A FARMER'S GUIDE TO GRAZING | 3 OF 4

According to USDA-NRCS, research has shown that effective implementation of grazing practices can improve soil health of grazing lands. Optimized livestock rotation, improved forage utilization, and adequate forage recovery periods can provide agronomic benefits such as increased soil organic matter, improved soil infiltration, increased forage availability, reduced soil erosion, and carbon sequestration.[1] These practices can also increase the profitability of livestock operations through improved adaptability to environmental conditions, enhanced forage utilization, and improved animal health.[2]

In this series of four Farmers' Guides to Grazing, we will focus on the economic, forage, and soil health benefits of grazing practices. The guides synthesize relevant literature on the benefits of intensive grazing (also known as management-intensive grazing), seasonal grazing practices, and grazing cover crops. **This third guide focuses on the economic, forage, and soil health benefits of patch-burn grazing and bale grazing.**

Patch-burn grazing is the intentional grazing of lands which have been managed with prescribed burning.[3] Prescribed burning typically occurs in early spring/ early fall to promote growth of high-quality forages for the grazing season.[4] Bale grazing is a winter-feeding practice where hay or other baled forages are fed on pasture with controlled access, similar to rotational grazing.[5] We've summarized the findings of 14 studies that evaluated the **economic, forage, and soil health impacts of patch-burn grazing and bale grazing practices**.


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Within the literature we reviewed, eight studies examined the effects of patch-burn grazing.

1. **Patch-burn grazing has the potential to improve forage quality and soil health.** Augustine & Milchunas[6] found that in short-grass steppe, patch-burn grazing increased nitrogen content approximately 1 to 2-fold. Teague et al.[7] found that water infiltration rate under areas of patch-burn grazing was higher than unburned areas in the rolling plains of north-central Texas. Evidence shows that patch-burn grazing may improve forage quality by removing old material and promoting new forage growth. Allred et al.[8] found that recently burned patches of vegetation contained more crude protein than unburned areas. Wanchuk et al.[9] also found that patch-burn grazing increased fiber and crude protein of forages in south-central North Dakota.
2. **Cattle performance may or may not improve under patch-burn grazing**. Augustine & Derner[10] found that cattle weight gains in Colorado were significantly greater under patch-burn grazing in 1 out of 4 years, but there was no significant difference in gains from unburned areas in 3 out of 4 years. In tallgrass prairie in northeast Oklahoma, cattle weight gains did not differ between burned and unburned treatments.[11] In mixed-grass prairie in southwest Oklahoma, yearlings performed at least as well under patch-burning compared to traditional management.[12] However, Winter et al.[13] found that cattle performance did not differ between burned and unburned treatments in southeastern Nebraska.
3. **Reduced feeding costs may occur under patch-burn grazing practices**. Baker et al.[4] found that burn cost was approximately $2.40/acre higher than traditional burning methods during the first 3 years. However, Limb et al.[12] found

GRAZING PATTERN	ROTATION FREQUENCY*	STOCKING RATE/DENSITY†
Continuous (Conventional)	No rotation	Set stocking rate and density
Traditional Rotational	Set rotation frequency	Stocking rate and density vary
Adaptive Multi-Paddock (AMP) Rotational	Rotation frequency varies based on forage availability/ quality, which is continuously monitored.	Stocking rate and density vary based on forage availability/quality.
Mob	Rotation frequency varies based on forage availability/ quality, which is continuously monitored (like AMP); cattle often moved more frequently and at higher densities.	Stocking rate and density vary based on forage availability/quality; increased stocking density is possible due to increased rotation frequency.

* Rotation frequency refers to the timing of grazing cattle and rest periods for forage production.

† Stocking rate describes the herd size and grazing units used in a grazing system over a specific period of time. Stocking density refers to the number of acres allocated per animal.[19]

that under patch-burning, supplement feed requirements decreased by 40%. Baker et al.[4] estimated that this decrease in supplemental feed requirements led to a decrease in winter feeding costs of $20 per head in the first year.

Within the literature we reviewed, six studies evaluated the effects of **bale grazing**.

1. **Bale grazing may have positive implications for soil and forage health.** A 2016 study conducted in North Dakota found improved crude protein and phosphorous content of forages following a bale grazing treatment.[14] Another study found that phosphorous amounts were 34% higher and soil density was 21% greater in a bale grazed system compared to swath grazing and straw-chaff grazing.[15] Extending the grazing season allows for improved nutrient cycling, which promotes forage growth.[16] However, increased nutrient density on bale-grazed sites may amplify leaching and runoff of nutrients.[15,16,17] Jungnitsch et al.[16] suggests that reducing stocking rates may alleviate the increased potential for leaching.
2. **Cattle weight gains may increase when bale grazing is used as a winter-feeding system.** Two studies in North Dakota found that average daily gain of cattle was higher for bale-grazed cattle (-0.11 ± 0.05 kg/day) compared to cattle fed in a dry lot (-0.23 ± 0.05 kg/day).[18,19]
3. **Bale grazing extends the grazing season, which may reduce winter feeding costs for cattle producers and increase profitability**. In North Dakota, Undi & Sedevic[19] found bale grazing reduced feed cost by around $0.37 (21%) per head per day compared to dry lot feeding through reduced labor and feeding costs.

