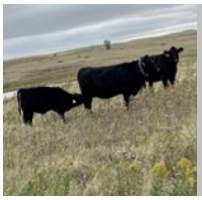

# Mineral Content of Forage With Patch-burn Grazing

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**Summary**

*Patch-burn grazing is a livestock management practice that provides several benefits for conservation and livestock production. The mineral content of forage on grazing rangelands is useful for producers to know to ensure that livestock nutritional requirements are being met.*

*We collected forage samples from spring-burned areas and unburned areas during late spring and late summer. We then analyzed the samples for calcium, phosphorus, copper and zinc content. Forage mineral content was higher in burned areas than in unburned areas. Phosphorous, copper and zinc were higher in burned areas in late spring and summer, while calcium was only higher during the late summer.*

## Introduction

North Dakota rangelands evolved with fire and grazing, which are important for maintaining disturbance-driven heterogeneity. Patch-burn grazing is the combination of fire in discrete patches within a pasture and ungulate grazing.

The forage regrowth in the most recently burned patch is high in protein content and low in structural fibers, which attracts livestock. Fire and grazer attraction to the recently burned patch results in heterogeneity through contrasts in vegetation structure, quality and quantity. This offers several advantages for conservation through maintaining ecosystem functioning, wildlife habitat and species diversity (Fuhlendorf et al., 2017; Hobbs et al., 2009).

Patch-burn grazing also has benefits for livestock production. Managing for heterogeneity decouples the relationship between precipitation and livestock gains by buffering forage resource and providing high-quality regrowth, which stabilizes livestock production during drought years (Allred et al., 2014; Spiess et al., 2020).

Minerals are an essential part of livestock nutrition and must not be overlooked when assessing whether nutritional requirements are being met during the grazing season. Rangeland forage is not always able to satisfy the requirements of grazing cattle (McDowell, 1996).

Macro and trace minerals are important for reproduction, health and growth of livestock. Cattle almost always require supplementation, but needs vary with forage and water sources, age, stress, breed and gestational status of the animal (Paterson and Engle, 2005).

Although minerals are an important component of livestock nutrition, no studies have examined the impacts of patch-burn grazing management on mineral concentration of forage. With knowledge regarding the forage mineral content in patch-burn grazing systems, producers can ensure that their current supplementation strategy is meeting mineral requirements effectively.

## Objectives

Our objective was to determine if patch burning can increase mineral availability in rangeland pastures. We expect post-fire regrowth in patches following spring fire to have greater forage mineral content than vegetation in unburned patches.

## Study Area

This study was conducted at the Central Grasslands Research Extension Center (CGREC). CGREC pastures are mixed-grass prairie consisting of native and introduced $C_3$ grasses, native $C_4$ grasses, forbs, legumes and shrubs.

*Photos by Megan Wanchuk*

Cows grazing on a recently burned patch.

Samples were collected in 2017 and 2018 on four pastures managed with patch-burn grazing. These pastures undergo a spring burning treatment in which a quarter of the pasture (15 hectares [ha]) is burned each spring, creating a four-year fire return interval.

### Procedures

To determine forage mineral content at the beginning and end of the grazing season, above-ground biomass was clipped from a 25- by 25-centimeter (cm) frame during late spring (May-June) and late summer (August-September). All plant material above the crown was clipped to minimize contamination from soil and litter but still include the live and standing dead material.

Samples were from thin-loamy ecological sites to minimize the effect of different soil type on mineral content. We dried samples for 72 hours at 105 C and ground them with a Willey mill using a 1-millimeter (mm) screen. We analyzed all samples for calcium, phosphorus, copper and zinc content using wet-chemistry analysis at the North Dakota State University Animal Sciences laboratory.

### Results and Discussion

Zinc and phosphorus content were greater during late spring and late summer in the forage regrowth after fire as compared with forage in unburned patches (Figure 1). In both years, calcium was only greater in the recently burned patch during late summer sampling.

Forage copper content in the recently burned patch was variable between years but still remained higher than unburned patches. Ash content was similar between patches, except in August 2017, when the burned patch had higher ash content than the unburned.

Overall, we found greater forage mineral content in recently burned patches compared with unburned patches (Figure 2). In Figure 2, values left of 0 would indicate that mineral content is decreased with fire. Values overlapping 0 would indicate no difference in mineral content between burned and unburned patches. Because all mineral content values are to the right of 0, this indicates fire has a positive effect on forage mineral content.

