Field Studies of Protective Shelters for Beef Calves

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Introduction

For the past 8 years, research scientists at the University of Idaho have conducted a series of controlled experiments designed to determine the effects of cold exposure on young calves. This work stemmed, in part, from field observations suggesting an association between exposure of calves to cold temperatures and excessive moisture under field conditions and incidence of the 'weak calf syndrome'. (11) Results of the experiments indicated that young calves are highly susceptible to the effects of cold exposure and that this stressor may be a direct or indirect cause of death of these animals. Life-threatening changes observed in severely cold stressed calves include subnormal body temperature, (3, 7) decreased concentration of blood glucose, (6) decreased total number of leukocytes in blood, (8) temporary failure of calves to absorb colostral immunoglobulins, (4) and decreased aortic blood pressure and heart rate. (10) Respiratory failure is the usual cause of death of severely cold stressed calves. Other changes commonly observed in cold-exposed young calves include intensive shivering, physical weakness, depression, reluctance to nurse, (3) changes in concentration of blood constituents other than glucose, (6,9) and extensive hemorrhage and straw-colored edema beneath the skin of the extremities. (2, 3)

Protective Calf Shelters

The results of the experiments on cold stress in young calves suggest that producers should provide protective shelter in order to avoid disease and death of these animals due to cold exposure. The need to provide protective shelter for calves is difficult for many beef cow/calf producers since their cattle are often raised in open range country and there is little opportunity to provide artificial shelter. Recently, a manmade protective shelter was patterned after the single calf hutches commonly used for raising dairy calves (1) and was modified for use by beef calves. **The protective shelters for beef calves are open on the front side, and are made of 4′ x 8′ sheets of 5/8″ exterior plywood, 2″ x 4″ supports, corrugated roofing material, and miscellaneous hardware (Fig. 1, 2; Table 1). The completed shelters are 8′ (Width) x 8′ (Depth) x 4′ (Height in the front; 3′6″ height in the rear) and have no flooring. Each shelter is designed to house a maximum of 10 calves at one time (Fig. 3) and costs approximately $125.00 for materials.** An extension bulletin gives details of construction and proper use of the shelters. (5)

Fig. 1. Details of offset view of protective shelter for beef calves (Reference 5).

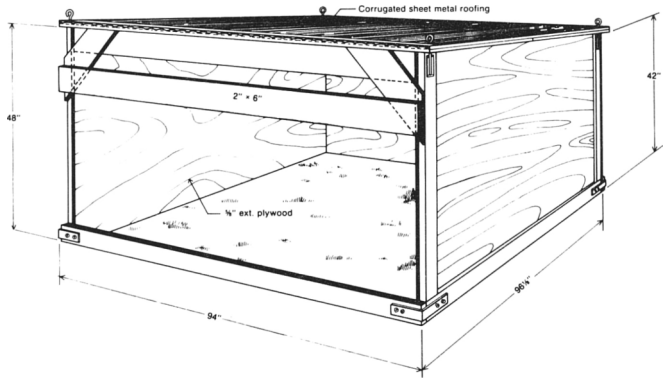
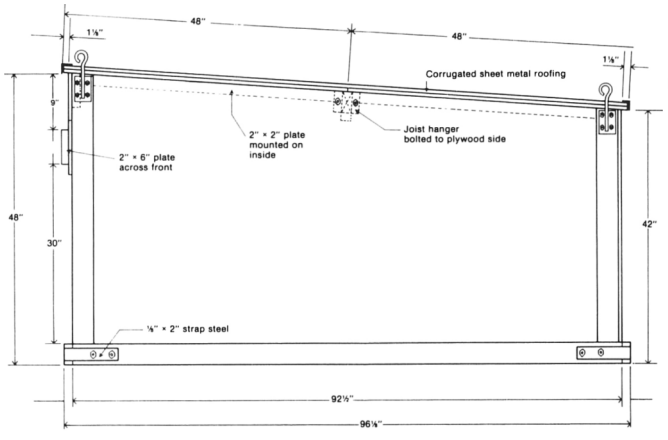


Fig. 2 Details of side view of protective shelter for beef calves (Reference 5).



