



David Little Livestock Range Management Endowment

AT THE UNIVERSITY OF IDAHO

2021 Project Progress Report:

Does protein supplementation in fall increase digestibility and, consequently, the amount of invasive grass species that are grazed by cattle on Idaho Rangeland?

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PRELIMINARY RESULTS for 2021:

BACKGROUND:

One of the major threats to sustainable rangeland use in Idaho is the widespread invasion of annual grasses like cheatgrass (*Bromus tectorum* L.) and medusahead (*Taeniatherum caputmedusae* L.). Because cheatgrass and medusahead require standing dead matter for them to establish and dominate, grazing could be a powerful tool in controlling their spread (Perryman et al., 2018). However, a key factor that determines the amount of the invasive grasses that cattle could graze is their digestibility in the rumen. Cattle will graze a high amount of a forage that has a high dry matter and fiber digestibility because what is consumed will not stay in the rumen for a long period of time, and this creates more space that allows them to graze more (Allen, 2000).

In our previous research (CY2019), we observed a 45 to 59% decrease in dry matter and fiber digestibility of both cheatgrass and medusahead as the season progressed from summer to fall and then winter. A decrease in nutritive quality, especially the dramatic decrease in crude protein content from 12.1 to 3.9% (on average) caused this substantial decrease in digestibility, which reduces the amount grazed by cattle in fall. Consequently, this limits the effectiveness of grazing in controlling the spread and domination of the invasive grasses on rangeland.

Protein supplementation can be effective in increasing dry matter and fiber digestibility of poor-quality forages. For instance, Allen (2000) reported that a 1% increase in dietary crude protein content increases feed intake by up to 1.9 lb/day due to an increase in digestibility. In addition, in a study in dairy cattle (Allen, 2000), increasing fiber digestibility by 1% increased feed intake by 0.4 lb/day, which led to a 0.55 lb/day increase in milk yield. Therefore, if supplementation increases dry matter and fiber digestibility of invasive annual grasses, then it could potentially increase the amount of forage grazed in late fall, and also improve cattle performance. However, the effectiveness of supplementation in increasing dry matter and fiber digestibility of cheatgrass and medusahead when their quality declines in fall is yet to be determined. Therefore, evaluating the impact of supplementation on digestibility of invasive grasses as they mature is key in developing targeted grazing strategies that can increase the health and function of Idaho rangelands by reducing these species.

HYPOTHESIS & OBJECTIVES:

Although targeted grazing could be used as an economical tool to battle the spread and domination of cheatgrass and medusahead on rangeland, cattle tend to consume less of these invasive grasses as they mature due to a decrease in dry matter and fiber digestibility caused by a decrease nutritive quality (especially the decrease in crude protein content). Although it can potentially increase the digestibility of poor-quality forages, it is not known whether providing a protein supplement improves digestibility of the invasive grasses as they mature. Therefore, this proposal will investigate the impact of providing supplemental distillers grain range cubes (or cake) on dry matter and fiber digestibility of cheatgrass and medusahead harvested on Idaho rangeland in late fall compared to summer when a protein supplement is not needed.

Objective: Investigate the effect of providing supplemental distillers' grain range cubes (or cake) on dry matter and fiber digestibility of cheatgrass and medusahead harvested on Idaho rangeland in late fall compared to summer when a protein supplement is not needed.

We hypothesize that providing supplemental protein in late fall increases dry matter and fiber digestibility of cheatgrass and medusahead, which could increase their consumption by cattle.

PROCEDURES:

Cheatgrass and medusahead samples will be collected in the Reynold Creek watershed in summer (June) and late fall (early September) to compare dry matter and fiber digestibility when nutritional quality is high and supplementation is not needed, to when quality is low (crude protein content less than 9%) and supplemental protein is provided. In preparation for chemical composition analysis, all collected samples will be oven-dried at 60°C for 48 h. Dried samples will then be ground through a #2 screen using a Retsch grinder. Ground samples will be analyzed for dry matter, organic matter, fiber (neutral and acid detergent fiber), lignin, and crude protein using standardized methods (AOAC, 1995).

