood Range and Livestock Research Station, South Dakota
- Climate: Semiarid with hot summers and cold winters.
  - Annual mean precip. 419mm
  - Annual mean temp. 8°C (Jan. = -14°C, July = 32°C)
- Ecological site: Clayey and loamy
- Vegetation: Mixed-grass prairie that is dominated by *Pascopyrum smithii, Bouteloua gracilis, and Bouteloua daactyloides* along with forbs including *Sphaeralcea coccinea* and *Achillia millifolium*
- Wildfire burned substantial portions of the study area in October 2016

Figure 1. Male (right) and female (left) buffalograss (A), Sampling (B) Stolon and tillers (C), Buds (D)

Methods

- Experimental design: Randomized Complete Block Design
- Three treatments (WPG, PBG, CG) with three pastures as blocks (pasture 3, 5, and 6)
- One soil core (10-cm diameter) randomly selected in each of the 5 exclosures in each pasture tri-weekly from June to July. Total 135 sample cores
- Soil cores were washed free of soils to expose the crowns
- Tillers were separated into generations including: 1st, 2nd, or 3rd generation crown tillers or stolon tillers (Fig. 3)
- Total crown and stolon tillers were counted by each generation, as well as total number of stolons
- Two tillers were randomly selected from each generation for no. of buds (Fig. 1D)
- One-way ANOVA was used to compare the means and a LSD test was used for multiple comparison among treatments (P<0.05)

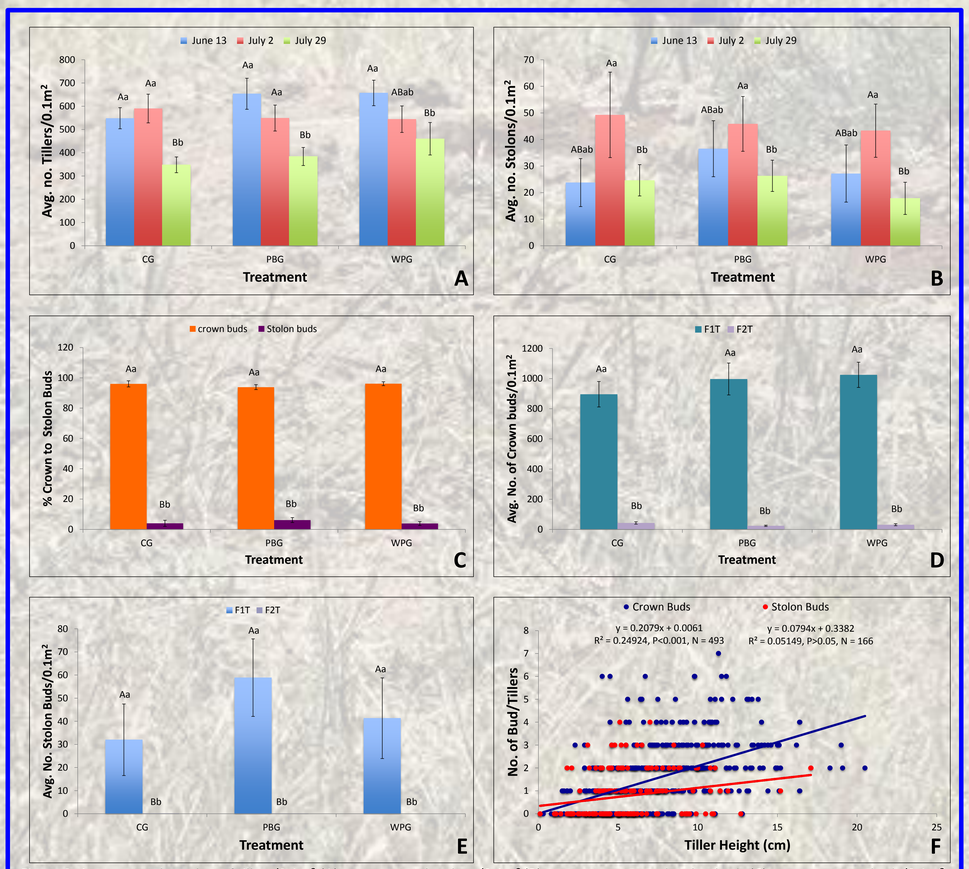

Figure 2. Average total number of tillers/0.1m² (A), average total stolons/0.1m² (B), percent crown and stolon buds (C), avg. no. crown buds/0.1m² (D), avg. no. stolon buds/0.1m² (E), relationship between no. of buds and tiller height (F). Different upper case letters indicate significant differences within the treatment, lower case letter indicate significant differences among the treatments.

