



BEEF CATTLE RESEARCH UPDATE

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Effects of Roughage Inclusion and Particle Size on Digestion and Ruminal Fermentation Characteristics of Beef Steers

Roughages (fiber) are included at low concentrations in high-concentrate finishing feedlot diets to help maintain rumen health and to reduce the incidence of digestive disorder including bloat, acidosis, liver abscesses and laminitis and to maximize energy intake. The inclusion rate is limited because based on cost per unit of energy, roughage is the most expensive component of feedlot diets. Grinding of roughage is a common practice to prevent sorting and increase forage digestibility. However, at low inclusion levels, improving forage digestibility in finishing diets is of questionable benefit, since the main purpose of the roughage is to provide “scratch factor”, maintaining rumen health. Increasing particle size of a low-quality forage versus inclusion level might maintain ruminal pH similarly to a shorter particle size at a higher inclusion rate.

Research by the Texas A&M AgriLife Research and Extension Center (Amarillo) evaluated the effects of corn stalk inclusion rate and particle size in finishing diets on digestibility characteristics, rumination activity, and ruminal fermentation characteristics of beef steers.¹ In this experiment, ruminally cannulated steers were fed steam-flaked corn based finishing diets consisting of 5% inclusion of a short-grind roughage, 10% inclusion of a short-grind roughage, 5% inclusion of a long-grind roughage, and 10% inclusion of a long-grind roughage. Differences in particle size were obtained by grinding corn stalks once or twice using a commercial tub grinder. The steers were outfitted with rumination monitoring collars to continuously measure rumination activity.

These researchers reported that feeding diets containing 5% roughage tended to increase ($P \leq 0.09$) dry matter, neutral detergent fiber, and starch total tract digestibility compared to diets containing 10% roughage. Both rumination time (298 vs. 245 min/day) and ruminal pH (5.82 vs. 5.74) increased ($P < 0.01$) in cattle fed diets containing long-grind corn stalks compared to diets containing the short-grind corn stalks. Cattle fed diets containing 10% roughage also had greater ($P < 0.01$) rumination time (289 vs. 254 min/day) and ruminal pH (5.88 vs. 5.69) compared to the 5% inclusion treatments. A benchmark for subacute acidosis is a pH below 5.6. Steers fed short-grind corn stalks tended ($P = 0.09$) to have a greater time under a pH of 5.6 compared to steers fed long-grind corn stalks (11.18 vs. 8.59 hr/day). Steers receiving the 5% inclusion rate of roughage also tended ($P = 0.09$) to have greater time under a ruminal pH of 5.6 compared to those receiving 10% roughage treatments (11.2 vs. 8.57 hr/day).

These data suggest that particle length increases rumination time regardless of inclusion rate. Thus, these researchers concluded that feeding a lower inclusion of roughage with a larger particle size may stimulate rumination and aid in ruminal buffering similar to that of a higher inclusion of roughage with a smaller particle size, without negatively impacting digestibility and fermentation.

Effect of Trace Mineral Source on Grazing Stocker Cattle Performance

Trace minerals are needed for vitamin synthesis, hormone production, enzyme activity, collagen formation, tissue synthesis, oxygen transport, energy production, and other physiological processes related to growth, reproduction and health. Traditionally, trace minerals used in animal feed have been categorized as either inorganic (primarily sulfate and oxide forms) or organic. "Organic" simply means that the mineral is bound to an organic material. These materials are generally amino acid complexes, proteinates, chelates, polysaccharide complexes, and propionates. Organic sources of trace minerals have higher availability compared to inorganic sources, but cost considerably more than inorganic sources (~7 to 12 times more). In recent years, a new category of trace minerals have

been developed, known as hydroxy trace minerals (source of copper, zinc and manganese). Hydroxy trace minerals are relatively insoluble in water and thus are less reactive in feeds and premixes than sulfates, resulting in greater vitamin stability and less oxidation of fats. In addition, hydroxy trace minerals are more bioavailable than sulfate forms of trace minerals. Hydroxy minerals cost more than inorganic sources but less than organics (~2 to 4 times greater than inorganic).

Kansas State University research in a 90-day grazing study using 276 crossbred heifers (645 lb) measured the consumption and growth resulting from a trace mineral supplement that contained zinc, copper, and manganese either in a sulfate or a hydroxy form.² The sulfate treatment consisted of a standard free-choice mineral formulated with sulfate forms of zinc, copper, and manganese. The hydroxy treatment consisted of a free-choice mineral formulated with the hydroxy forms of zinc, copper, and manganese at a 40% reduction in level.

There were no significant differences in average daily gain or mineral intake during the grazing trial. Thus, these researchers concluded that providing a free-choice mineral using hydroxy forms of trace minerals (copper, zinc, and manganese) provides comparable performance when formulated at 40% of a sulfate trace mineral based supplement.

¹ Weiss, C. P., W. W. Gentry, C. M. Meredith, B. E. Meyer, N. A. Cole, L. O. Tedeschi, F. T. McCollum, and J. S. Jennings. 2017. Effects of roughage inclusion and particle size on digestion and ruminal fermentation characteristics of beef steers¹. *J. Anim. Sci.* 95: 1707-1714.

² Weibert, C. S., W. R. Hollenbeck, S. B. Laudert, J. D. Kubick, and D. Blasi. 2017. Feeding a novel trace mineral at lower levels to grazing stocker cattle does not impair performance. *Kansas Agricultural Experiment Station Research Report Cattlemen's Day Beef Cattle Research: Vol. 3: Iss. 1: 57-59.* Available: <https://dx.doi.org/10.4148/2378-5977.1349>.