Watering Livestock During Northern Plains Winters

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Watering livestock in the winter in the northern plains can be frustrating. Over the years, new techniques have been developed and new waterers invented to help with this chore. None are perfect. As a reliable waterer, the free-flowing spring offers many advantages except it is often in a less than desirable location and not available to many producers. Increased genetic potential of cattle necessitates better care, including frequent watering. This article gives a brief review of the development of watering systems for cattle and compares some of the current commercial water fountains.

Water is an essential feed for cattle. Canadian research suggests cows will eat snow after a short adaptation period (not watered for several days). However, for health and feed efficiency, it is recommended to provide ice free water to cattle daily. National Research Council Nutrient Requirements for Beef Cattle (1984) water requirements are given in table 1.

Table 1. Water Requirements for Beef Cattle[a] (Gallons/Day).

Type Animal	Wt. (Lb)	Temperature[b] 40°F	Temperature[b] 70°F
Growing Calves	400	4.0	5.8
	600	5.3	7.8
	800	6.3	9.2
Finishing Cattle	800	7.3	10.7
	1000	8.7	12.6
Wintering Cows	900	6.7	9.7
	1100	6.0	8.7
Lactating Cows[c]	900	11.4	16.9
Bulls	1600	8.7	12.6

a) NRC Nutrient Requirements for Beef Cattle, 1984
b) Water intake up to 40°F is relatively constant
c) Varies with milk production

Prior to the availability of electricity, small numbers of cattle were usually watered by hand operated pump jack on the farmstead. Large water tanks were partially covered and insulated with straw and soil to reduce heat loss. Several of these units are still in use in combination with wind or electric pumps. Some cattlemen use tank heaters fueled by wood, coal, fuel oil, propane or other combustible material to keep the water thawed. In remote areas larger tanks may be used to retain latent heat of water coming from the ground.

Electric water pumps and pressure water systems increased the number of animals that could be watered and reduced the labor required. Early automatic water fountains were designed to operate in moderate climates but often were not dependable in severe weather. Energy efficiency was not as critical a factor in the early years of automatic water fountains.

In recent years, energy consumption has become more critical. New designs and new materials have made possible several new water fountain designs that have potential for reducing maintenance time and energy consumption for watering livestock in the winter. Three years ago, a field trial was started at the Carrington Irrigation Station Livestock Unit to evaluate the energy consumption and operation of different water fountain designs.

Five different commercial water fountain treatments were installed prior to the winter of 1982-83. The standard automatic metal fountain (Treatment 1) has an electrically heated reservoir that provides ice free water to livestock.

A float valve is centrally located under a protective cover for easy maintenance. Two widely used waterers were used to represent this design, a Ritchie No. 5, rated at 500 watts (photo 1), and a Pride of the Farm Model WE-4 (photo 2), rated at 600 watts. Treatment 2 was a home-insulated version of the standard metal fountain. A Pride of the Farm was super insulated with 4 inches of styrofoam (photo 3) around the outside of the waterer protected by a custom made plywood cover. Diagram 1 gives an expended perspective of one method of super insulating a fountain. Treatment 3 was a Bohlman concrete fountain Model 75, rated at 298 watts (photo 4). This fountain is the same basic design but uses a poured reinforced concrete frame insulated inside with 2 inches of rigid board insulation. The fourth design was a recirculating waterer (photo 5) that required no supplemental heat. The Johnson Artificial Spring (Treatment 4) has a submerged 120 volt, 2 amp

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pump that runs continually to recirculate water through a 3/4-inch diameter pipe from a fiberglass reservoir 10-feet in the ground to the surface bowl. An adjustable overflow pipe allows water not consumed by livestock to fall back into the buried reservoir. The constant motion of the water in the surface bowl and the ground heat surrounding the buried reservoir prevent freezing. A float valve on the buried reservoir opens when cattle consume water in the

Photo 1. Standard Metal Fountain, Ritchie No. 5.

Photo 2. Pride of the Farm, Model WE-4.

Photo 3. Home insulated water fountain.

