cattle by either system of management. The actual choice will be highly dependent upon the relative availability and cost of roughages and concentrates in a particular situation.

**Table 5. Economic Evaluation of Feedlot Performance**

| Items | Cost/lb. of gain | |
|---|---|---|
| | Grower Ration | Finishing Ration |
| Number of steers | 45 | 46 |
| Total lbs. gained | 24,610 | 25,285 |
| Ration costs | $ .143 | $ .139 |
| Yardage @12¢/head/day | .043 | .042 |
| Total cost | $ .186 | $ .181 |

# Effect of Milo Preparation on Energy Utilization by Feedlot Steers as Determined by Respiration Calorimetry and Comparative Slaughter

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## Story in Brief

Eighteen Yearling Hereford steers were used to measure the energetic efficiency of feedlot rations containing dry rolled (DR) or reconstituted (38 percent moisture) rolled (RR) milo, and to compare respiration calorimetry and the comparative slaughter technique as methods for determining net energy of high concentrate feedlot rations. Net energy of the RR grain ration was significantly ($P<.01$) greater than the DR grain ration during the feedlot phase as determined by the comparative slaughter technique.

When determined by respiration calorimetry net energy tended to be greater for the RR grain ration but differences between the two rations were not statistically significant. A comparison of the two methods showed that net energy values for both rations were significantly ($P<.001$) greater when determined by respiration calorimetry than when determined by the slaughter technique.

## Introduction

Due to the small size of milo grain it is necessary to process the grain in order to obtain satisfactory gain and feed efficiency by feedlot cattle. Various processing methods such as grinding, pelleting, rolling, popping, steam-flaking and reconstituting have been tried. Previous work at this station has shown that reconstituting milo greatly improves feed efficiency over dry processed milo without affecting rate of gain of feedlot cattle.

Early work in measuring efficiency of energy utilization was done with respiration calorimetry; however, due to the tedious and time consuming nature of this method most of the present day work in energy studies with cattle has been done using the comparative slaughter technique. Modern technology and high speed data processing have made respiration calorimetry more practicable. This study was undertaken to investigate the effect of reconstituting milo on the net energy value of high concentrate rations for feedlot cattle, and to compare respiration calorimetry and the comparative slaughter technique as methods for measuring energy utilization.

## Materials and Methods

The two processing treatments studied were dry rolled and reconstituted rolled milo grain. Reconstituted grain containing about 38 percent moisture was prepared by soaking air-dry grain in water for 24 hours, after which the excess water was drained. This grain was stored in air-tight plastic bags for 20 days. Both the dry and reconstituted grains were rolled through a 12 x 18 inch roller mill prior to feeding. Other ingredients were combined into a premix which was added to the rolled grain so that both rations contained 84 percent milo on a dry matter basis as shown in Table 1.

Eighteen yearling Hereford steers weighing approximately 600 pounds were divided into three equal groups. One group was slaughtered at the start of the study and carcass specific gravity determined to estimate body composition of the experimental lots in order that net energy values of the two rations could be estimated by the comparative slaughter technique. The remaining animals were drenched with thiabendazole, im-

**Table 1. Ingredient Composition of Rations**

| | (% of Ration DM) |
|---|---|
| Rolled milo | 84.0 |
| Dehydrated alfalfa meal pellets (17% CP) | 4.93 |
| Cottonseed hulls | 4.93 |
| Soybean meal (44% CP) | 4.30 |
| Urea (45% nitrogen) | 0.64 |
| Salt | 0.60 |
| Bonemeal | 0.60 |
| Vitamin A (1600 IU/lb. of ration) | |
| Chlortetracycline (5 mg/lb. of ration) | |

planted with 24 mg of diethylstilbesterol and placed in pens equipped with individual feeding stalls.

The study consisted of a feedlot phase an dtwo total energy balance trials, one at the beginning of the feedlot phase (energy balance trial 1) and another at the end of the feedlot period (energy balance trial 2). Each energy balance trial consisted of an excreta collection period, a heat production phase with cattle on full feed, and a fasting heat production phase. Heat production of the animals was determined while the animals were in respiration chambers by measuring oxygen consumption, carbon dioxide and methane production, and urinary nitrogen excretion during two consecutive 24-hour periods. Fasting heat production was measured to estimate the maintenance energy requirement of each steer.

Upon completion of energy balance trial 1, the steers were placed in the feeding pens where they were fed ad libitum in individual stalls. The cattle were returned to the respiration chambers for a second energy balance trial at the completion of the feedlot phase. All animals were slaughtered immediately after energy balance trial 2 and carcass specific gravity was determined.