Key Takeaways

1. **Potential for improved soil health and forage quality:** Patch-burn grazing and bale grazing may have positive health implications for soils and forages. The improved nutrient cycling in soils and increased nutrient density of forages on pastures from patch-burn grazing and/or bale grazing may have positive impacts on cattle performance and economic viability.
2. **Potential for increased cattle weight gains:** Research indicates that cattle weight gains are at least no worse under patch-burn grazing and bale grazing management compared to traditional management. This suggests that patch-burn grazing and bale grazing could be a viable alternative to traditional management practices without negatively impacting cattle performance. Improved soil health and forage quality may contribute to the possibility of higher gains for cattle grazing on pastures managed with patch-burn grazing and/or bale grazing.
3. **Potential for reduced feeding costs:** Patch-burn grazing and bale grazing may contribute to reduced feeding costs, improving profitability of cattle operations. Patch-burn grazing and bale grazing extend the grazing season, potentially reducing the amount of supplementary feeding required, and thus reducing overall feed costs. Bale grazing may also reduce the cost of labor required for handling feedstuffs.

References

1. USDA NRCS. (2017). Grazing Management and soil health. Accessed January 24, 2024.
2. The Financial Implications of Conservation Agriculture: Insights from Analyses of Farms in the Upper Midwest. (2023). The Financial Impacts of Managed Grazing Systems. Accessed January 24, 2024.
3. Scasta, J. D., Thacker, E. T., Hovick, T. J., Engle, D. M., Allred, B. W., Fuhlendorf, S. D., & Weir, J. R. (2016). Patch-burn grazing (PBG) as a livestock management alternative for fire-prone ecosystems of North America. *Renewable Agriculture and Food Systems*, *31*(6), 550–567.
4. Baker, H. M., Shear, H. E., Peel, D. S., Raper, K. C., & Fuhlendorf, S. D. (2023). *Implementation, costs and benefits of patch-burn grazing*. Oklahoma Cooperative Extension Service.
5. Halich, G. S. (2021). Bale Grazing: Feeding Hay the Rotational Grazing Way. 2021 KY Fall Grazing Conference.
6. Augustine, D. J., & Milchunas, D. G. (2009). Vegetation responses to prescribed burning of grazed shortgrass steppe. *Rangeland Ecology & Management*, *62*(1), 89–97.
7. Teague, W. R., Duke, S. E., Waggoner, J. A., Dowhower, S. L., & Gerrard, S. A. (2008). Rangeland vegetation and soil response to summer patch fires under continuous grazing. *Arid Land Research and Management*, *22*(3), 228-241.
8. Allred, B. W., Fuhlendorf, S. D., Engle, D. M., & Elmore, R. D. (2011). Ungulate preference for burned patches reveals strength of fire–grazing interaction. *Ecology and Evolution*, *1*(2), 132-144.
9. Wanchuk, M. R., McGranahan, D. A., Sedivec, K. K., Berti, M., Swanson, K. C., & Hovick, T. J. (2024). Improving forage nutritive value and livestock performance with spatially-patchy prescribed fire in grazed rangeland. *Agriculture, Ecosystems & Environment*, *368*, 109004.
10. Augustine, D. J., & Derner, J. D. (2014). Controls over the strength and timing of fire–grazer interactions in a semi-arid rangeland. *Journal of Applied Ecology*, *51*(1), 242-250.
11. Fuhlendorf, S. D., & Engle, D. M. (2004). Application of the fire–grazing interaction to restore a shifting mosaic on tallgrass prairie. *Journal of Applied ecology*, *41*(4), 604-614.
12. Limb, R. F., Fuhlendorf, S. D., Engle, D. M., Weir, J. R., Elmore, R. D., & Bidwell, T. G. (2011). Pyric–herbivory and cattle performance in grassland ecosystems. *Rangeland Ecology & Management*, *64*(6), 659-663.
13. Winter, S. L., Fuhlendorf, S. D., & Goes, M. (2014). Patch-burn grazing effects on cattle performance: Research conducted in a working landscape. *Rangelands*, *36*(3), 2-7.
14. Brummer, F., Sedivec, K., Berg, M., Augustin, C., Nester, P., Gerhardt, S., Buckley, J., Stegeman, A., & Whitted, D. (2016). Impacts of Bale Grazing on Herbage Production, Forage Quality and Soil Health in South-central North Dakota. *NDSU Central Grasslands Research Extension Center*.
15. Kelln, B., Lardner, H., Schoenau, J., & King, T. (2012). Effects of beef cow winter feeding systems, pen manure and compost on soil nitrogen and phosphorous amounts and distribution, soil density, and crop biomass. *Nutrient Cycling in Agroecosystems*, *92*, 183-194.
16. Jungnitsch, P. F., Schoenau, J. J., Lardner, H. A., & Jefferson, P. G. (2011). Winter feeding beef cattle on the western Canadian prairies: Impacts on soil nitrogen and phosphorus cycling and forage growth. *Agriculture, ecosystems & environment*, *141*(1-2), 143-152.
17. Bernier, J. N., Undi, M., Ominski, K. H., Donohoe, G., Tenuta, M., Flaten, D., Plaizier, J. C., & Wittenberg, K. M. (2014). Nitrogen and Phosphorus utilization and excretion by beef cows fed a low quality forage diet supplemented with dried distillers grains with solubles under thermal neutral and prolonged cold conditions. *Animal Feed Science and Technology*, *193*, 9-20.
18. Undi, M., & Sedivec, K. K. (2021). PSXI-17 Performance of beef cattle overwintered on bale-grazed pasture or in a dry lot in south-central North Dakota. *Journal of Animal Science*, *99*(Suppl 3), 343.
19. Undi, M., & Sedivec, K. K. (2022). Long-term evaluation of bale grazing as a winter-feeding system for beef cattle in central North Dakota. *Applied Animal Science*, *38*(3), 296-304.

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