Feeding Beef Cows In Winter

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Published nutrient requirements for beef cattle do not include guidelines for adjusting rations during winter, although good stockmen are painfully aware of the need for more feed during cold weather. The need to meet the cow's energy requirement during late gestation combined with the high cost of stored feeds makes winter feeding of beef cows particularly important to the cow-calf operator. The following discussion should assist cattlemen in adjusting available nutrient tables to meet the needs of beef cows exposed to winter conditions.

TABLE 1—Wind-Chill Factors for Cattle With Winter Coat

Wind Speed (mph)	Temperature (°F)												
	−10	−5	0	5	10	15	20	25	30	35	40	45	50
Calm	−10	−5	0	5	10	15	20	25	30	35	40	45	50
5	−16	−11	−6	−1	3	8	13	18	23	28	33	38	43
10	−21	−16	−11	−6	−1	3	8	13	18	23	28	33	38
15	−25	−20	−15	−10	−5	0	4	9	14	19	24	29	34
20	−30	−25	−20	−15	−10	−5	0	4	9	14	19	24	29
25	−37	−32	−27	−22	−17	−12	−7	−2	2	7	12	17	22
30	−46	−41	−36	−31	−26	−21	−16	−11	−6	−1	3	8	13
35	−60	−55	−50	−45	−40	−35	−30	−25	−20	−15	−10	−5	0
40	−78	−73	−68	−63	−58	−53	−48	−43	−38	−33	−28	−23	−18

Before discussing effect of temperature on nutrient requirements, we must understand the basic relationship between an animal and the thermal environment. The thermoneutral zone (TNZ) is the range in environmental temperature where livestock are most productive. It is sometimes referred to as a comfort zone when relating temperature to humans; however, it must be emphasized that thermal comfort for the stockman is usually different from that for the cow, and care must be taken not to evaluate animal environments based on human comfort. While this may at first appear obvious, it is a principal which is easy to overlook. The concept of thermoneutrality varies but for purposes here is defined as the range in effective temperature where cow performance is maximized.

Effective Temperature

The term effective temperature may require clarification. Effective temperature is an index of the heating or cooling power of the environment in terms of dry bulb temperature. It would include any environment factor that alters environment heat demand such as solar radiation, wind, humidity or precipitation. Specific formulas for calculating effective temperature of the total environment have not been developed, although the combined effect of some environmental variables such as wind and temperature (wind-chill index) is available. A wind-chill table prepared specifically for

cattle during winter has been developed at Kansas State University (Table 1).

Lower critical temperature, often used in discussing animal-environment relationships, is the lower limit of the TNZ. It is the effective temperature below which an animal must increase rate of heat production to maintain constant body temperature. Lower critical temperature also may be defined as the temperature at which rate of performance begins to decline as temperatures become colder. Effective temperatures below the lower critical temperature (below the TNZ) constitute cold stress.

The lower critical temperature for cattle varies according to how much insulation is provided by the hair coat and how much feed the cow consumes. For example, a cow being fed a maintenance ration may have a lower critical temperature of 32 °F if dry, but lower critical temperature may be 60 °F if the same cow is wet. Consequently, 40 °F may be a comfortable environment if the cow is dry but cold when the cow is wet.

Adjusting Rations

Coldness of a specific environment is the value that must be considered when adjusting rations for cows. Coldness is simply the difference between effective temperature (wind-chill) and lower critical temperature. Using this definition for coldness instead of using temperature read on an ordinary thermometer helps explain why wet windy days in March may be colder for a cow than extremely cold but dry calm days of January. So knowledge of environmental conditions alone is of little value in assessing potential impact of climatic stress unless one also knows the lower critical temperature of the animal involved.

Likewise, any listing of lower critical temperatures for animals also requires specific descriptions of animal variables that alter either rate of heat production or heat loss, such as insulation, plane of nutrition or muscular activity. These factors working in combination make accurate predictions of lower critical temperature difficult. Estimated lower critical temperatures for beef cows having varying hair coat descriptions are shown in Table 2.

Adjusting Cow Rations

The major effect of cold on nutrient requirement of cows is increased need for energy. In fact, most data suggests that needs for protein, vitamins and minerals are not altered during cold. Therefore, adjusting rations for cold weather is essentially a matter of increasing energy during cold to compensate for increased rate of heat loss as effective temperature falls below the animal's lower critical temperature.