Field Study

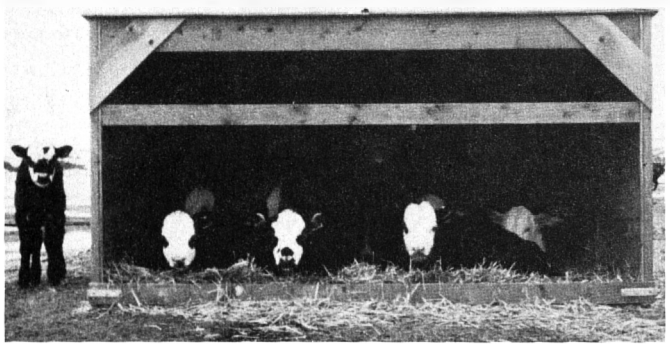
Eight of these protective shelters were constructed for use in a field study in Idaho. The field study was designed to 1) correlate existing weather data with the amount of usage of the shelters by the calves and 2) to determine the feasibility and cost effectiveness of the shelters. With the assistance of

TABLE 1. Bill of materials for protective shelters for beef calves*

No.	Description
5	— 5/8" x 4' x 8' exterior plywood
9	— 2" x 4" x 8'
2	— 2" x 6" x 8'
4	— lb 8d galvanized nails
1	— lb 16d galvanized nails
1	— lb galvanized roofing nails
14	— 3/8" x 3" carriage bolts and washers
4	— 3/8" x 2" carriage bolts and washers
4	— 1/4" x 1 1/4" carriage bolts and washers
4	— 1/2" x 6" eye bolts
2	— 3/8" x 4" lag screws and washers
2	— 2" x 4" joist hangers
4	— 1/8" x 2" x 15" steel strap
4	— sheets 26" (W) x 8'(L) corrugated steel roofing, 31 gauge
2	— 8' metal flashing strips, angled and 1" x 2" on a side
1	— qt wood preservative (must be nontoxic to animals: no penta)
1	— gal exterior latex or oil-base paint

* Reference 5

Fig. 3 View of protective shelter for beef calves under field use.



county extension faculty, 4 beef cow/calf producers (1 located in northern Idaho, 1 in southwestern Idaho, and 2 in southeastern Idaho) were assigned as cooperators. Two shelters were delivered to each of the 4 cooperators before the start of the calving season in January, 1984. A fifth cooperator, located in southwestern Idaho, built his own shelters and joined the field study in 1985. The shelters were scheduled to be placed on the respective ranches for 2 consecutive calving seasons and then relocated to the ranches of other cooperators nearby for further testing and evaluation. Further, the shelters were equipped with weather instruments so that minimum and maximum temperatures outside and within the shelters, relative humidity, and wind speed could be recorded twice a day (early morning and late afternoon). In addition, cooperators counted the total number of calves outside and within the shelters at the same times that the weather data were recorded. **The shelters were placed in fields close to the areas where the cows were fed and moved to adjacent clean ground and rebedded when the old bedding became damp and soiled.** More recently, as many as 35 additional cooperators have joined the field study to further test the effectiveness of protective shelters for beef calves. Part of the latest group of cooperators is located in a 5 county area in southeastern Idaho, and they are affiliated with the Idaho Total Beef Program Integrated Resource Management (ITBP IRM) SEIVB Project. The ITBP IRM SEIVB Project is designed in part to develop new management practices to improve survival and performance of beef calves. The remainder of the new cooperators are located in northern Idaho and are also part of a separate ITBP IRM Project.

Results

The weather and other data collected in the field study have been summarized for each of the 5 original herds and also for a 6th herd that was part of the 5 county ITBP IRM SEIVB Project. In addition, attempts were made to determine possible correlations between selected weather observations and the proportion of calves located within the shelters. There was considerable variation in temperature and relative humidity data recorded between herd locations due to differences in weather patterns in different locations and to differences in time of the calving period. Nevertheless, similarities were found between herds with regard to several of the weather variables (Table 2). In the majority of cases, the average temperatures within the shelters in the morning and afternoon were only slightly higher than the average respective temperatures outside. Further, the change in temperature within the shelters from morning to afternoon was almost exactly the same as the change in temperature outside for the same period. The high and low range of temperatures within the shelters and outside reflect the extreme differences in temperatures recorded depending on herd location and prevailing local weather conditions.

TABLE 2. Average and high/low temperatures within and outside the calf shelters

	Observation	
Temperature	Morning	Afternoon
Within the shelters	31.2±4.4°F*	44.0±1.6°F
Range — within the shelters High	41.0°F	41.7°F
Low	11.5°F	38.3°F
Outside the shelters	30.4±5.0°F	43.4±1.9°F
Range — outside the shelters High	37.6°F	48.4°F
Low	10.8°F	39.2°F

* Mean±SEM; degrees Fahrenheit.

The differences between the minimum and maximum temperatures within the shelters and the minimum and maximum temperatures outside reflect the changes in temperature that occurred between reading periods and were similar in all herds (Table 3). The differences between minimum and maximum temperatures within the shelters

noted for the morning and afternoon readings were similar in magnitude to the respective changes in morning and afternoon temperatures outside. These results along with those from Table 2 suggest that the temperatures within the shelters changed primarily as a result of normal changes in outside temperature rather than from a warming effect that may have occurred while calves occupied the shelters.