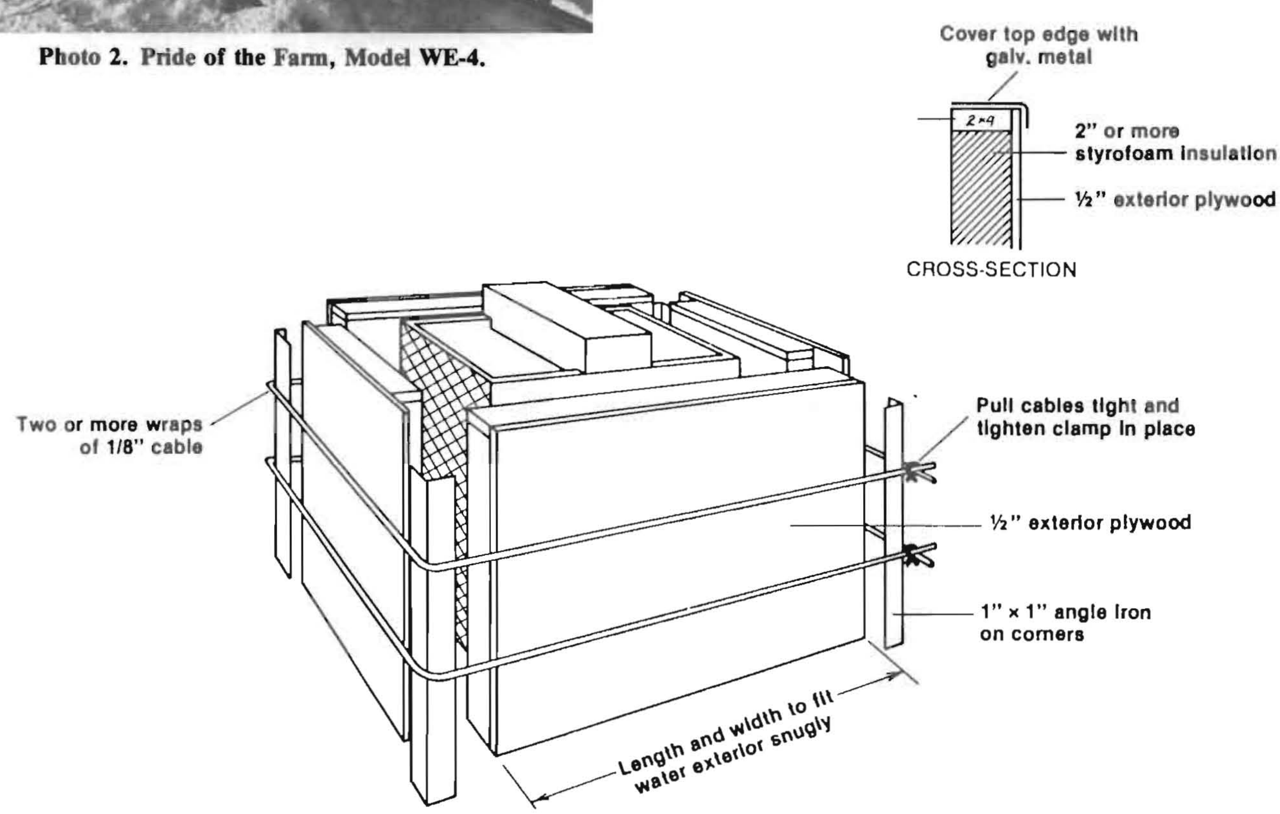

Diagram 1. Superinsulated Livestock Water Fountain

surface bowl and the level in the buried reservoir drops (see diagram 2). Treatment 5 was an energy free waterer. The Mirafount (photo 6) is a super insulated waterer that utilizes residual heat of the water coming through the buried lines and periodic replacement of the water in the 40 gallon reservoir to keep from freezing. A heat well 15 inches in diameter installed to a depth of 10-feet provides a place for the 3/4-inch diameter insulated feeder line to come up to the waterer from the buried water line. Drinker floats block out the cold winter wind and reduce heat loss from the surface of the water. Cattle must push the float down in order to drink (see diagram 3).

