NDSU Extension evaluates impacts of grazing use on grassland growth and production

Miranda A. Meehan[1] and Kevin K. Sedivec[2]

Grazing management decisions can have long-term impacts on plant growth and forage production. The goal of this program is to demonstrate the impact of grazing use on grassland growth and development the following growing season to facilitate improved grazing management and enhanced climate resilience of forage resources. With the exception of Kentucky bluegrass in 2023, the highest growth occurred in pastures with slight to moderate use and the lowest growth in pastures with severe use. Severe use reduced forage production by as much as 57% (2022) and 54% (2023). The results of this program demonstrate the importance of having a grazing management plan and monitoring grazing use to reduce long-term impacts to grazing resources.

Summary

NDSU Extension evaluated the impact of grazing use intensity following the 2021 and 2022 grazing season on the growth and production of grasslands the following year. County and state Extension personal evaluated 51 pastures in 12 North Dakota counties over the two-year period. Samples were classified based on county and degree of use. Degree of use was classified using a visual assessment with four categories: 1) Slight to Moderate (<40% use), 2) Full (40%-60% use), Close (60%-80% use), and Severe (>80% use). Growth of key grass species was monitored weekly starting in late-April and ending June 2 in both 2022 and 2023. Forage production was determined prior to the initiation of grazing each year. Grazing management can have long-term impacts on forage growth and production. Severe use reduced forage production by as much as 57% (2022) and 54% (2023). Monitoring grazing use in the fall to reduce or eliminate overgrazing of fall tillers can enhance tiller development the subsequent spring and prevent long-term reductions in forage growth and production.

Introduction

Grazing management in the fall can have significant impacts on forage growth and production during the subsequent growing season (Goetz, H. 1963.; Heitschmidt et al. 1987; Dormaar et al. 1989). The Northern Plains grasslands are dominated by cool-season grasses, which can make up to 85% or more of the species composition. The most common native cool-season grass in the state is western wheatgrass. Research by Goetz (1963) reported that fall grazing reduced western wheatgrass growth by nearly 4 inches or 30%. This loss in growth translates to a loss in overall forage production.

Cool-season grasses develop tillers in the fall, and the development of these tillers has a direct impact on plant growth the next year. Most tiller development takes place from late August through early October, and again in April and May (Matthew et al. 2000). Plants initiate spring growth from the fall tillers. If these tillers are eaten or die due to drought stress, then spring growth must occur from new tillers developed in April and May.

If livestock graze tillers below the growing point in the fall (usually in between the bottom two leaves), the tillers usually will not survive the winter. Drought stress also affects the survival of fall tillers. Fall drought creates a low moisture environment where buds do not come out of dormancy, thus resulting in no new tiller growth or causing death to those tillers that did develop. If tillers do not establish or survive the fall, a delay in growth and development will occur the following growing season due to new tiller development in the spring. For example, NDSU Extension found that following the 2017 drought, tiller development in the spring occurred two to four weeks later than the previous year's carry-over tillers.

In response to concerns expressed regarding the long-term impacts of grazing management during drought, NDSU Extension launched a program to evaluate the impacts of grazing use intensity on grassland growth and production following the 2021 drought. This program was continued for an additional growing season to further evaluate the influence of grazing use on forage growth and production under different fall moisture

[1]Animal Sciences Department, NDSU; [2]School of Natural Resource Sciences, NDSU

conditions. The goal of this program is to demonstrate the impact of grazing use on grassland growth and development the following growing season to facilitate improved grazing management and enhanced climate resilience of forage resources.

Experimental Procedures

NDSU Extension evaluated impacts of grazing use to grassland growth and production at 38 locations in ten counties in 2022 and 23 sites in seven counties in 2023. Samples were classified based on county and degree of use. In the fall of each year, degree of use was classified using a visual assessment approach adapted from Dyktserhuis (1951) that includes four categories: 1) Slight to Moderate (<40% use), 2) Full (40%-60% use), Close (60%-80% use) and Severe (>80% use). Monitoring occurred over a nine-week period from April 8, 2022, to June 2, 2022. Due to cold temperatures delaying plant growth in 2023, monitoring occurred over a six-week period from April 28, 2023, to June 2, 2023. Key grass species monitored included crested wheatgrass, smooth brome, Kentucky bluegrass, and western wheatgrass. Prior to initiation of grazing (May 26-June 15), clipping was completed to determine forage production. Clippings were completed at three plots per location using a 1.92 ft^2 frame, which was clipped to ground level. Samples were air dried and weighed to determine average forage production for each location.

Results and Discussion

Analysis was completed for growth and production at the end of the monitoring period for each year. Growth of key species and production is depicted using box plots to display median values and variability in the data.

