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SYMPOSIA AND ORAL SESSIONS

ALPHARMA Beef Cattle Nutrition: Challenging the Limits of Caloric Intake in Feedlot Cattle

18 Sites, rates, and limits of starch digestion and glucose metabolism in growing cattle. G. Huntington*[1], C. Richards[2], and D. Harmon[3], [1]*North Carolina State University*, *Raleigh*, [2]*The University of Tennessee*, *Knoxville*, [3]*The University of Kentucky*, *Lexington*.

Growing cattle in the U.S. consume up to 6 kg of starch daily, mainly from corn or sorghum grain. Total tract apparent digestibility of starch usually ranges from 90 to 100% of starch intake. Ruminal starch digestion ranges from 75 to 80% of starch intake, and is not greatly affected by intake over a range of 1 to 5 kg starch /d. Starch apparently digested in the small intestine ranges from 36 to 49% of starch entering the small intestine, and digestibility decreases as starch entry increases. Starch apparently digested in the large intestine ranges from 44 to 46% of starch entering the large intestine. Approximately 70% of starch digested in the small intestine appears as glucose in the bloodstream. However, glucose use by visceral tissues regularly exceeds glucose supply from intestinal starch digestion. Within the range of starch intakes that do not cause rumen upsets, increasing starch (and energy) intake increases the amount of starch digested in the rumen, increases the supply of starch to the small intestine, increases starch digested in small intestine (albeit at reduced efficiency), and increases starch digested in the large intestine such that total tract digestibility remains relatively constant. Most of the starch is still digested in the rumen, but increasing amounts of starch escape ruminal and intestinal digestion, and disappear distal to the ileocecal junction. Again within the range of starch intakes that do not cause rumen upsets, as starch intake increases, hepatic gluconeogenesis increases, glucose entry increases, glucose irreversible loss increases, with a significant portion lost as CO_2. The ability to increase use of dietary starch to support higher weight gains or improved marbling could come from increasing starch digestion in a healthy rumen or the small intestine, but we conclude that the main limit to use of dietary starch to support liveweight gain is digestion and absorption from the small intestine. Increased oxidation of glucose at higher starch intakes may alter energetic efficiency by sparing other oxidizable substrates, like amino acids.

Key Words: Beef cattle, Grain, Starch

19 Ruminal dynamics during adaptation of beef cattle to high-concentrate diets. M. S. Brown*[1,2], [1]*West Texas A&M University*, *Canyon*, [2]*Texas Agricultural Experiment Station*, *Amarillo*.

Several economic factors have favored minimizing the proportion of forage in the diet for finishing cattle within biological constraints. Two such factors are lower ration costs per unit of net energy and greater ration density, which can result in a lower volume of feed to mix, deliver, and contain in the bunk. However, an abrupt transition in substrate supply to the ruminal environment from exclusively forage to cereal grain can have a persistent deleterious impact on subsequent performance by the ruminant host. Adaptation programs used in practice must balance optimizing performance by feeder cattle with the risk of digestive disturbance. Although the period of time during which finishing cattle are adapted to ad libitum consumption of a high-concentrate diet may only be 10 to 20% of the total length of the feeding period, the success of the adaptation process can exert an important influence on performance during the entire feeding period. The focus of this paper will be to review the influence of increasing dietary concentrate supply on ruminal microbial populations and ruminal fermentation dynamics.

Key Words: Diet adaptation, Fermentation, Starch

20 An upper limit for caloric density of finishing diets. C. Krehbiel*, J. Cranston, and M. McCurdy, *Oklahoma State University*, *Stillwater*.

High-concentrate finishing diets are fed to beef cattle to maximize growth and gain efficiency. High-concentrate diets generally contain from 2.0 to 2.4 Mcal/kg DM of NE_m, and 1.3 to 1.7 Mcal/kg DM of NE_g. Caloric density of finishing diets varies due to differences in grain source and degree of processing, roughage level and source, fat supplementation, among others. Because animals generally become more efficient as ME intake increases, it may be desirable to maximize energy density of the finishing diet. Grains, primarily corn, sorghum, barley and/or wheat, are the main constituents of high-concentrate diets, and are often processed to increase ruminal and total tract starch digestibility. Degree of processing results in varying dietary energy concentration and availability, which influences ME intake and animal performance. For example, a recent summary suggests that flaked corn has 14 and 19% greater NE_m and NE_g, respectively, than dry-rolled corn. Gain efficiency is generally greater in cattle fed steam-flaked grains. However, flaking to a density of 0.28 kg/L or less decreased DMI despite an increase in ME concentration. Although all-concentrate diets have been fed to ruminants, roughage is included to decrease the incidence of metabolic disorders. Because cost of ME increases as roughage level increases, a minimal percentage (4.5 to 13.5% DM basis) of roughage is generally included. Feedlot performance and carcass characteristics are influenced by roughage level and source, due to their affects on DM and NE intake. Fat is supplemented to finishing diets to increase dietary energy density. Although increasing ME intake by supplementing fat has generally increased G:F, supplementing fat above 6% of DM has resulted in decreased intake to a level where G:F is maintained or decreased. Effects of dietary energy density on ADG and G:F are well documented; however, effects on tissue accretion and metabolic control factors are not well defined. The purpose of this review will be to evaluate the literature and assess the relationship between dietary energy density and animal performance in an effort to define an upper limit for caloric density of finishing diets.

Key Words: Beef Cattle, Energy Density, Performance