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Beef Science Cluster

Developing improved tame forage varieties for western Canada

Project Title:

Nutritional evaluation of barley forage varieties for silage

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Background

Although barley silage is an important component of backgrounding and finishing diets in Canada, there is limited information available regarding the digestibility and nutritional quality of barley forage varieties. Plant cell wall degradability, and specifically the extent and rate of neutral detergent fibre (NDF) digestion in the rumen is believed to range from 40 to 80% due to environment, plant maturity and varietal differences. The effects on silage digestibility can seriously reduce backgrounding gain feed efficiency.

Objectives

1. compare feed quality characteristics of barley varieties grown for silage including within and between variety variation in the extent and rate of cell wall degradation;

2. evaluate ensiling characteristics of barley varieties selected for extremes in cell wall degradability;

3. evaluate performance (rumen function, digestibility, growth, carcass quality) of animals that have been fed barley silage selected for extremes in rate of cell wall degradability.

What they did

On-farm sampling:135 silage samples representing 16 barley varieties were collected from 11 beef, 95 dairy and 29 mixed beef/dairy operations in south-central Saskatchewan and southern Alberta over two years. Of these, seven barley varieties had at least 3 samples harvested at the same stage (mid-dough) in each year. These seven varieties (Conlon, CDC Copeland, AC Metcalf, CDC Cowboy, Xena, Falcon and Legacy) were tested in the lab for NDF, starch and protein content and NDF digestibility after a 30 hour incubation in an artificial rumen. Three varieties that had similar NDF, starch and protein contents, but that different NDF digestibility (NDFD) were selected for further study. These were CDC Cowboy (high NDFD), Copeland (intermediate NDFD) and Xena (low NDFD). CDC Cowboy is a 2-row general purpose variety with high forage yield, CDC Copeland is a 2-row malting variety, and Xena is a 2-row general purpose (feed) variety.

Ensiling Study: The three barley varieties found to have high (CDC Cowboy), a intermediate (CDC Copeland), and low NDFD (Xena) were seeded on the same date, at the Lethbridge research station, managed the same and silaged at mid dough maturity. Silage samples were analyzed for NDF, starch, and protein content and again analyzed for NDFD.

***Feeding Study*:** The same three varieties were grown at the University of Saskatchewan, managed the same, and silaged without an inoculant at mid-dough. The three silages were fed to 288 steers averaging 705lbs in a small pen feeding trial (12 head per pen). Diets were identical except for the type of silage used. Steers were backgrounded for 68 days. At 850lbs, the steers stepped up to a finishing diet over 12 days, then finished for 148 days and shipped at 1378lbs. Intakes, gains and feed conversions were measured throughout the feeding trial, and carcass weights and grades were collected at slaughter.

What they learned

On-farm study: When barley silage samples grown in a variety of locations in Alberta and Saskatchewan were averaged by variety, CDC Cowboy, CDC Copeland and Xena all had similar starch, NDF, and protein levels, but had different NDFD.

Ensiling Study: When these three varieties were all grown in Lethbridge, the researchers found no difference in silage quality among the different barley varieties. Varieties were all found to have similar starch and protein levels, slight differences in NDF levels (Xena was lower than CDC Cowboy and CDC Copeland), and no differences in NDFD.

Feeding Study: When the same three varieties were grown in Saskatoon, the results came out differently again. This time, CDC Cowboy silage had more NDF and less starch and thus less energy than the CDC Copeland or Xena silages. These differences were also evident when the backgrounding diets formulated with these silages were analyzed.

Backgrounding steers fed CDC Cowboy silage grew more slowly, ate less and converted less efficiently than steers fed CDC Copeland or Xena silage. The higher NDF levels in the CDC Cowboy silage likely limited feed intake, dietary energy intake and growth.

Finishing steer performance was unaffected by barley variety, probably because there was so much less silage in the diet. *Over the entire feeding period*, the variety of barley used to make the silage had no measurable effects on steer performance. The differences in growth performance seen in the 68 day backgrounding period were diluted by the lack of differences in the longer 148 day finishing period.

Carcass lean yield and quality (marbling) grade were unaffected by the variety of barley used to make the silage, but steers fed CDC Cowboy silage had lighter carcasses (797lbs) than those fed CDC Copeland (817lbs) or Xena silage (811lbs).

What it means

Since no difference was found in the ensiling study this would have suggested that silage made from CDC Cowboy (most digestible NDF) would produce better animal performance than CDC Copeland (intermediate NDFD) and Xena (lowest NDFD). In this study, silage made from CDC Cowboy actually had higher NDF than the silage made from CDC Copeland and Xena. As a result, steers fed silage made from CDC Cowboy had poorer performance (lower feed intake, energy intake, growth rate and feed efficiency) during the high silage backgrounding period. This is probably a result of “genotype by environment interaction”. Different varieties of

plants (or animals) perform differently in different growing conditions. Some thrive under optimal conditions and wilt under adverse conditions. Year-to-year variations in rainfall and temperature conditions, and soil type and fertility can influence how different barley varieties grow and mature, and the quality of the silage they produce.

While this study suggests that barley variety alone may not be a great predictor of animal performance, it certainly emphasizes the importance of feed testing. In winter feeding programs, forages with high NDF levels can prevent cows from consuming enough feed to maintain their body condition.

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