The growth of key grass species was influenced by degree of use in both years (Figure 1). Growth of both smooth brome grass and western wheatgrass was highest at locations with slight to moderate use and lowest at locations with severe use. Kentucky bluegrass was strongly influenced by degree of use in 2022 (Figure 1c); however, this trend was not as strong in 2023 (Figure 1d). Due to the shallow rooting depth, Kentucky bluegrass growth and production is significantly impacted by drought (Toledo et al. 2023). We believe that the impacts of plant growth in 2022 were more influenced by drought conditions and for 2021 more impacted by management. The reduced growth of these cool-season grasses is likely caused by tiller mortality or a loss of plant vigor in the fall from a combination of drought stress and high grazing use that either removed the growing points or reduced plant vigor of the evaluated cool-season grasses. Plants that experience tiller mortality need to use carbohydrates that are stored in the roots to grow a new tiller in the spring, which results in delayed spring growth and the subsequent growth and production potential.

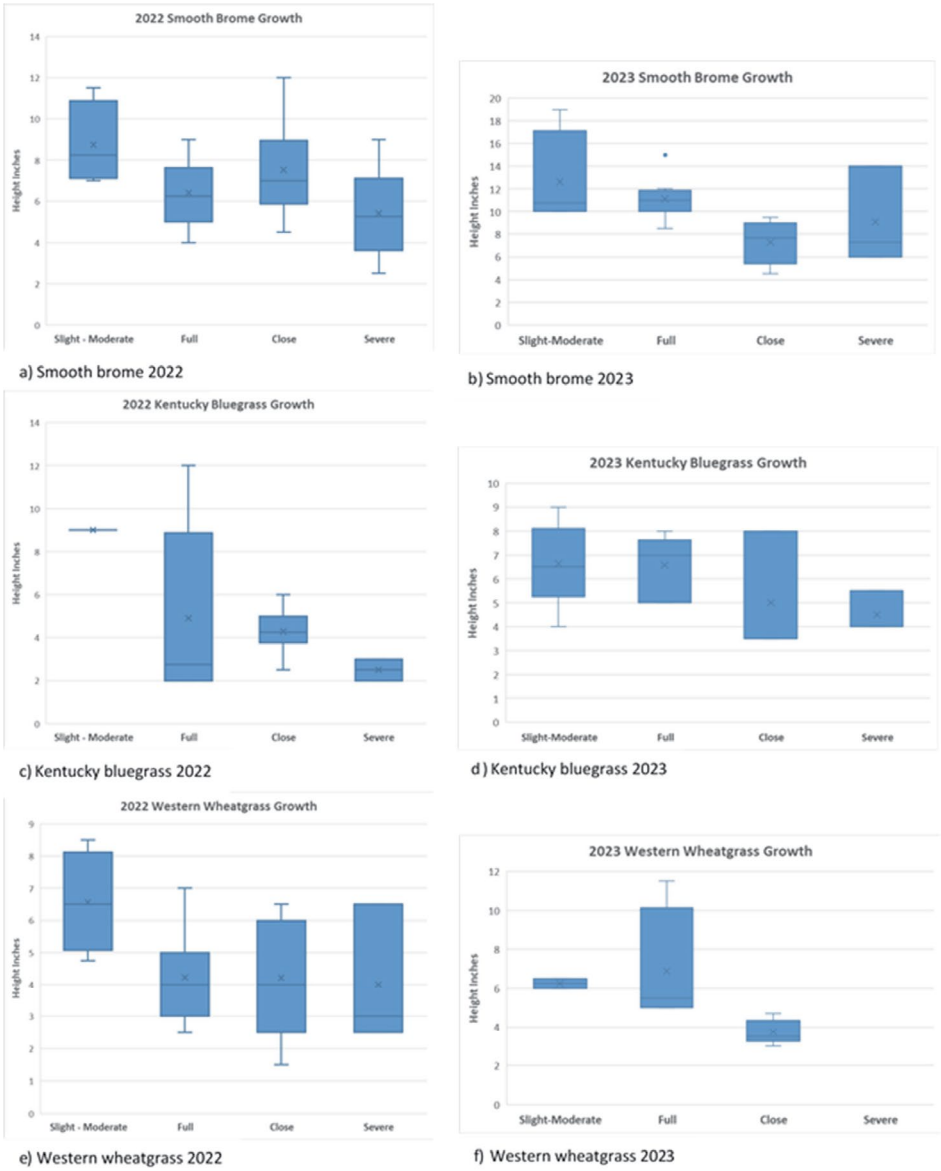

Figure 1. Growth of a) smooth brome in 2022, b) smooth brome in 2023, c) Kentucky bluegrass in 2022, d) Kentucky bluegrass in 2023, e) western wheatgrass in 2022 and f) western wheatgrass in 2023 in expressed as height in inches by degree of use slight-moderate (<40%), full (40%-60%), close (60%-80%) and severe (>80%).

The height of smooth brome was highest for slight to moderate use pastures with a median height of 8.25 inches in 2022 (Figure 1a). However, full use pastures had greater growth with a median height of 11 compared to 10.75 inches for the slight-moderate use in 2023 (Figure 1b). Severe use pastures had the lowest median height at 5.25 and 7.3 inches in 2022 and 2023, respectively. The height of Kentucky bluegrass was the highest for slight to moderate use pastures and lowest in the severe use pastures in 2022 with median heights of 9 and 2.5, respectively (Figure 1d). Whereas, in 2023 the full use pastures had the greatest growth at 6.5 inches and the close use pastures had the lowest growth at 3.5 inches. The height of western wheatgrass was the highest for slight to moderate use pastures across both years with a median height of 6.5 inches in 2022 and 6.25 inches in 2023 (Figures 1e and 1f). The full and close use pastures fell in the middle with median heights ranging between 3.5 and 6 inches. The severe use pastures had the lowest median height at 3 inches in 2023. Western wheatgrass was not found or documented in the severe use locations in 2023.

