

# Energy Requirements of Mature Beef Cows as Influenced by Weight and Level of Milk Production

S. A. Ewing, Larry Smithson, Craig Ludwig and Dwight Stephens

## Story in Brief

Twenty mature Hereford cows were fed individually in drylot to determine energy requirements during maintenance or gestation and lactation. The cows were selected to provide a range of from 800 to 1300 pounds in body weight. Digestible energy requirements were determined for each cow during a yearly cycle involving gestation and lactation.

For dry, mature and pregnant cows the daily digestible energy requirement can be expressed by the formula  $DE \text{ (Mcal.)} = 5.669 + 0.00831 \times \text{weight}$  TDN requirements appear to increase about 0.4 to 0.5 pound per 100 pounds increase in cow weight. Estimates of energy requirements of beef cows as affected by body weight and milk production are presented. Such data will be useful in determining the energetic efficiency of beef cows varying in body size.

## Introduction

Previous research at the Oklahoma Station concerning level of winter feeding has contributed to the establishment of recommended seasonal weight change patterns for brood cows. Such weight change patterns appear to be consistent with both reproductive efficiency and winter feeding economy. No previous work has been reported which would establish the energy requirements to support these suggested weight changes for the beef cow. In addition, much interest has been expressed by the industry relative to the influence of cow size on energy requirements and the corresponding feed input.

The work reported herein was done with both of the above factors in mind to establish the energy requirements to foster desirable weight change patterns during typical lactation and dry periods for the mature beef cows representing a reasonably wide range of weights.

## Procedure

The experiment was conducted at the Ft. Reno Station during the period from February 1965 to March 1966. Twenty mature Hereford

Acknowledgement is extended to the American Hereford Association, Kansas City, Missouri, for financial assistance for this study and to Godding Cattle Research, Foraker, Oklahoma, for permitting purchase of experimental cows from their performance-tested commercial herd.

cows from 6 to 7 years of age were selected as experimental animals. Weights of the cows ranged from 800 to 1400 pounds when measured at a point immediately prior to calving.

Four cows were not permitted to raise their calves and remained open. These cows served to establish the energy requirements for maintenance.

The remaining producing cows were utilized to establish energy requirements for the producing cow during a lactating period of 215 days post partum at which time the calf was weaned. This period was followed by a non-lactating period from 215 days post partum to a point immediately prior to the following parturition. During the non-lactating period the energy requirements for wintering dry, pregnant cows were observed.

All cows were maintained in a large dry lot and were fed individually. The mixed ration fed during the lactation and dry periods contained 59 and 49 percent TDN, respectively. Digestible energy values for the respective rations were 1.216 and 1.067 Mcal/pound. Energy values were determined by digestion trials conducted during each period using the chromic oxide reference technique.

Weights were taken routinely at weekly intervals for the purpose of adjusting feed allowance. All weights were obtained after a 12-hour shrink period without feed and water. The weight change pattern for each cow was established as follows:

Period	Time	Cow Weight Change
I <sub>a</sub> (lactation)	From immediately prior to calving to 56 days post partum.	Lose approximately 15 percent of pre-calving weight.
I <sub>b</sub> (lactation)	From 56 days post partum to 215 days post partum.	Gain approximately 8.5 percent of pre-calving weight.
II (non-lactation)	From 215 days post partum to immediately prior to the following parturition.	Gain approximately 6.5 percent of pre-calving weight and as a result return to the weight observed at the time the cow was placed on experiment prior to calving.

The calves were permitted to run with the cows except during feeding periods each day. All calves were offered feed individually to supplement that consumed in the form of milk.

Milk production was estimated at 14 day intervals for each cow by the calf weight difference technique involving weights before and after nursing. Milk samples were taken periodically for fat analysis to permit

the expression of milk yield on a fat-corrected basis. Energy requirements determined during the lactation phase for individual cows were corrected for milk yield in order to express requirements exclusive of that for milk production.

The weights of cows, expressed as the initial weight observed prior to calving, and the numbers involved in each phase of the study are shown in Table 1.

## Results

The results of the study concerning Digestible Energy (DE) and Total Digestible Nutrient, (TDN) requirements during the non-lactation period are summarized in Table 2. It should be noted that the requirements stated are average requirements for the entire non-lactation period of approximately 150 days or the last 5 months of pregnancy. No attempt has been made at this writing to determine requirements for advancing pregnancy during this period. Maintenance requirements for dry, open cows are shown in Table 3.