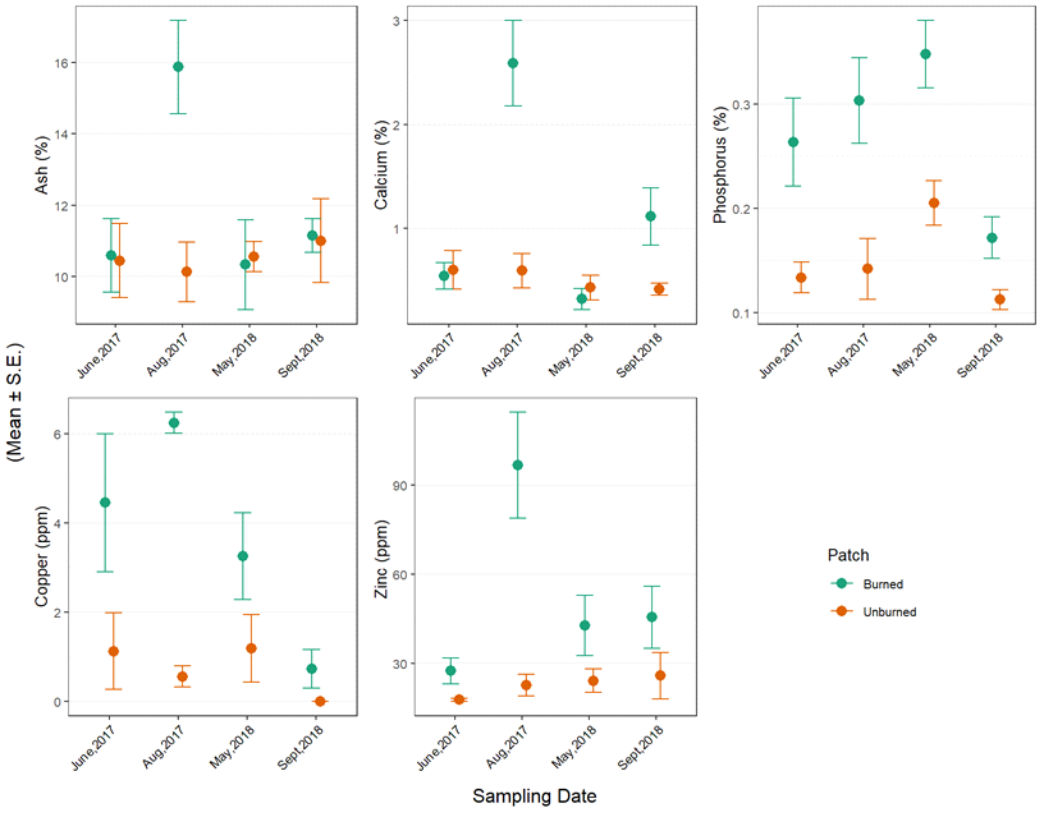


**Figure 1.** Ash, phosphorus, copper, zinc and calcium content in forage by sampling date in burned and unburned patches at CGREC in 2017 and 2018. Copper, zinc and phosphorus are greater in the burned patches compared with the unburned during the late spring and late summer. Calcium is greater in the burned patches during the late summer only.

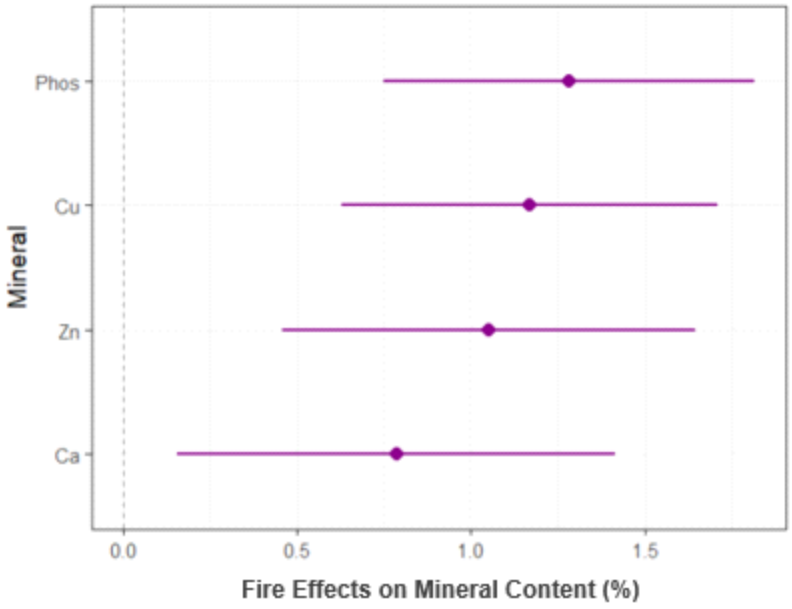


**Figure 2.** Phosphorus, copper, zinc and calcium content of forage is greater in the recently burned patches than unburned patches. Values to the right of 0 indicate that fire increases forage mineral content. Mineral values in this figure are expressed as percent dry matter.

The results seen in patch-burn grazing are consistent with studies using fire and excluding grazing (Van de Vijver et al., 1999). Higher mineral concentration in recently burned patches is caused by reduced age of plant tissue, increased leaf-to-stem ratio and nutrients distributed over less biomass of post-fire vegetation. Increased mineral content in forage appears to last longer with patch-burn grazing than just fire alone, likely due to grazing delaying plant maturity (Van de Vijver et al., 1999).

Increased mineral content of forage on burned areas relative to unburned areas is another benefit of patch-burn grazing management. Livestock production and producer profitability potentially can be increased through reduced mineral supplementation costs and increased cow performance from enhanced immune functioning and reproductive performance.

## Conclusions

Recently burned patches in patch-burn grazing systems have greater forage mineral content than unburned patches for the four minerals tested. The next steps are to see if forage mineral content is greater in other minerals important for beef production and how long the increase lasts. With this information, producers can be sure that their mineral supplementation strategy is effectively meeting livestock requirements.

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