David Little Livestock
Range Management Endowment
AT THE UNIVERSITY OF IDAHO

2016 Project Progress Report:

Investigating Palatability of Invasive Grass Species Ventenata (*Ventenata dubia*) in Idaho Range Livestock

By Anne H. Laarman

PRELIMINARY RESULTS for 2016:

PERSONNEL:

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BACKGROUND:

Ventenata *(Ventenata dubia)* is an exotic annual grass that has infested rangelands in the inland Northwest, and caused significant damage to rangeland forage through significant declines in forage production[1]. Nutritionally, ventenata is not much different from other forage sources such as cheatgrass in terms of crude protein content or NDF digestibility, but its palatability for livestock is quite poor. Reasons for low utilization of ventenata as forage are unclear. It is hypothesized that either the wiry growth of ventenata plants or perhaps ventenata hosts a microbial organism that decreases its appeal to cattle[2].

Ventenata invasions in Idaho rangelands carries with it a compounding negative influence. First, ventenata decreases forage production, so less forage is available to rangeland livestock; and second, ventanata is poorly palatable, so the loss of forage is not compensated for by different species of forage. Understanding the factors that explain ventenata's poor palatability is key in developing rangeland forage management strategies that can improve the efficiency of Idaho rangelands infected with ventenata.

HYPOTHESIS & OBJECTIVES:

Despite ventenata having a similar nutritional profile to cheatgrass, its forage value is considerably worse, suggesting a lack of palatability. Palatability is derived from internal factors such as structure of the plant itself, as well as external factors such as bacterial or fungi microbes bound to the surface. This proposal will investigate both internal and external factors of ventenata and their impact on palatability.

[1] Prather, T., Burke, I. 2011. Symposium: *Ventenata dubia* – an emerging threat to agriculture and wildlands? Spokane, WA: Proceedings of Western Society of Weed Science. 107-111.

[2] Prather et al., 2013. Ventenata biology & management in pasture, hay & CRP. University of Idaho Field Tours Workshop. Available at http://mysare.sare.org/mySARE/assocfiles/978995WorkshopHandout.pdf

Objective 1: Investigate the role of palatability inherent to ventenata itself.

The first question to address is whether the palatability problem is due to inherent ventenata issues, such as high silica within tissue structure that makes ventenata unpalatable. We hypothesize the wiry (silica within structural tissues) growth pattern of ventenata plant may contribute to the palatability problem. To test this hypothesis, we will pellet ventenata-infested grass to eliminate the role of wiry growth in palatability.

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Objective 2: Examine the role of surface-bound microbes in shaping ventenata palatability.
Previous work on ventenata has found *Fusarium spp.* fungi within ventenata that negatively affect other grasses (UI-SARE). There are fungi that are associated with deterring herbivory[3] and perhaps fungi also play a role in deterring livestock from grazing ventenata. We hypothesize that surface-bound microbes play a role in the poor palatability of ventenata. To test this hypothesis, we will heat-treat ventenata to kill surface-bound microbes and rinse the ventenata to eliminate any secreted toxins from the surface.

PROCEDURES:

This study will test objectives 1 and 2 simultaneously through the ventenata processing. Early-weaned beef calves at the University of Idaho Beef Center will be divided into 5 groups to test the effects of wiry plant growth and surface-bound microbes on ventenata palatability. As a positive control, the ventenata group (VT-UNT) will receive an untreated grass hay high in ventenata, harvested from a source near Moscow, ID. To investigate OBJECTIVE 1, a pelleted ventenata group (VT-PELLET) will receive a grass hay high in ventenata that has been pelleted. To investigate OBJECTIVE 2, a treated ventenata group (VT-TREAT) will receive a grass hay high in ventenata that has been heat-treated and rinsed to eliminate surface-bound microbes and microbial toxins. Also included to control for the effect of the heat treatment, a treated control group (CTRL-TRT) will be fed a ventenata-free grass hay that has been heat-treated and rinsed to eliminate surface-bound microbes and microbial toxins. The untreated control group (CTRL-UNT) will receive an untreated grass hay without ventenata.

