

# Preference and Forage Quality of 13 Cultivars of Forage Barley and 2 Cultivars of Oats when Grazed by Sheep

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## IMPACT STATEMENT

*Annual forages are an important feed source for Montana producers. With new cultivars entering the market, it is important to know their nutrient quality in order to determine how they can fit into your livestock management. We also wanted to evaluate differences in animal preference, an important tenant of forage quality.*

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## SUMMARY

Annual forages are an important part of the Montana agricultural community, and provide a valuable and high-quality forage source for livestock. Varieties are continuously being developed for improved forage quality and digestibility. This study aimed to evaluate the forage quality of several new cultivars of forage barley, as well as commonly-used varieties that are already available. Two cultivars of oats were also included in the trial which are commonly used throughout MT. Sheep were allowed to graze all varieties at the same time in order to evaluate preference. All plots were sampled for forage quality and herbage mass production. Sampling and grazing was initiated at approximately 5-10 days post heading. All forages sampled were considered to be fairly high-quality livestock feed, with crude protein ranging from 16.2-21.5%, and total digestible nutrients ranging from 60.3-65%. However, nitrates were elevated in all plots, with oat plots having the highest. Oats also were the most preferred by sheep, with visual estimates of forage mass removed ranging from 55-87%, while the forage barley estimates ranged from 21.7-56.7% removal, depending on cultivar. This research demonstrates that annual forages can be a high-quality, highly-accepted grazing source, however care must be taken to avoid nitrate toxicity.

## INTRODUCTION

Small grains are highly-ranked commodities contributing to the Montana economy. Barley for grain is one of the top crop items (in acres) produced in Montana (USDA, 2016) and forage barley acres are increasing as grain prices decrease. Barley and oat production has risen in Montana since the last census conducted in 2012. The Montana State Agriculture Overview (2015) reported a total of 860,000 acres of barley and 22,000 acres of oats harvested in 2015. Although there has been a rise in small grain production, overall cereal grain prices in 2016 have caused concern among producers. A combination of a declining livestock market, lower international/domestic corn prices, and an adequate supply of eastern and western feed grains has reduced small grain prices. Concerned producers have begun looking for an alternative market for their small grains, sparking an interest in the use of annual cereal crops as forage.

The economic value of feeding cereals as forage to livestock depends on both yield and quality. Factors that influence year-to-year variability in forage quality are species composition, plant maturity, and environment (Buxton, 1996). Grazing animals avoid certain components of vegetation based on chemical characteristics and “anti-quality” factors. Grazing preference is usually influenced by nutritive characteristics and the proportion of

indigestible components present in forage (Thomas et al., 2010). Thomas et al. (2010) reported that the grazing strategy for sheep allowed them to respond to changing vegetation characteristics. The sheep in this study preferred to consume forage that did not limit nutrient availability and allowed for increased intake of digestible dry matter. The authors of this study suggest that grazing strategy and preference by sheep allows them to maintain nutrients essential for optimal rumen function.

Variation in yield and quality of cereal forages depends on cultivar, stage of growth, year, and planting location (Berkenkamp, et al., 1987a). Oats used as forage are generally higher yielding than other cereal crops such as barley, wheat, triticale, and rye (Berkenkamp, et al., 1987a; Berkenkamp, et al., 1987b). However, yields comparable to oat have been reported in the literature in both barley and triticale (Cherney and Marten, 1982). Utilizing cereal crops as forage is a potential alternative market option for producers during times when cereal grain prices are low. Cereal forages have high yield potential; however, producers need to be mindful of the trade-off between yield and forage quality. Grazing preference varies due to differences in quality between cultivars. Research regarding grazing selection and preference between different cereal forages may be useful for producers during cultivar selection. Selection will vary based on environmental conditions, the goals of the producer, and the type of animal being used.

## PROCEDURES

Fifteen cultivars were established on May 18, 2016 at the Bozeman Agricultural Research and Teaching farm. Species were established into a prepared seedbed using a no-till drill at a rate of approximately 65 pounds pure live seed per acre. Fertilizer amounts were based off of soil samples taken prior to establishment. All species were grown in a dryland environment, with no supplemental irrigation.

The study was planted as a randomized complete block design, with a total of three reps per cultivar. Each block contained all fifteen cultivar entries. Individual plots measured 6 ft x

15 ft. Initial plant heights were taken in three locations within each plot across the diagonal using a meter stick. Initial herbage mass samples for all plots were taken on July 13, 2016, after a majority of the cultivars had begun heading. All cultivars were within 5-10 days of heading at harvest. As all plots were uniform in growth, a 1 ft x 1 ft quadrat was randomly thrown into the middle of each plot, and samples were cut to a 3-inch height. Samples were immediately weighed and placed in a 60°C oven to determine dry weight. Density was determined using dry herbage mass weights.

Each replication was fenced off individually using mesh nylon fencing. On July 18, 2016 at 0800, eight Rambouillet rams ( $47.0 \pm 8.3$  kg) were placed into block 1 for a 24-h grazing period. Sheep were removed after 24-h and placed into block 2 for the second day of data collection. On day 3, sheep were moved into block 3 for the final 24-h grazing period. Sheep had *ad libitum* access to water.

Residual herbage mass samples were taken each day immediately after sheep removal in a similar manner to determine initial herbage mass. Herbage mass removal was calculated by subtracting residual plot herbage mass from initial plot herbage.

Forage samples were submitted to Midwest Laboratories (Omaha, NE) for nutrient analysis. Acid detergent fiber (ADF), total digestible nutrients (TDN), crude protein (CP), crude fat (CF), net energy for maintenance (NEm), and nitrate levels were evaluated.

## RESULTS AND DISCUSSION

No differences were observed between cultivars in herbage mass production, residual herbage mass production, or initial or residual plant heights (Table 1). It is not surprising that there were no differences between the initial heights and herbage mass production of cultivars, as all entries appeared to have fairly similar growth. The two oat entries did mature a little quicker, with seed heads appearing about 3 days ahead of the forage barley entries.

A trend for significance was observed for herbage mass removal, and there was a significant difference in visual estimation of

herbage mass removal. It is likely that the sampling method decreased the differences in herbage mass removal, as there was significant variation throughout the plots due to grazing, which was difficult to capture using only two quadrat clippings. Researchers observed that every day sheep were placed into a new block, they immediately grazed on the oat plots before grazing on the barley plots.

No significant differences were observed between cultivars for CP or CF, but there were differences for ADF, TDN, NEm, and nitrates (Table 2). The cultivar MT103101-5 is part of a program breeding for improved digestibility, so it is not surprising that it had the highest TDN. These findings are similar to previous research where 'Horsford' and 'Haybet' were found to have higher TDN and CP than 'Otana' and 'Stampede' (Cash et al., 1997).

The forage quality of all entries is acceptable for livestock at most production classes, with the biggest concern being the nitrate levels. Particularly with oats, grazing livestock on forages with levels above 1% NO<sub>3</sub> is not recommended, as issues with reproduction and performance are often observed. It is not surprising that the oats had the highest nitrate levels, as oats are known to be nitrate-accumulators, and our values are in agreement with several other published reports (Bolan and Kemp, 2003; Crawford, et al., 1961; Gul and Kolp, 1960). We did not observe issues in our rams, likely because they were able to access other lower-quality forages, plus they were not reproductively active, decreasing likelihood of symptoms.

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