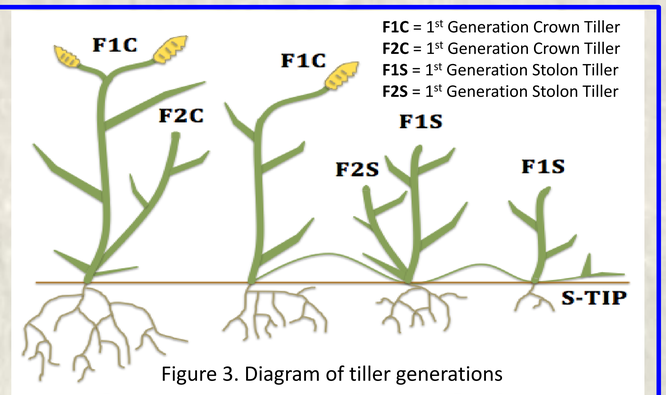

Figure 3. Diagram of tiller generations

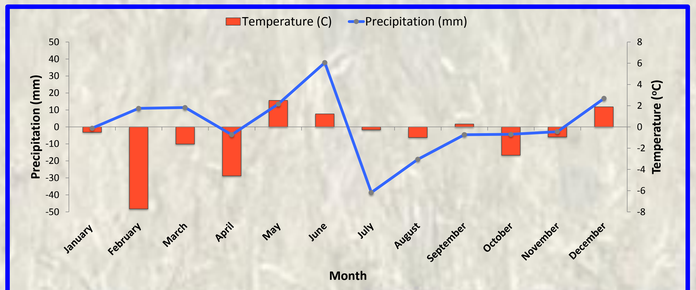

Figure 4. 2018 precipitation and temperature deviations from long-term (1968-2017)

Results and Discussion

- Total tillers were significantly higher in the late spring than later summer, and there was no treatment effect (Fig. 2A).
- Total stolons significantly increased in early summer and no treatment effect occurred for sampling dates (Fig. 2B). Assumptions can be made there was more allocation of resources put towards stolon production later in the summer.
- Percent crown buds and stolon buds had no difference between the treatments, but crown buds was significantly higher than stolon buds (Fig. 2C).
- Treatments had no effect on bud production by generation, but within each treatment 1st generation was significantly dominant (Fig. 2D, 2E). More likely tiller recruitment comes from 1st generation crown buds 86-92%.
- There seems to be a positive relationship between tiller height and number of buds (Fig. 2F). Generally speaking the taller tillers produced more buds than shorter tillers.
- This study was only conducted in the second year post disturbance, which had above average precipitation early in the growing season (Fig. 4) and could have had impacts on the results.
- Treatments may have had an effect on buffalograss performance after the first year disturbance, therefore further investigation is needed.

Acknowledgements

This research was funded by the U.S. Department of Agriculture AFRI (Grant Number 2017-67020-26511) and NCR-SARE (Grant Number 2015-38640-23781), through a grant awarded to South Dakota State University and the Griffith Undergraduate Research Award.

References

1. Fuhlendorf and Engle. Restoring Heterogeneity on Rangelands: Ecosystem Management Based on Evolutionary Grazing Patterns: We propose a Paradigm that enhances Heterogeneity. 2001
2. Russell. Belowground Bud Bank Dynamics of Native, Perennial Grasses and Interactions with Fire in the Northern Great Plains. 2013
3. Herben et al. Clonal Growth and Plant Species Abundance. 2014