

Publications

The following articles have been published from this project during the past year:

- Cardellino, Ricardo. 1970. A comparison of different age of dam correction factors for weaning weight in beef cattle. M.S. Thesis, Oklahoma State University.
- Cardellino, Ricardo and R. R. Frahm. 1970. Age of dam adjustments for weaning weights of beef cattle. *J. Anim. Sci.* 31:161 (Abstract).
- Deutscher, G. H. 1970. Productivity of Angus-Holstein crossbreds versus Angus heifers under tall grass range conditions. M.S. Thesis, Oklahoma State University.
- Frahm, R. R. 1970. Can you select herd bulls at weaning time? Proceedings of the Ft. Reno Livestock Research Station Field Day, Oct. 22, 1970.
- Frey, John. 1971. Evaluation of cow type classification score and its relationship to cow productivity. M.S. Thesis, Oklahoma State University.
- Tanner, J. E., R. R. Frahm, R. L. Willham and J. V. Whiteman. 1970. Sire x sex interactions and sex differences in growth and carcass traits of Angus bulls, steers and heifers *J. Anim. Sci.* 31:1058.
-

Beef Feedlot and Nutrition

Effect of Previous Plane of Nutrition Upon Efficiency of Energy Utilization by Beef Steers

J. E. McCroskey, H. A. Deramus, Jr., R. R. Johnson and D. G. Wagner

Three lots of four Hereford steers each were started on feed in the summer of 1970 to study the effect of level of energy consumption and previous plane of nutrition upon efficiency of energy utilization by beef steers. Efficiency of feed and energy utilization are being determined from feedlot performance, respiration calorimetry, and the slaughter technique.

All lots of steers were individually hand-fed a high-grain finishing ration. One group of steers (lot 1) was fed at maximum feed intake from the start of the study to approximately 1000 lb. A second group (lot 2)

was fed to gain one pound per head daily until lot 1 reached slaughter weight, then put on full feed. The third group (lot 3) was fed at a maintenance level until lot 1 reached slaughter weight, then put on full feed.

Total energy balance was determined at the beginning, at intervals during the feeding period and will be determined just prior to slaughter, using respiration calorimetry and carbon-nitrogen balance. Carcass energy gain will also be determined using the slaughter technique.

The first two lots of steers have been slaughtered and the third group will complete the study about May 1, 1971. This study should show the relative efficiency of feed and energy utilization of beef cattle fed to slaughter weight under three widely different feeding regimes, and should answer some of the questions relating to compensatory gain. Results of the study will be presented in the 1972 report.

Effect of Melengestrol Acetate (MGA)¹ Upon Energetic Efficiency of Feedlot Heifers

J. E. McCroskey and H. E. Kiesling

Three sets of identical twin beef heifers were used in a feeding study to determine the effect of Melengestrol Acetate (MGA) upon energy gains and losses as determined by respiration calorimetry and carbon-nitrogen balance. The heifers were individually fed a high grain ration with both members of a pair fed the same amount of feed. One member of each pair also received 0.5 mg. of MGA daily. Fasting heat production and total energy balance were determined twice during the study.

Results of the study indicate that MGA-fed heifers were less efficient in energy utilization in both balance studies as reflected by lower values for digestible energy, metabolizable energy, and net energy. Energy stored as protein and fat was also lower for MGA-fed heifers. There was an indication of a slight decrease in energy required for maintenance due to MGA feeding as determined by the changes in fasting heat production from the beginning to the end of the study. Thus, the results suggest that when feed intake is limited, efficiency of energy utilization by feedlot heifers is not improved by feeding this level of MGA.

¹Melengestrol Acetate (MGA) provided courtesy of the Upjohn Company, Kalamazoo, Michigan

Publications

Kiesling, H. E. and J. E. McCroskey. 1971. Energetic efficiency of heifers fed MGA. Southern Section of American Society of Animal Science (Abstract).

Rumen Fermentation Rates In Steers Fed High Concentrate Rations

R. R. Johnson

Much work has been done in the past and more is presently being conducted on the utilization of various processed grains in high concentrate rations for beef cattle. It is now well known that the performance of beef cattle, especially feed efficiency, can be improved by the substitution of certain processed grains for dry rolled or ground grains.

In addition, there are basic differences between the cereal grains themselves in their ability to support performance of finishing beef cattle. Explanations for these differences in performance have not been found, however. During the past year, a new project was initiated to study the rates of synthesis of the volatile fatty acids from various processed grains in the rumens of beef cattle. Although it is well recognized that practically all carbohydrates that are fermented in the rumen are converted to volatile fatty acids which are eventually utilized by the host animal as an energy source, the rate of synthesis of these volatile fatty acids and the ratios of the three major acids, acetic, propionic and butyric acids, can be highly variable.

These variations are presumably associated with performance of the animal. The effects of grain processing and other ration modifications in high concentrate rations on these rates of synthesis have not been studied. During the past year, two preliminary experiments were conducted in which whole shelled corn was compared to ground corn and reconstituted milo was compared to dry rolled milo as the major feed ingredients in high concentrate rations for fistulated beef steers. The levels of lactic acid, volatile fatty acids and pH in the rumens of these animals were measured at various times after feeding. In addition, microscopic examination of the bacteria and protozoa were made. Analytical measurements on these samples have not been completed as yet. Presently an automatic feeding device which will allow more accurate measurement of the rate of synthesis in the rumen is being built and tested.