Feed, fecal and urine samples were analyzed for dry matter, protein, fiber and heat of combustion (energy) by standard laboratory procedures Net energy for maintenance plus gain (NEm+g) of each ration was determined during each total energy balance trial using respiration calorimetry and during the feedlot period using the comparative slaughter technique.

## Results and Discussion

Feedlot performance for the two groups is shown in Table 2. One steer in the RR grain-fed group died due to bloat, which was not attributed to the milo processing treatment. During the feedlot period average daily dry matter intake was significantly ($P < .05$) less for the cattle on

the RR grain rations. Although not statistically significant, feed efficiency was 8.25 percent greater for the RR grain-fed group. In addition, the RR grain ration had a significantly ($P < .01$) greater NEm+g than the DR grain ration when determined by the comparative slaughter technique. These results are in agreement with other reports in which reconstituted milo was compared with the dry form.

Results of the two total energy balance trials are shown in Table 3. Since feed intake was lower for cattle fed the RR grain ration, all comparisons were made on the basis of dry matter consumed. In both energy balance trials digestible energy was higher for the RR grain ration. Several reports have suggested that the benefit from reconstituting milo is due to increased digestibility of the grain. This study supports that suggestion. Net energy tended to be greater for the RR grain ration than for

**Table 2. Effect of Milo Preparation on Feedlot Performance and Energetic Efficiency of Feedlot Steers Determined by the Comparative Slaughter Technique**

| Item | Dry rolled grain | Reconstituted rolled grain |
|---|---|---|
| Initial empty body wt. (lb.) | 599 | 604 |
| Final empty body wt. (lb.) | 916 | 908 |
| Avg. daily empty body wt. gain (lb.) | 2.10 | 1.83 |
| Avg. daily dry matter intake (lb.) | 16.3 | 12.9* |
| Dry matter/lb. empty body wt. gain (lb.) | 7.88 | 7.23 |
| Avg. daily energy gain/lb. DM (kcal) | 1.96 | 1.93 |
| NEm+g (Mcal/100 lb. DM) | 66.2 | 77.0** |

* Means in the same row differ significantly ($P < .05$).
**Means in the same row differ significantly ($P < .01$).

**Table 3. Effect of Milo Preparation on Energetic Efficiency of Feedlot Steers Determined by Respiration Calorimetry**

| | Balance trial 1 | | Balance trial 2 | |
|---|---|---|---|---|
| | DR grain[1] | RR grain[2] | DR grain[1] | RR grain[2] |
| Steer wt. (lb.) | 688 | 653 | 954 | 945 |
| Daily feed (lb. DM) | 13.4 | 9.1** | 13.8 | 10.6** |
| Gross energy consumed (Mcal/day) | 27.36 | 18.86** | 27.8 | 21.36** |
| Digestible energy (Mcal/100 DM daily) | 150.5 | 165.4** | 147.3 | 154.9* |
| Metabolizable energy (Mcal/100 lb. DM daily) | 121.8 | 129.0 | 117.0 | 126.6** |
| Net energy (Mcal/100 lb. DM daily) | 90.3 | 97.3 | 86.2 | 87.3 |

[1] Dry rolled milo.
[2] Reconstituted rolled milo.
* Means in the same row within each balance trial differ significantly ($P < .05$).
**Means in the same row within each balance trial differ significantly ($P < .01$).

the DR grain ration in both balance trials but the differences were not statistically significant. The NEm+g values of both rations were lower in trial 2 than in trial 1 indicating that the net energy value of a feed decreases as the animal fattens.

A comparison of techniques for estimating NEm+g of the total ration is given in Table 4. The values for respiration calorimetry were obtained by pooling the data of the two energy balanced trials. Net energy values determined by respiration calorimetry were significantly ($P<.001$) higher (approximately 28 percent) than values determined by the comparative slaughter technique. These higher values appeared to be valid since the maintenance requirement of an animal would be less when confined to a respiration chamber due to less activity and environmental stress.

Results of this study indicate that efficiency of feed and energy utilization of milo grain can be increased approximately 16 percent by reconstituting the grain to approximately 38 percent moisture.

**Table 4. Comparison of Respiration Calorimetry and the Comparative Slaughter Technique for Measuring NEm+g of Feedlot Rations**

| Item | Respiration[1] calorimetry | Slaughter technique |
|---|---|---|
| | (MCal NEmtg/100 lb. DM) | |
| Dry rolled grain ration | 88.3 | 66.2*** |
| Reconstituted, rolled grain ration | 94.2 | 77.0*** |
| Average | 91.0 | 71.1*** |

[1] Data for trials 1 and 2 were pooled.
***Means in the same row differ significantly ($P< .001$).