The feeding strategy of the 5 groups will be set up according to a double-choice feed preference study, as done in other livestock species (Sola-Oriol et al., 2009, 2011). Daily, each animal will be fed 15 lb of a reference diet (CTRL-UNT) and 15 lb of a test diet (CTRL-TRT; VT-TREAT; VT-PELLET; VT-UNT) in two separate feeders. Further, a control group being fed 2 feeders of CTRL-UNT will also be included. All animals will be fed their treatment forages for a 7 day adaptation period, followed by a 7 day study period. In addition, all calves will be fed a protein supplement and a mineral supplement, and have unlimited access to water.
On days 1 and 7 of the study period, calves will be weighed, and their average daily gain measured. On a daily basis, the feed provided and weighbacks will be measured for each animal. To quantify the palatability of ventenata, we will use the formula below (Sola-Oriol et al., 2009):

$$\%\ Preference = \frac{Test\ diet}{Test\ diet\ +\ Reference\ diet} * 100\%$$

[3] Xhan, D X, Nagabhyru, P. and Chardl, C L. 2009. Regulation of a chemical defense against herbivory produced by symbiotic fungi in grass plants. Plant Physiology V 150(2):1072-1082.

Using the above equation will yield values from 0 to 100%, and allows us to quantify the extent to which cattle prefer one diet over the other. An animal with no preference for the test diet will consume an equal amount of both, which results in a 50% preference. When offered a choice between VT-UNT and CTRL-UNT, the animals are expected to consume much more of the reference diet, resulting in a preference between 0 and 50%, which reflects the poor palatability of ventenata.

Cattle from the UIdaho beef center will be used under the guidelines of the Institutional Animal Care and Use Committee guidelines. To optimize statistical power when expecting a 12% coefficient of variation, and expecting 20% difference from control to be detected, 7 animals per treatment will be used (Berndtson, 1991), totaling 35 animals for the current study.

RESULTS:

To complete this study, we used 6 month-old weaned beef calves; with spring calving, these animals were available in September. Animal work was completed at the end of October, and data analysis is in progress. Preliminary results include feed intake and body weight changes. Currently, we are working on completing digestibility analysis and nutritional composition of all 5 treatments. Once analysis is complete, a manuscript will be prepared and results will be shared with Extension Faculty at University of Idaho and Oregon State University.

Interim results show that beef calves grazing ventenata hay in any form do not experience any difference in body weight gain compared to a mixed grass hay (Figure 1). Despite the similar average daily gains, beef calves showed a strong preference away from ventenata-infested hay (Figure 2). At 50% preference, calves prefer both offered feeds equally. At 0% preference, calves, prefer only the reference diet, and will not consume the test diet. The control treatment, where calves were fed 2 bins of reference diet, showed no difference from 50%, confirming that our feed preference test worked. The ventenata treatment (VENT) showed a preference of 19%, highlighting its poor palatability. While autoclaving ventenata made no difference to palatability, pelleting ventenata-infested hay (VENT-pelleted) increased feed preference to 50%, completely erasing the negative palatability associated with ventenata.