Waterers in treatments 1, 2 and 3 were installed over a 12-inch plastic pipe heat well that extended 8 feet into the ground. Water lines are buried at approximately 8 feet. All waterers were installed in fenceline installations with 20 to 30 head of cattle on each side. Wateres were installed approximately 50 feet from any buildings with wind protection from trees and wind fences no closer than 50 feet. Water temperatures were checked periodically in the electrically heated fountains and maintained at 40 to 50 degrees. Each waterer was connected on a separate circuit to a kilowatt hour meter. Energy consumption was

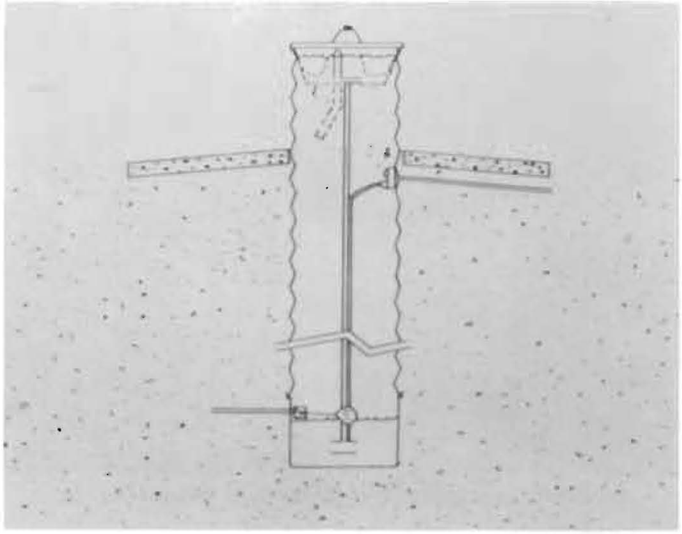

Diagram 2. Schematic diagram of recirculating fountain.

Photo 6. Mirafount energy free waterer.

Photo 4. Concrete water fountain, Bohlman.

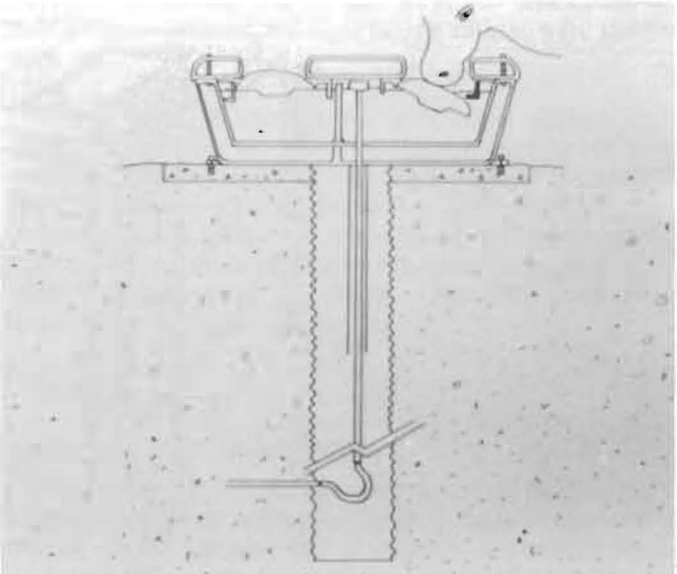

Diagram 3. Schematic diagram of energy free waterer.

Photo 5. Johnson Artificial Spring recirculating fountain.

monitored from early November to late March, the normal heating season for stock waterers in North Dakota. Ambient temperatures are reported in Figure 1.

RESULTS AND DISCUSSION

All waterers required some maintenance during the trial. A 36-watt electric heat tape was installed on treatments 1, 2 and 3 to avoid freezing of the feeder line from just below the ground surface up through the feeder valve assembly. Water dripping from animals' chins accumulated as ice around all waterers and had to be manually removed. Accumulated ice from spillage was noticeably more severe around the unheated type waterers.

Temperatures during the first winter were the second warmest on record and provided little challenge to the waterers. The second winter provided more of a test with several weeks of near record setting cold. The third winter was more typical with intermittent periods of mild weather and extreme cold. Extreme cold (ambient temperatures of −20° F or wind chills of −50° F and colder made occasional thawing of the standard fountains necessary. It was necessary to periodically remove the surface ice from the bowl of the Johnson Artificial Spring when wind chills approached −100° F and below. In every case, a pail of hot water was sufficient to thaw frozen areas and render the waterers serviceable.

