Wind Chill

Providing windbreaks for cattle reduces stress in the herd.

by ***Heather Smith Thomas***

PHOTO BY TRACY KELLIHER

In many regions, wind chill can be a big issue during colder months. Planning ahead for winter weather can save money in reduced feed costs, reduced illness and health costs, and provide an increase in efficiency.

When cattle are stressed by wind and cold, they seek shelter. If there are no natural windbreaks in pens or pastures, stockmen can provide artificial wind barriers to give protection from wind and drifting snow.

David Ames, retired environmental physiologist at Colorado State University, did early studies at Kansas State University on cold weather effects on cattle. He developed wind chill indexes for cattle and established their critical temperatures.

"Realizing the value of windbreaks has come partly from understanding the wind chill factor," Ames says. "The impact of wind chill, in combination with energy requirements for cattle during cold weather, suggests there is a lot of value in feed cost savings, well-being of the animals, etc., if they are protected from wind when temperature drops below their thermo-neutral zone."

Ames says the army developed the wind chill index for humans earlier. He notes the difference between humans and livestock is the presence of a hair coat. In cold weather, the hair coat stands up fluffy with tiny air spaces between the hairs, creating excellent insulation to hold body heat in and to keep cold out. This hair "blanket" works well to keep a cow warm — unless the hair gets wet and flattens, allowing moisture next to the skin. When cattle get wet, or if wind blows hard enough to separate the hair, they are as vulnerable to cold as if they were smooth-skinned.

"If wind blows with enough velocity, the insulating quality of hair is lost," Ames says. "It's like blowing the coat off your back; it blows holes in that hair coat. In those conditions, windbreaks become more important."

Wind speeds become an issue at velocities of more than 10 miles per hour. Ames says the first response of a cow to a wind chill situation is to try to get out of the wind. This is when cattle head for the trees or brush or into a draw or use a manmade windbreak.

Several windbreak designs have been shown to lower energy feed costs in winter.

Variety of windbreaks

In many parts of the country there are no natural shelters, and on some ranches, there are no trees.

"In some instances, ranchers have used big bales of hay, letting cattle eat their windbreak during winter. This works well, especially if you move the windbreak to different locations each year. A windbreak will collect cattle and they crowd there and impact the grass and soil. We put out more bales in different areas the next year," Ames says.

Stacked bales are not the best windbreaks but do give protection for a large area. "There are advantages and disadvantages — but you can move these bale windbreaks every year or even during winter," he explains. "How much effort you want to make in building a windbreak necessitates looking at cost versus benefit."

If cattle are given the opportunity to go into a draw or behind a hill or behind some trees — compared to standing out on flat, bare ground — the cost is low. "But when you start putting posts in the ground to hold a windbreak, and put up lumber, that adds to the cost," he says. "The fact there are windbreaks throughout the West suggests there must be some value, or people wouldn't build them."

Windbreaks in Nebraska feedlots show an economic advantage. Ames says the value is harder to quantify for cow-calf operators but several designs have been shown to lower energy feed costs in winter.

He notes there are good plans for windbreak designs available. Engineers and animal scientists from North Dakota and Nebraska have created worksheets on building windbreaks.

"One famous kind of windbreak in Wyoming is a half circle, because you don't always know which direction wind will come from," Ames says. Half circles can catch a north wind, west wind and a southwest or northwest wind.

"In a half circle you can protect from every direction except an east wind, which is normally not a direction we get wind. I've seen some windbreaks in Wyoming that are more than a half circle," he says.

University of Wyoming Extension Beef Cattle Specialist Steve Paisley says there are many ways to create windbreaks.

"You can buy fabric windbreaks and attach them with zip-ties or lace them to existing panels or fence," he says. "This is a short-term fix that works fairly well."

Paisley says these windbreaks have been used in pens at the University of Wyoming, and though they are not long-term, they have lasted fairly well.

"I don't know how long they actually last, but my parents in western Nebraska have some in their calving pens that have been there for more than 10 years," he says. "I would guess these fabric windbreaks would have at least a five-year lifetime or longer, depending on how well they are attached and how much the wind can grab."

During drives around the countryside, Paisley observes what other ranchers do to provide relief for their herds.