As for digestibility analysis, the 3 treatments that will be tested for each of the grasses will be: 1) summer sample without supplementation, 2) late fall sample without supplementation, and 3) late fall sample with distillers' grain range cubes (or cake) supplementation. To determine digestibility of collected samples, an ANKOM gas production system (ANKOM Technologies, Macedon, New York, USA) will be used as described by Alfonso-Avila et al. (2015). This system allows the measurement of the rate and extent of digestion in the laboratory, by incubating feeds together with rumen fluid that is collected from cattle. Briefly, 1.5 g of each of the forage samples will be added to 2 Ankom measurement glass vials. On the day of incubations, rumen contents will be collected 2 h after morning feeding from 2 ruminally fistulated cows and used as the inoculum. Each Ankom measurement vial will receive 45 mL of McDougall's buffer (a solution used to stabilize pH) and 15 mL of the strained rumen fluid (3:1 ratio). Thereafter, each measurement vial will be flushed with carbon dioxide, sealed, and incubated at 39°C for 24 h.

During incubation, the amount of gas produced will be measured, and will be used to determine the rate at which each sample is digested. At the end of the 24 h of incubation, measurement vials will be placed in an ice bath to stop fermentation. The residue in each vial will then be centrifuged to separate the liquid from the solid matter. The liquid fraction will then be analyzed for ammonia and volatile fatty acids, which are products of fermentation, and give an indication of the amount of protein and energy an animal will obtain from the feed. The solid fraction will then be analyzed for dry matter, organic matter, fiber (neutral and acid detergent fiber), lignin, and crude protein. Dry matter, organic matter, fiber (neutral and acid detergent fiber), and crude protein digestibility will then be calculated by difference. This procedure will be repeated twice to account for day-to-day variation. Data will be analyzed using the MIXED procedure of SAS (SAS Institute Inc., Cary, NC).

PROPOSED TIMELINE:

Activity	2020	
	Jun - Sept	Oct - Dec
Harvest of Forages		
Nutrient Composition and Digestibility Determination		
Statistical Analysis and Preparation of Progress Report		

ACCOMPLISHMENTS:

We recently completed the collection of the final/late Fall (late September) cheatgrass and medusahead samples in southern Idaho. We currently are grinding the collected forage samples and are planning to start analysis soon. Therefore, we still are on schedule to complete the study by December this year based on the timeline we proposed when we submitted the grant (above).

PUBLICATIONS/OUTPUTS:

We are planning to present our research findings at the Pacific Northwest Animal Nutrition Conference (January 2022) and annual meeting of the American Society of Animal Science (July 2022). We also plan on presenting our research finding at the Twilight Tour (Nancy M. Cummings Research, Extension, & Education center) in Sept 2022. Besides a popular press article in Line Rider, we also will submit a manuscript for publication in Applied Animal Science (scientific journal) once we have completed analysis. We will keep the Little Endowment Advisory Committee updated on all these planned milestones.

CITATIONS:

Allen, 2000. Effects of diet on short-term regulation of feed intake by lactating dairy cattle. J. Dairy Sci. 83:1598-1624.
Alfonso-Avila, A. R., E. Charbonneau, C. Lafreniere, and R. Berthiaume. 2015. Effect of glycerol in combination with alfalfa on in vitro gas production and microbial protein synthesis. Canadian Journal of Animal Science. 95:577-588
Association of Official Analytical Chemists (AOAC) 1995. Official methods of analysis. AOAC, Arlington, VA, USA.

Perryman, B. L., B. W. Schultz, J. K. McAdoo, R. L. Alverts, J. C. Cervantes, S. Foster, G. McCuin, and S. Swanson. 2018. Viewpoint: An alternative management paradigm for plant communities affected by invasive annual grass in Intermountain West. Rangelands. 40:77-82.