Results from the lactation phase are shown in Table 4. The energy values are based on observed requirements for the pregnant cow correct-

Table 1. Initial Weights of Individual Cows Comprising the Experimental Group

Maintenance <sup>1</sup>	Lactation Period	Non-Lactation Period
1320	1370	1370
1250	1315	1315
930	-----	1315 <sup>2</sup>
780	1285	1285
	1285	1285
	1280	1280
	-----	1260 <sup>2</sup>
	-----	1140 <sup>3</sup>
	-----	1130 <sup>3</sup>
	1040 <sup>4</sup>	-----
	1005	1005
	1005	1005
	990	990
	980	980
	975 <sup>4</sup>	-----
	970	970
	935	935

<sup>1</sup> Dry, open cows utilized for determining maintenance requirement.

<sup>2</sup> Cows lost calves during lactation period, but were re-bred and utilized during non-lactation period.

<sup>3</sup> Cows that were selected from Ft. Reno range herd and conditioned for the non-lactation period.

<sup>4</sup> Cows removed from test at end of the lactation period.

**Table 2. Energy Requirements for Wintering Mature, Pregnant Cows During the Dry Period.**

Cow Weight (lb.)	Daily Energy Requirement	
	Digestible <sup>1</sup> Energy (Mcal.)	Total Digestible <sup>2</sup> Nutrients (lb.)
800	12.31	5.80
900	13.14	6.28
1000	13.97	6.56
1100	14.80	6.94
1200	15.64	7.32
1300	16.47	7.70

<sup>1</sup> Daily DE (Mcal.) = 5.669 + 0.00831 W<sup>2</sup> Daily TDN (lb.) = 2.771 + 0.00379 W**Table 3. Energy Requirements for Maintenance (Dry-Open Cows)**

Cow Weight (lb.)	Daily Energy Requirement	
	Digestible <sup>1</sup> Energy (Mcal.)	Total Digestible <sup>2</sup> Nutrients (lb.)
800	11.71	5.35
900	12.31	5.63
1000	12.92	5.91
1100	13.53	6.19
1200	14.13	6.46
1300	14.74	6.74

<sup>1</sup> Daily DE (Mcal.) = 6.861 + 0.00606 W<sup>2</sup> Daily TDN (lb.) = 3.138 + 0.00277 W

ed for estimated yield of 4 percent fat-corrected milk, plus the energy probably required in addition for a given yield of milk containing 4 percent butter fat.

It should be noted that degree of activity and climate influence energy requirements. Therefore, these data should be interpreted with regard to the location in which the work was accomplished, which was central Oklahoma. Further, the degree of activity experienced in dry lot may be considerably less than under range conditions. It is generally accepted that the energy requirement for walking is approximately one percent above maintenance per 100 pounds of weight per mile.

Table 4. Estimated Energy Requirement of Beef Cows Representing Different Weights and Levels of Milk Production.

Cow Weight (lb.)	Daily Milk Production (lb.)	Daily Energy Requirement	
		Digestible <sup>1</sup> Energy (Mcal.)	Total Digestible <sup>2</sup> Nutrients (lb.)
800	8	19.90	9.41
	10	21.23	10.07
	12	22.55	10.73
	14	23.87	11.39
	16	25.20	12.05
	18	26.52	12.71
	20	27.85	13.37
900	8	20.88	9.94
	10	22.21	10.60
	12	23.53	11.26
	14	24.85	11.92
	16	26.18	12.58
	18	27.50	13.24
	20	28.81	13.89
1000	8	21.86	10.47
	10	23.19	11.13
	12	24.51	11.79
	14	25.83	12.45
	16	27.16	13.11
	18	28.48	13.77
	20	29.81	14.43
1100	8	22.84	11.00
	10	24.17	11.66
	12	25.49	12.32
	14	26.81	12.98
	16	28.14	13.64
	18	29.46	14.30
	20	30.79	14.96
1200	8	23.82	11.53
	10	25.15	12.19
	12	26.47	12.85
	14	27.79	12.51
	16	29.12	14.17
	18	30.44	14.83
	20	31.77	15.49
1300	8	24.80	12.06
	10	26.13	12.72
	12	27.45	13.38
	14	28.77	14.04
	16	30.10	14.70
	18	31.42	15.36
	20	32.75	16.02

<sup>1</sup> Daily DE (Mcal.) = 6.764 + 0.0098 W + (Daily lb. 4% FCM × 0.662)<sup>2</sup> Daily TDN (lb.) = 2.529 + 0.0053 W + (Daily lb. 4% FCM × 0.350)