Utilization Of Waste Products In Animal Feeds

Ronald R. Johnson

A new research area which has received more emphases than any other research area in the last year or two is the utilization of waste products from agricultural as well as other industries for some productive purpose. Since many of these waste products are cellulosic in nature, it has logically been suggested that ruminant animal feeds might be the best area in which to utilize them. The ruminant has the natural capacity for digesting many materials such as the fibrous portions of plant tissues and miscellaneous forms of nitrogen which most other animals do not possess. Because of the importance of this type research, the overall area of improving the quality of our environment and the solution to pollution problems, a project is being initiated to study the utilization of waste materials in animal rations.

Basically, this project is designed to cover the study of the utilization of practically any type of waste or by-product that conceivably has a potential as a animal feed ingredient. The initial emphasis will be placed, however, on the utilization of high cellulose type materials in ruminant rations. A tremendous number of cellulose materials are at present accumulated as waste materials causing disposal problems as well as posing potential losses to the industries associated with them. Among these might be listed waste paper, municipal rubbish, residues from the wood-pulping and forest industries, rice hulls, sugar cane bagasse and other similar products of agricultural and industrial enterprises.

Virtually all of these materials contain high proportions of cellulose or fibrous type components, but in addition, almost all of them are highly lignified and, as a consequence, have a very low digestibility, in some cases approaching zero. Thus, it is quite likely that in order for any of these to be utilized as animal feeds, a certain amount of chemical processing will be required to release the usable forms of carbohydrates and other nutrients.

There are numerous chemical treatments which have already been developed which are capable of performing this process but which have not necessarily proven to be economically feasible. It is quite likely that these materials will find a role in the nutrition of animals existing on a maintenance type ration, such as a wintering cow, rather than on the rations that are commonly found in feedlot situations. During the coming year, a number of these products will be examined in laboratory tests and in limited number of animal tests to determine their possible contribution towards the nutritive requirement of ruminants.

Relationship Between Laboratory Characteristics And Intake Of Bermudagrass By Grazing Steers

J. E. McCroskey and D. E. Hopson

Five grazing studies were conducted during the summer of 1969 using eight yearling Hereford steers to determine the consumption of Midland Bermudagrass pasture and to relate intake to certain laboratory characteristics. Forage consumption was determined using an external indicator (polyethylene glycol) to calculate fecal dry matter output, and the lignin ratio to determine dry matter digestibility. Hand clipped and esophageal forage samples were analyzed chemically for crude protein, acid detergent fiber, acid detergent lignin, and cell-wall constituents. *In vitro* dry matter disappearance was also determined on all forage samples.

Average forage dry matter consumption for the five periods from May to October were 13.4, 13.2, 9.5, 23.5, and 30.6 lb., respectively. The high intake during the last two periods reflects an unusually abundant amount of forage due to heavy rainfall late in the summer. Intake normally would continue to decline throughout the growing season. Statistical analysis of the data showed that voluntary intake was highly correlated with the acid detergent lignin content of the forage samples collected by esophageal fistulated steers ($-.93$). *In vitro* dry matter disappearance, which is an estimate of forage digestibility, was highly correlated with the acid detergent fiber and cell-wall constituents on hand clipped forage samples ($-.97$ and $-.95$, respectively). Results of the study indicate that the acid detergent lignin content of forage samples obtained by esophageal fistulated animals can be used as a predictor of forage intake. Furthermore, increasing fiber and cell-wall constituents have a highly depressing effect upon forage digestibility.

Publications

Hopson, D. E. 1971. The determination of intake and digestibility of harvested and grazed forage by the use of indicators. M.S. Thesis. Oklahoma State University.

Indirect Determination Of Forage Intake Using Indicators

J. E. McCroskey and D. E. Hopson

Determination of forage intake by grazing animals requires (1) a measure of fecal output and (2) an estimate of forage digestibility. This study was conducted to compare different levels and methods of administration of an external indicator for measuring fecal output, and to compare the accuracy of two methods of estimating digestibility.

Four digestion trials were conducted using yearling Hereford steers to compare the accuracy of polyethylene glycol (PEG) given at levels of 50, 100, 150, and 200 gm. per day administered either in single (8:00 a.m.) or split doses (8 a.m. and 4:30 p.m.) to calculate fecal output. *In vitro* dry matter disappearance and the lignin-ratio were compared as estimates of forage digestibility. All steers were fed bermudagrass hay, and feed intake, fecal output, and digestibility were determined directly.

Results of the study revealed that PEG given in split doses gave more accurate estimates of measured fecal output than when given in a single dose. Of the four levels of PEG compared, 150 gm. given in split doses gave the greatest accuracy, however 50 and 100 gm. given in split doses gave fecal output calculations almost as accurate as the 150 gm. level. The 200 gm. level was the least accurate because of low percent recovery.

There was no significant difference between forage digestibility determined by the conventional digestion method and by the *in vitro* technique; however, digestion coefficients determined by the lignin-ratio method were significantly lower ($P < .05$) than those determined by conventional digestion trial. Comparison of actual intake with values calculated using PEG, lignin-ratio, and *in vitro* methods indicates the greatest accuracy was obtained with 150 gm. of PEG given in split doses, and using the *in vitro* procedure to estimate digestibility. In view of the small and non-significant differences in accuracy of fecal output determination between the 50 and 150 gm. levels of PEG, the lower level given in split doses would be more practical and would give essentially the same accuracy in estimating forage intake.

Publications

Hopson, D. E. 1971. The determination of intake and digestibility of harvested and grazed forage by the use of indicators. M.S. Thesis. Oklahoma State University.

Hopson, D. E. and J. E. McCroskey. 1971. Polyethylene glycol as an external indicator. Southern Section American Society of Animal Science (abstract).