The Big Chill

Examine effects of temperature, wind and moisture.

Story by
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If your farm or ranch is inundated with piles of snow and the wind is blowing hard, your cows may look pretty miserable. Producers need to understand how weather affects cattle to best manage the herd from economical and animal-care viewpoints, says David Ames, Colorado State University professor of animal science.

"It changes energy requirements," he says. "You're going to have times when the energy requirements of beef cows can go up 20% in a month as compared to average." If those requirements are not met, he warns, a host of problems can occur.

When thinking about cold, Ames emphasizes that it's not all about actual temperature. "Effective temperature is not simply the thermometer on the barn; it's how cold it feels," he says. To get an accurate assessment of how cold a cow feels, producers must consider wind chill and moisture levels.

"Comfort temperature" is the temperature at which a cow's energy needs must be supplemented for her to maintain condition, Ames explains (see Table 1). When the effective temperature falls below the comfort temperature, "the requirement for energy goes up about 1% for every degree."

Table 1: Estimated comfort temperatures for beef cattle

Coat description	Comfort temperature, ° F
Summer coat or wet coat	59
Fall coat	45
Winter coat	32
Heavy winter coat	18

Source: Ames and Insley, 1975.

Wind and rain

Wind chill, a combination of wind speed and actual temperature, can raise an animal's comfort temperature (see Table 2). Consider a cow with a comfort temperature of 25° F. "On a cold day, when the wind's blowing and it seems like zero degrees, that's a 25% increase in energy requirements," Ames notes.

Hair coat and moisture levels interact similarly. If it's a cold day and you put on a down jacket, you're not cold, Ames says. "But, if you took a hose and wet the jacket, you'd probably be cold. The same thing happens to a cow — they've got a dry, fluffy hair coat, and then it rains.

"If they get wet, that comfort temperature is going to go up," he notes.

Because of wind chill and moisture, the coldest days for cattle in terms of effective temperature aren't typically in January, when it may dip below 20°, he says. Instead, days in February or March when it's raining, windy and 33° become the coldest.

"That's a lot more cold stress," he notes. The cows' comfort temperature would be around 50°, while the effective temperature is around 20°-25°. "That's a 30-some-degree cold stress," Ames says. "On the other hand, if they were dry and fluffy, their comfort temperature would be more like 20 degrees."

Freezing profits

Cold can put a big chill on profits in a variety of ways, Ames notes. The biggest problem is skyrocketing costs for all that extra feed. Producers know it costs a certain amount every day or every month to feed cattle. During harsh weather conditions, the percentage increase in feed costs can be determined based on the comfort and effective temperatures (see Table 3).

Ames emphasizes that producers should avoid trying to predict how much to feed cows based on a specific day's weather. Instead, they should think in more general terms. "Don't feed your cows based on what it is today, what it was yesterday and what it will be tomorrow," he says. "In the month of January, just plan to feed them 15% more."

Plus, harsh weather can cost producers for feed *not* eaten. Ames says feedlot situations where cattle are forced to walk across frozen or thick mud to reach frozen silage are real management problems.

Severe weather can also affect bovine health and reproduction. "In a primary sense, it involves shortage or inadequacy of energy," Ames says. As secondary effects, immunity to disease is reduced, and milk production can be reduced. In extreme circumstances, bulls can become sterile due to frozen testicles.

Severe cold stress and inadequate nutrition will reduce the ability to get cows bred back, he says. "It's just a matter of how they spent their nutrition."

Cold weather can also have effects all the way down to the end product. "Most people would associate stress

Table 2: Wind chill factors

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	-45	-41	-36	-31	-27	-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

Source: Ames and Insley, 1975.

Table 3: Increased maintenance energy costs for cattle

	Cow weight, lb.				
	800	900	1,100	1,210	1,320
Coat description	--- Percentage increase per degree coldness ---				
Summer coat or wet coat	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	0.7	0.7	0.7	0.6	0.6

Source: Ames and Insley, 1975.

with dark-cutting cattle," Ames notes. "There's no doubt that weather probably plays a role there.

