Forage Fiber Digestibility Dynamics in the Northern Mixed Grass Prairie Following Spring Wildfire

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Abstract

Forage quality plays an important role in determining grazing distribution in both natural and livestock production systems. Fire is a known modifier of forage quality, however, the dynamics of forage quality following fire have not been well characterized. Our objective was to quantify the magnitude and longevity of fire effects on forage digestibility in order to determine when the greatest benefit might be gained from post-fire grazing. Following the Pautre wildfire of April 2013, exclosures were erected at three paired, burned and nonburned sites along the fire perimeter. Samples were collected in June, August and November 2013 and June and August 2014 and analyzed for acid detergent fiber (ADF), neutral detergent fiber (NDF), in vitro dry matter disappearance (IVDMD) and average fermentation rate. Fire decreased ADF and NDF and increased IVDMD and AFR during June and/or August of the 2013 growing season with effects diminishing by November. No fire effects were apparent in 2014, with only June to August seasonal differences in forage digestibility apparent. This suggests that the dynamics of forage digestibility following fire are largely driven by season, peak increases in forage digestibility occur soon within the first growing season following fire and any increases are short-lived.

Introduction

• Fire is a known modifier of forage quality.
  • Increases digestibility and crude protein, decreases anti-quality factors, improves foraging conditions.
  • Increases in forage quality can improve animal performance and can be used to manipulate grazing distribution.
  • Thus, fire has the potential to improve animal performance and grazing distribution.

Methods

• 3 paired burned and nonburned locations along a north-south gradient of the fire perimeter.
  • Sampled in June, August and November 2013 and June and August 2014.
  • 1 L grab samples from mowed clippings.
  • Lyophilized and ground to 2 mm.
  • Acid detergent fiber and neutral detergent fiber determined via the ANKOM® methods.
  • In vitro dry matter disappearance determined via a 48 hour incubation in rumen liquor using a modified Tiller and Terry (1963) method.
  • Average fermentation rate determined by measuring methane gas production over a 96 hour period of incubation in rumen liquor using a 48 hour incubation in rumen liquor using a modified Tiller and Terry (1963) method.

Hypotheses:
1. Fire will increase forage fiber digestibility
2. Forage fiber digestibility will decrease with advancing season and time since fire

Results

2013

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<th>Neutral Detergent Fiber</th>
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2014

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Discussion

• Burned sites exhibited:
  • Decreased acid detergent fiber (ADF) and neutral detergent fiber (NDF).
  • Decreases in fibrous bulk can decrease required rumen space.
  • Decreasing required rumen space can increase intake capacity.
  • Increased intake can lead to improved animal performance.
  • Increased in vitro dry matter disappearance (IVDMD) and average fermentation rate (AFR).
  • A greater portion of the forage from burned sites was ultimately digestible and that digestion took place at a faster rate.
  • More energy can be gained per unit of forage ingested.
  • Less time and energy are spent to digest forage.
  • Improvements on burned sites manifested in only June 2013 for ADF, NDF and AFR and only through August 2013 for IVDMD.
  • All metrics were similar between burned and nonburned sites by November 2013.
  • No improvements in digestibility persisted into 2014.
  • Only a seasonal effect was apparent.
  • Much of the impact of fire can be attributed to the removal of litter and standing dead vegetation.
  • Increases leafiness of forage.
  • Decreases effort required to select for higher quality, new growth

Conclusions & Implications

• Improvements in forage fiber digestibility peak shortly following spring fire and are short-lived.
• There is a short window of opportunity to take advantage of improvements in forage quality following fire.
• This window is incompatible with the recommendation that pastures be rested from grazing for two growing seasons following fire.
• Prescribed fires applied with the intention to improve foraging conditions or grazing distribution would need to be implemented on a regular basis.

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