TABLE 2
Estimated Lower Critical Temperatures for Beef Cattle

Coat Description	Critical Temperature
Summer Coat or Wet	59 °F
Fall Coat	45 °F
Winter Coat	32 °F
Heavy Winter Coat	18 °F

Two factors that determine rate of heat loss for animals exposed to cold are temperature difference between the animal's body temperature and the environmental temperature—and the animal's total insulation provided by hair, hide and fat. These factors can be used to predict rate of heat loss and, therefore, maintenance energy requirement for animals exposed to cold as shown in Table 3.

To determine magnitude of cold, lower critical temperature is used as a starting point. Estimates of critical temperature for beef cattle are listed in Table 2.

The value of the system described here is to more accurately feed energy during periods of cold. The system assumes present NRC energy requirements are accurate for thermoneutral conditions.

Example

Feeding tables suggest that a 1,200-lb. cow requires 16.4 megacalories metabolizable energy during the last one-third of pregnancy. This amount of energy could be supplied with 16½ lb. of good mixed hay. How much should the cow receive if she is dry and has a winter hair coat but the temperature is 20 °F with a 15-mph wind?

Step 1: Cow's lower critical temperature is 32 °F (Table 2).

Step 2: Wind-chill (effective temperature) is 4 °F (Table 1).

Step 3: Magnitude of cold (32 – 4) is 28 °F.

Step 4: Adjustment is 1% per degree of cold or 28%.

Step 5: Feed cow 128% of requirement or 20.9 lb. of hay.

This example is typical of many feeding situations; however, it must be emphasized that if the cow is wet, the same increase in feed would be required at 31 °F wind-chill (28 ° of coldness).

TABLE 3—Increased Maintenance Energy Costs for Cattle Per Degree (F) Coldness

	Cow Weight (lb.)				
	800	990	1,100	1,210	1,320
Coat Description	Percentage Increase Per Degree Coldness				
Summer Coat or Wet	2.0	2.0	2.0	1.9	1.9
Fall Coat	1.4	1.4	1.3	1.3	1.3
Winter Coat	1.1	1.1	1.0	1.0	1.0
Heavy Winter Coat	.7	.7	.7	.6	.6

Although it may be most accurate to calculate increased energy needs as shown in the previous example, many cattlemen are reluctant to do so. *The thumb rule is to increase the amount of feed 1% for each degree of coldness.*

Additional Cold Impact

An additional impact of cold has been found recently that influences the value of most feedstuffs. Research indicates a decline in ration digestibility during cold. Values ranging from .1-.4% decline per degree centigrade have been reported. Although energy requirement is not altered in this instance, a change in amount of diet necessary to meet nutritional needs is evident. Data would suggest a reduction of about 1% in digestibility per 10 °F fall in effective temperatures for cattle. In the preceeding example, an additional 2.8% or .5 lb. of hay is required to offset lower digestibility.

Preliminary results from an experiment at Kansas State University suggests several advantages for adjusting energy levels for cold weather. In the first year (1979-80) of a 2-year experiment, the following data has been gathered using 60 commercial cows fed in dry lot.

TABLE 4
Results of Adjusting Feed Levels for Cows During Cold

	Ration Adjusted for Coldness	Ration Not Adjusted
Weight Change During Last 135 Days of Gestation	+115	+ 26
Weight Change at Weaning	– 105	– 119
Net Weight Change	+ 10	– 93
Daily Milk Production	20.3 lb.	17.5 lb.
Percent Cycling in 60 Days From Mean Calving Date	82%	65%

These data have not been statistically analyzed and include only the 1979-80 winter. By rectal palpation, the cows fed adjusted rations are estimated to have conceived an average of 10 days earlier (June 5 vs. June 15). The amount of additional feed per cow was equal to 125 lb. of corn.

Beef cows exposed to cold require more energy for maintenance. The system described here based on cows' external insulation (hair coat) and existing conditions (wind-chill) estimates that cows require about 1% more feed for each degree of coldness. Preliminary results from a recent study suggest that the advantages of such ration adjustments appear to be economically favorable.