"If you look at the percentage of beef carcasses that are cutting dark through different seasons of the year, they do change," he continues. "There is also data that suggests that dark cutters are more prevalent in some climates than others."

Preventing the avalanche

The first thing a producer should do to prevent weather-related problems, Ames says, is send cattle into the storm in good body condition. Condition is also insulation, he says. "A cow that goes into the winter in better shape will be more tolerant of more cold weather than a cow that lacks insulation.

"Once they get behind, it's like the proverbial snowball — it gets worse fast," he adds.

The second preventative measure is to protect cattle from harsh conditions. However, before a producer even thinks about building a shelter, they must consider the benefit relative to the cost.

"If you look at the impact of hot weather or cold weather on performance and efficiency of animals, they are most efficient in their thermal-neutral temperature, neither hot nor cold," Ames says.

The obvious question then, he asks, is "Why don't we build facilities so they're always in that thermal-neutral temperature?" The reason is that building facilities often costs more than the cost of extra feed to keep animals warm, Ames explains.

"You need to eliminate the extremes in cold and heat down to the point where it's cost-effective, but not beyond that," he emphasizes. Typically, the best solution to eliminate extremes is some form of windbreak or snow fence (see "Out of the Cold," page 22).

Tougher than you think

"Animals have a wonderful ability, especially young ones, to survive cold weather," Ames says. While calves may lose ears or tails to extremely cold weather, he emphasizes that they usually still survive.

Something called "brown fat" allows calves to survive cold weather, Ames says. "It's a special fat cell that's mobilized when animals are cold-stressed and they're young and have those available."

Newborn calves have brown adipose tissue, which, Ames says, "is metabolically impacted by the adrenal hormones and results in the massive production of energy."

A physiological mechanism for producing heat rapidly, it's only effective starting at birth for a relatively short period of time — only a few days. After that, producers must find other ways to protect calves from harsh weather.

"There are mechanisms cattle have to behave differently, to have physiological changes, so they are tolerant of cold weather," he states. "We may want to limit the extreme impacts of cold weather so they're more productive, and we don't spend all our money putting feed in them. But it's not necessarily inhumane to a cow to leave her outside.

"They can tolerate a lot of cold weather, but they need feed if they're going to do that," Ames notes.

Maximizing resources

In areas where it gets very cold but there's very little wind or rain, says Bret Olson, professor of animal and range science with Montana State University-Bozeman, "we're finding that cattle are very tolerant of cold temperatures."

During four different winters, cows were weighed before and after they went on a two-month trial. Animals were not fed hay and only supplemented with a protein cake three days a week. "Our cows went into winter in good condition," Olson says, at body condition scores (BCSs) of 5.5 or 6. "They either gained a little bit of weight, or they lost a minimal amount of weight.

"We have indirect evidence that the cows in this grazing situation lower their metabolic rate and lower their needs," he says. "There are some studies that suggest that when we do feed our cows quite a bit of hay during the wintertime, they elevate their metabolic rate and keep it elevated. Therefore, you need to continue to feed them hay to maintain that elevated metabolic rate."

Another result of the study, Olson says, was that when thinner cows (due to a harsh fall) came out of winter, they actually added backfat. "Usually you think of animals using backfat during the winter as a reserve, but they added backfat," he says. "I think that was since the animals' priority was to put on more insulation to help reduce heat loss."

Cattle also know how to best acquire needed resources from the environment, Olson notes. On sunny days, cattle will stand broadside to the sun to maximize surface area, and on windy days, they stand with their rear ends to the wind to minimize surface area. Coat temperatures measured on sunny days were at about 110º, he explains. "They're absorbing a lot of heat from the sun. The more heat they can get from the sun, the less energy they have to use from their body or from food.

"They have ways to maximize their heat gain from their environment, and they automatically minimize ways to lose heat."