ASSESSING SULFUR FERTILIZATION TO IMPROVE STATEWIDE MONTANA FORAGE QUALITY AND VALUE BY REDUCING NITRATE ACCUMULATIONS IN FORAGE BARLEY

Amanda R. Grube

Department of Animal and Range Sciences, Montana State University, Bozeman, MT 59717

2021 was an exceptional year in terms of drought in Montana, however, high, toxic nitrate levels in forages are not exclusive to these extreme drought years. Chronic nitrate toxicity in sheep and cattle can cause reduced conception rates and early term abortions, economically burdening operations that rely on lamb and calf sales (1). Sulfur is a component of methionine and cysteine, two essential amino acids that are necessary to protein synthesis in plants (2). Sulfur deficiencies in plants have been linked to slower nitrate assimilation due to lack of methionine and cysteine (2). This study will investigate and build upon unpublished data from Westcott et al. (3) examining the role S plays in nitrate accumulation in 'Lavina' forage barley. Five dryland agriculture sites have been identified across the state (Ft. Ellis Teaching Farm, Central Agriculture Research Center, Northwestern Agriculture Research Center, and private land in Broadview, MT). Each site will have split plot, main plots randomized complete block design with variable rates of urea fertilizer based on expected yield for the location and soil nitrate in the top six inches of soil (0x, 1.0x, 1.5x established base rate) applied to the main plots on top of soil N levels and variable rates of gypsum fertilizer (0, 10, 20 lbs/A S) applied to the subplots. 'Lavina" forage barley will be planted at a constant rate of 100 lbs/A. Growth rate will be monitored weekly at three out of the four locations. Forage barley will be harvested at approximately ≥ 50% of the tiller heads at Feekes growth stage 10.5. All samples will be analyzed using a FOSS NIR 2500 as well as wet chemistry methods to determine crude protein, fiber, sulfur, nitrates, magnesium, calcium, and phosphorus. Relative forage quality and relative forage value will be calculated based on values analyzed to compare quality between locations and treatments. Using soil tests levels of sulfur and plant tissue levels of sulfur, a predictive model will be developed to predict subsequent sulfur concentrations in plant tissue from soil test. The purpose of this study is to address statewide demand to improve cereal forage quality as one of the critical drivers of Montana's beef and sheep industries.

1. Goosey, H., Carr, W., King, M., & Jones, C. (2022). Nitrate Toxicity of Montana Forages. Montana State University Extension.
2. Li, Q., Y. Gao, and A. Yang. 2020. Sulfur Homeostasis in Plants. International Journal of Molecular Sciences 2020, Vol. 21, Page 8926 21(23)
3. Westcott et al., unpub. Data

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