"North of Cheyenne a lot of oil field tires are used as windbreaks," he says. "Up around Douglas and Gillette you'll see abandoned oil storage tanks on their sides. There's probably a low cost solution in your own area, using whatever is readily available and inexpensive."

Portable windbreaks enable producers to utilize pastures that have no shelter, trees or brush.

Advantages of porous windbreaks

Ames says the design of a windbreak is important. "With a solid wall — such as a plywood sheet — wind goes up and over and dips right down behind it. You need openings creating at least 20% porosity. That gives a larger downwind effect, with a greater area behind the windbreak that provides protection."

Porous windbreaks, such as slats on a fence with small spaces between them, work the best in terms of how much area behind them can provide wind reduction. A solid structure only gives protection immediately behind it.

"All you need is about 80% wind blockage," Paisley says. "Much of the research on this was done in the 1970s and 1980s by Bob Jairell, here in Wyoming. He developed most of the snow fences that came into common use."

Wind will go over a solid wall, according to Ames. "If you use slats, some of the air flows through at a much lower velocity, and protects animals much farther out," he says. "If you build windbreaks too high, however, it costs more because you have to use taller posts."

Lorne Klein, grazing and forage specialist at Saskatchewan Ministry of Agriculture, says optimum protection is obtained with a fence porosity of 25 to 33%, which means only 75 to 66% of the windbreak is solid.

"For example, for 25% porosity, you could place 6-inch boards 2 inches apart," he says. "For 33% porosity, 6-inch boards would be placed 3 inches apart. With a porous windbreak, the protected area behind it extends 8 to 10 times the height of the windbreak."

If cattle are standing right next to the wall to be out of the wind, the boards are too close together. A 30% porosity gives a much larger protected area; cattle can benefit from a proper windbreak even when they are 20 feet behind it. This gives more protection to more cows.

Diagrams showing how this factor works and why a porous fence is more beneficial than a solid one can be seen in the document "Portable Windbreak Fences," which can be found at *saskatchewan.ca/agriculture*.

Portable windbreaks

Klein says stockmen in western Canada are discovering the benefits of portable windbreaks. These enable producers to utilize pastures that have no shelter, no trees or brush. The ability to move windbreaks when cattle are moved to other fields is a large advantage over building permanent structures in every field.

Windbreaks must be constructed in such a way that they remain stable and won't tip over in a strong wind. Portable windbreaks need a broad base with the width of the base at least 1.5 times the height to counter the force of the wind and to keep from blowing over. They must also be ruggedly built to withstand the stresses of strong wind and of being moved to different locations.

continued on page 70...

Create windbreaks

There are many variables, and there is no one correct way to build a windbreak. "As long as you can do something that protects animals from wind during cold weather, it will be helpful," says David Ames, retired environmental physiologist at Colorado State University. "You also need to spread cattle out (not all bunched up behind one windbreak) and you don't want them standing in cold water or mud. A windbreak should be on a high/dry well-drained area," he says. Figure out what might work best in specific pastures regarding where to locate the windbreaks and what type to use.

Every ranch is a little different regarding natural terrain and wind direction. The air currents may be different depending on whether you are in a valley, on the plains or situated on a mountainside. "In Wyoming the state has a lot of information available regarding the prevailing wind directions," says Steve Paisley, a University of Wyoming Extension beef cattle specialist. "A lot of wind mapping is already done. If you know the direction of prevailing winds in your area this may help." **HW**

Porus windbreaks work the best in terms of how much area behind the structure can provide wind reduction.

...Wind Chill continued from page 69

Windbreaks must be constructed so they remain stable in a strong wind.

"Whether a windbreak blows over or not is simply a function of three things — the height of the wall, the weight of the structure and the width of the base," Klein says. "The mistake many people make is not having the base wide enough. Most windbreaks here are not extremely heavy because they are built of oilfield pipe and lumber, so they all weigh about the same per foot."

For the windbreak to be secure, the legs need to be 7 feet out, for an 8-foot wall. Total height is usually about 9 feet because most people build them a little off the ground to keep the bottom from being buried in snow. "Many people put the legs out 5 feet on each side, but that's not enough to withstand a strong wind," he says.