TABLE 3. Difference between minimum and maximum temperatures within and outside the calf shelters

Min/max temperature difference	Observation	
	Morning	Afternoon
Within the shelters	14.8±1.7°F*	17.5±3.4°F
Outside the shelters	16.0±3.1°F	20.8±2.6°F

* Mean±SEM; degrees Fahrenheit.

In general, the windspeeds recorded near the calf shelters were not excessive and they remained relatively constant throughout the day (Table 4). Windspeeds were not recorded within the shelters and were assumed to be minimal since the open side of the shelters almost always faced away from the wind source. On some ranches the shelters were placed in areas that were protected by surrounding hills, foliage, and trees and the windspeeds there were comparatively low. On other ranches the shelters were placed in open fields with little or no natural protection where the windspeeds were generally higher. The combination of speeds between 3½- and 5-MPH generated a chill factor that lowered the actual air temperature by approximately 5° F. However, in many instances there were temporary gusts or sustained high winds and the average windspeeds during these periods were much higher than the averages reported in Table 4. Under these circumstances the actual air temperatures were from 15 to 30° F lower than the average temperatures reported because of the chill factor produced by the high windspeeds.

TABLE 4. Windspeeds outside the calf shelters

	Observation	
	Morning	Afternoon
Windspeed (miles per hour)	5.1±1.0*	3.6±1.1

* Mean±SEM.

As expected, the relative humidity values were quite high primarily because of the low air temperatures although the actual quantity of water vapor in the air was low. Further, there was little difference between the relative humidity of the air within the shelters and the relative humidity of the outside air. This indicates that the air within the shelters did not become heavily laden with excessive water vapor during the times the calves occupied the shelters. Moreover, none of the cooperators reported seeing an accumulation of frost on the inside walls or ceiling of the shelters. Previous work by other researchers has shown that the small amount of water vapor in cold air has little wetting effect on the haircoat and skin of animals.

Attempts were made to correlate selected weather data with the proportion of calves that occupied the shelters. Regardless of the time of day, the best correlations were negative ones found in association with the outside air temperatures. For example, as the minimum and maximum outside air temperatures decreased, there was a corresponding increase in the proportion of calves within the shelters. The clearest association was seen, however, between a decrease in the average outside air temperatures and an increase in shelter usage by calves. This increase in the proportion of calves within the shelters with decreases in outside air temperatures was linear and there was no sharp increase in shelter usage as the outside air temperatures decreased below a certain threshold point. There were no strong correlations between shelter usage by calves and the other weather data collected such as air temperatures within the shelters, windspeed, or relative humidity.

Comments and Experiences of Cooperators

Further evidence of the value of protective shelters for beef calves comes from the comments and experiences of the cooperators with the field study that were willing to try the shelters as a new management practice. Following are excerpts of the comments and experiences of these cooperators.

"The calves quickly started to use the shelters both day and night. I suppose this was partly due to the fact that the snow depth was well over 2 feet and inside the shelters was the only dry place to bed." "...a wooden grain trough...was placed in close proximity to both calf shelters so calves would not have to go far to nurse and would go back to the shelters afterwards. This was especially important in bad weather." "Once or twice in the middle of the night, a cow was bawling because she couldn't find her calf. We were worried it was in the ditch, but it was in the shelter, all warm and dry." "As the weather became worse we noticed a few cases of scours in all our calf lots, but the calves in the shelter lot seemed to get over the scours faster because they could get out of the rain and wind and dry off once in awhile." "...calves that have been in the shelters haven't had near the health problems the others have had." "We had one calf that was sick with scours and pneumonia for over 2 weeks and he was always in the calf shed when we checked on them and doctored. That calf came through the bad weather and made it." "When the weather became sunny and temperatures got up to bearable levels during the day... the calves discontinued use of the shelters almost altogether." "I would really recommend this to others...it seems to be a real calf-saver."

"The calf sheds have worked out very well for me." "The calves appear to do so much better when they are in the sheds where they are dry. It was evident the protected

calves were more comfortable, since they left the shelter to eat and then returned immediately after finishing. The calves still head for the sheds when a rain comes up. It always surprises me how quickly new calves find the sheds after they hit the ground." "...if a rancher saves just one calf he otherwise would have lost to the weather, the unit is paid for."

"All calves were exposed to shelters and they used them every day. There have only been a very few days that the calves didn't spend time in the shelters. This no doubt has been one of the worst winters on record—some herds in the valley have lost as high as 40% of their calves. We were very fortunate to calve 95%, but it was due to the calving facilities we have, calf shelters and many tons of straw." "...shortly after the first 2 shelters were placed in this field, a very severe snowstorm hit. The next day we discovered the shelters packed with calves. After the storm abated, those inside showed no ill effects, but it took the others 3 days to get over it." "There's no question in my mind that they're saving us a lot of trouble." "The shelters are a testimonial to me that we can minimize death loss and sickness."