Forage production was impacted by grazing use in both 2022 and 2023 (Figure 2). The slight to moderate use sites had the greatest production with a median of 2,548 pounds per acre in 2022. However, the full use sites reported the highest production in 2023 with a median value of 2,925 pounds per acre. In 2022, the full and close use sites were similar with medians of 1,275.8 and 1,250 pounds per acre, respectively. This similarity is likely due to an outlier location with close use that reported much higher production than the other sites at 5,175 pounds per acre. Across both years the severe use sites had the lowest production, reporting median values of 1,091 and 1,335 pounds per acre in 2022 and 2023, respectively. When compared to the highest producing grazing uses the severe use locations had 57% (2022) and 54% (2023) reduction in forage production.

Grazing management decisions can have long-term impacts on forage growth and production. Severe use of grasslands, especially in the fall, can result in tiller mortality by either removal of the growing point or physiological stress to cool-season grasses. Tiller mortality can delay growth of cool-season grasses the following growing season, as well as reduce growth and overall forage production. These impacts are magnified following a drought as a result of increased tiller mortality caused by drought stress and the higher probability of pastures receiving heavier grazing use. The results of this program demonstrate the importance of having a grazing management plan and monitoring grazing use to reduce long-term impacts to grazing resources. Good grazing management paired with monitoring of pastures enhances the health and resilience of grazing systems. If you are interested in developing a grazing plan or learning more about tools to monitor grazing use, contact your local NDSU Extension agent.

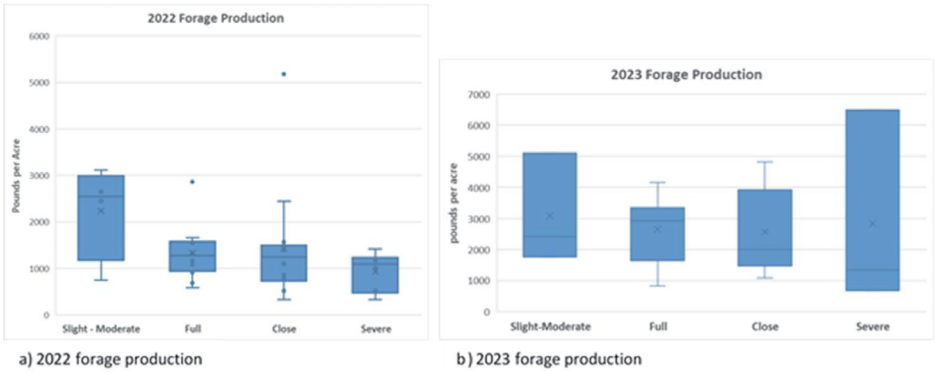

Figure 2. a) 2022 and b) 2023 forage production expressed as pounds per acre by degree of use slight-moderate (<40%), full (40%-60%), close (60%-80%) and severe (>80%).

Acknowledgments

Thank you to the following: NDSU Extension personal for their assistance with monitoring grasslands: Hannah Nordby, Breana Kiser, Heidi Marxen, Rachel Wald, Renae Gress, Rick Schmidt, Sarah Crimmins, Shelby Hewson, Paige Brummund, Jeff Stachler, Monica Fitterer, Jared Lovro and Skyla Folden.

Citations

Derner, J. D. and R. H. Hart. 2007. Grazing-induced modifications to peak standing crop in northern mixed-grass prairie. Range. Ecol. Mgt. 60: 270-276.

Dormaar, J. F., S. Smoliak, and W. D. Willms. 1989. Vegetation and soil responses to short-duration grazing on fescue grasslands. J. Range Manage. 42: 252–256.

Dyksterhuis, E. J., 1951. Use of ecology on range land. Society for Range Management. 4 pp.

Goetz, G. 1963. Growth and development of native range plants in the mixed grass prairie of western North Dakota. MS thesis. North Dakota State University.

Heitschmidt, R. K. and J. Walker. 1983. Short duration grazing and the Savory grazing method in perspective. Rangelands 5: 147–150.

Matthew, C., S. G. Assuero, C. K. Black, and N. R. Sackville Hamilton. 2000. Tiller Dynamics of Grazed Swards. In Grassland Ecophysiology and Grazing Ecology, CABI Publishing, New York. 422 pp.

Smart, A. J., B. Dunn, and R. Gates. 2005. Historical weather patterns: a guide for drought planning. Rangelands 27: 10-12.

Toledo, D., K. Swanson., M. Meehan, C. Dahlen, R. Christensen, and D. Asplin. 2023. Forage quantity and quality of pastures dominated by Kentucky bluegrass do not meet the nutritional recommendations for beef cow-calf pairs in a drought and non-drought year. Grass and Forage Sci. 78: 268-274.