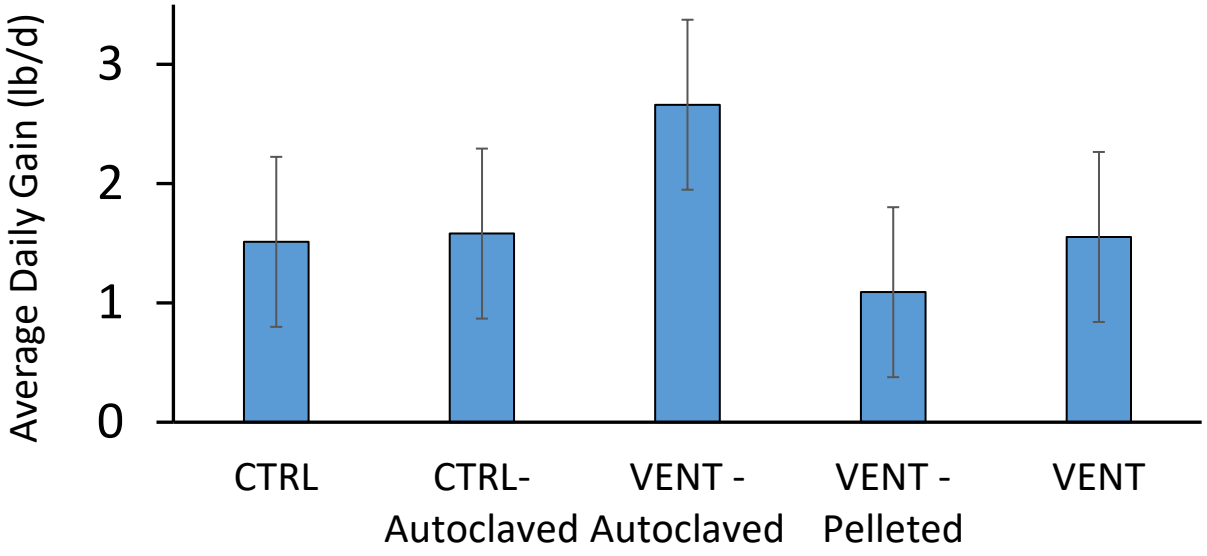

Figure 1. Average daily gain of weaned beef calves offered a choice between a reference diet, consisting of mixed grass hay, and 1 of 5 test diets. No differences in average daily gain were detected among the 5 diets. Test diets: CTRL – mixed grass hay; CTRL-

Autoclaved – mixed grass hay, autoclaved; VENT-Autoclaved – Ventenata-infested hay, autoclaved; VENT-Pelleted – Ventenata-infested hay, pelleted; VENT – Ventenata-infested hay.

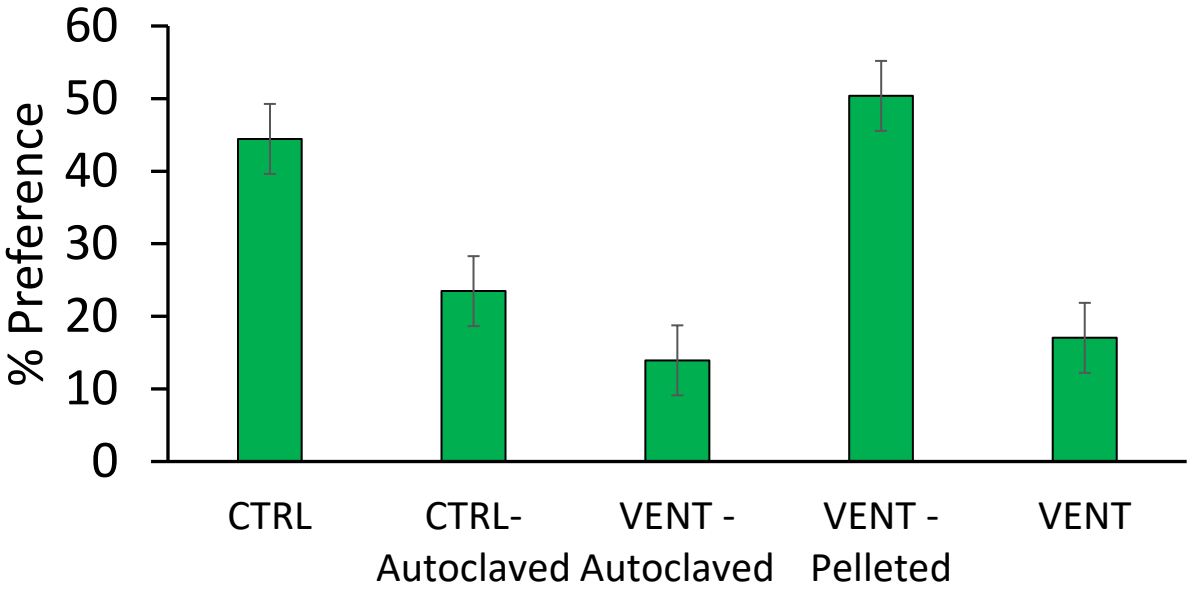

Figure 2. Feed preference of weaned beef calves offered a choice between a reference diet, consisting of mixed grass hay, and 1 of 5 test diets. Preference of 50% indicates equal preference between reference diet and test diet. Preference of 0% indicates total preference for reference diet, away from test diet. Calves fed CTRL and VENT-Pelleted showed no preference between reference and test diets, while calves fed VENT showed strong preference away from VENT, highlighting its poor palatability. Test diets: CTRL – mixed grass hay; CTRL-Autoclaved – mixed grass hay, autoclaved; VENT-Autoclaved – Ventenata-infested hay, autoclaved; VENT-Pelleted – Ventenata-infested hay, pelleted; VENT – Ventenata-infested hay.

OUTPUTS:

Dissemination of information will begin once data analysis is finalized. Results will be presented at the Pacific Northwest Animal Nutrition Conference in Richland, WA on 18-19 January, 2017. In addition, we anticipate generation of a manuscript for publication in the scientific community and we will approach the Idaho Cattle Association to investigate the possibility of publishing this study in Line Rider magazine.