"I was pleased with the way the calves used the shelters and it was sure good to know that the calves had shelter and a dry place to lay on those cold stormy nights."

Summary

Adequately fed calves are usually able to generate sufficient body heat from their natural food supply to maintain normal body temperature. Calves often lose more body heat by convection and evaporation than they are able to generate when they become wet from exposure to rain, snow, and excessive ground moisture and when exposed to high winds. **Evidence obtained so far suggests that the protective shelters described here help decrease the loss of body heat of calves by providing a clean, dry, and wind-free environment. In addition, sheltered calves may suffer less disease and respond better to treatment than nonsheltered animals. As an investment, the value of protective shelters can be measured in terms of improved survival and performance of calves.**

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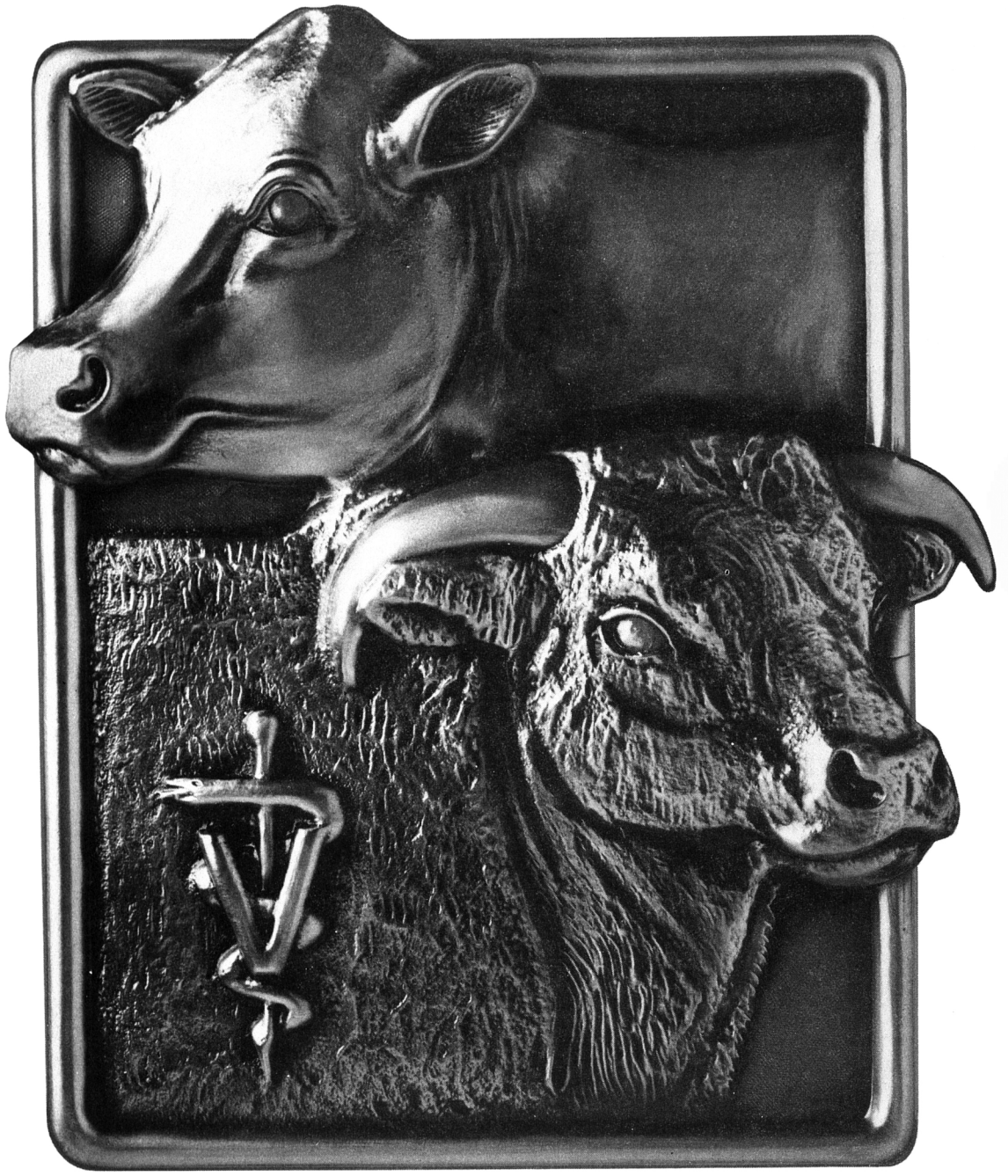

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