Some cattlemen think that porosity of the structure will help keep it from blowing over, but this is not true. The force of wind that results in tipping over a structure is a combination of pressure against the windward side and suction on the leeward side.

A partially porous fence must withstand the same amount of wind force as a solid fence. Force reduction from reduced surface area is offset by increased suction when wind goes through the openings between the boards.

Klein says, "Engineers tell me that the porosity, whether 10% or 50%, creates the same amount of air pressure. There is still suction on the leeward side."

Ease of movement is just as important as the sturdiness of the structure.

"If you have to get off your tractor to move windbreaks, you may not take time to do it," Klein says. "I use a 3-point hitch and move mine once a week. I'm out there with the tractor anyway, and I back up to a windbreak, lift it up, drive forward and drop it where I want it and go get the next one."

It's important for windbreaks to be designed for easy movement using whatever equipment is available.

The end-tow design needs skids or wheels but is easier to move through narrow gates. "Many producers like the side-lift design because they have a front-end loader on their tractor," Klein says.

Windbreaks for feedlots

Paisley says feedlots have different requirements than cow-calf operations.

Terry Mader in eastern Nebraska did a lot of environmental stress studies looking at windbreaks in feedlots," Paisley says. "He found slight improvements in intake and performance in cattle with windbreaks during winter. If windbreaks remained in those pens during summer, however, he saw a decrease in feed intake and performance because the cattle got too hot. In warm weather cattle need a breeze to help keep them cool."

Removing windbreaks or altering them so they don't obstruct wind in the summer can be helpful.

Paisley says at the university's research station, a lot of bulls are tested that are exposed to wind.

"The windbreaks we're using are hinged metal panels," he says. "They act as windbreaks when they are rotated down, and during summer we rotate them up, for shade. In confinement feeding, this gives the best of both worlds. It protects feed bunks from the wind and provides shade in summer." **HW**

Reducing windchill effects pays off

"Cattle can survive in very cold weather, but they'll eat a lot more and their efficiency of production drops. We're looking at a combination of economic factors as well as health and well-being. A good windbreak can be a win-win situation where you improve everything," says David Ames, retired physiologist at Colorado State University.

"When animals start to get cold, it takes about 1% more feed for every degree (Fahrenheit) of cold. With a winter hair coat, cows don't start to get cold at the same temperature as they would if they are wet. With summer hair or when they are wet, they start to get cold at about 50 degrees. As they grow more hair for winter, and it is dry hair, that critical temperature can drop below 20 degrees. When cows' critical temperature is down to less than 20 degrees they may not be stressed at all. For example, when the temperature is 10 degrees on a winter day, and they have a full hair coat, cows may not need any protection. But wind chill can take the temperature down to an effective temperature of minus 10 degrees — and windbreaks have value," he explains.

Some of the coldest days for cattle are when the temperature may be higher but it's wet. "A March day with wet and wind, at 32 degrees, is more stressful on cows than zero on a sunny winter day. A gray, windy wet day in March can make them a lot more miserable. And if they are standing in mud, this is a huge energy drain. If you can alter any of those factors — keep them dry, and out of the wind — this will improve their energy efficiency and lower your energy costs when temperatures are below their critical point."

It's a double whammy if cattle get wet. Their critical temperature is higher and the wind magnifies the cold stress. "Windbreaks can be part of the solution," says Ames.

Steve Paisley, University of Wyoming Extension beef cattle specialist, says that in a cow-calf operation, if a cow's lower critical temperature is taken into consideration (about 20 degrees Fahrenheit) and she is exposed to wind, wind chill begins to affect her feed requirements. "A cold windy day can easily increase her requirements by 30 to 40%, some days. This can be site specific to some extent," says Paisley.

Producers try to balance the expense of putting in a windbreak with what they perceive the benefits or savings to be. A miserable blizzard in late winter or early spring can easily show the benefit of good windbreaks, preventing some of the problems that would otherwise be detrimental or even devastating in a cow-calf herd — such as chilled, stressed calves, pneumonia, frozen ears or frostbitten teats. "A windbreak is just another form of insurance policy, trying to avoid those major wrecks," he explains.

Mother Nature isn't predictable. **HW**

PHOTO BY BECKY HARRELL