Electrical usage is reported in table 2. Electricity was turned on for an average of 140 dys. Occasional checking of water temperatures in the standard fountains is recommended as the thermostats may drift. Average daily electrical cost for each of the waterers at $.08/KWH is given in table 2. Initial costs for each waterer are also given. Electricity costs for waterers in treatments 1, 2 and 3 were proportionally the same during each of the three years in the trial. Operating the Johnson Artificial Spring on a timer could substantially reduce the energy costs. Depending on the number of cattle serviced, the unit could run for an hour in the morning and an hour in the evening for 1/12

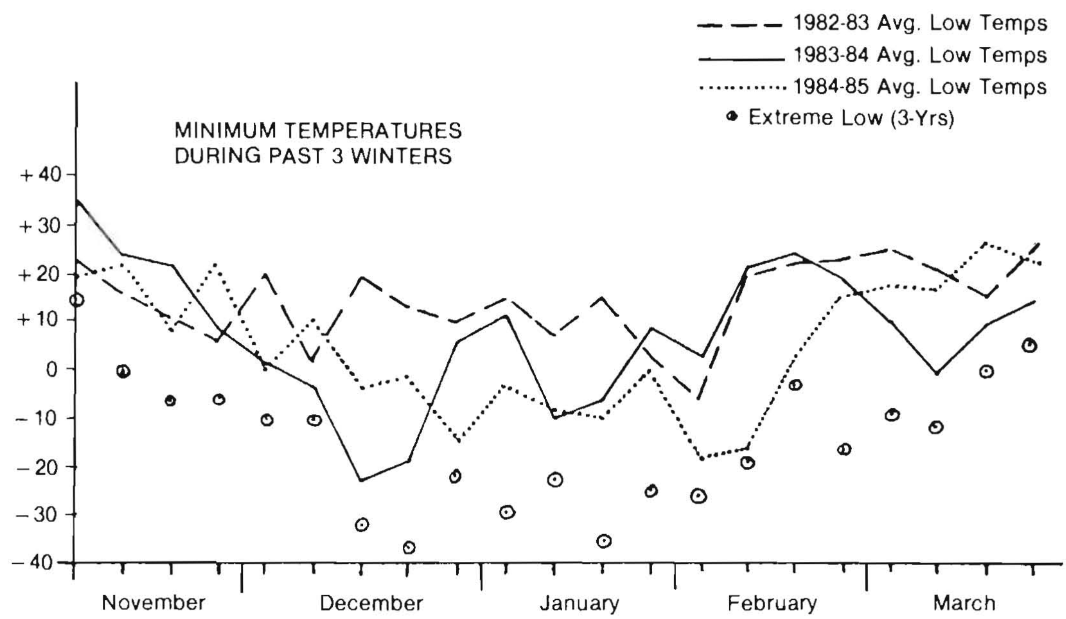

Figure 1.

Table 2. Livestock Water Fountain Electrical Usage 1982-1985.

	Standard Metal Fountains			Super Insulated Std. Fountain	Concrete Fountain	Recirculating Fountain	Energy Free
Brand	**Pride of the Farm**	**Pride of the Farm**	**Ritchie**	**Pride of the Farm**	**Bohlman**	**Johnson Artificial Spring**	**Mirafount**
Model	WE-4	WE-50	No. 5	WE-4	Model 75	—	2 Hole
Suggested Retail Price	281.75	300.00	304.99	281.75 + insul.	338.95	460.00	695.00
Avg. Electrical Use/Day (KWH)	9.99	9.32	8.70	7.65	6.31	5.40	0
Cost/Day@$.08/KWH	.80	.75	.70	.61	.50	.43	0
Cost/Winter, Avg. 140 Days	111.89	104.38	97.44	95.40	70.67	60.48	0

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the cost of constant operation. A self-draining feature prevents freezing of the water in the bowl when the pump is not running. The Mirafount's manufacturer recommends a minimum of four head to keep the waterer operational. However, in periods of subzero cold and cold winds, the authors recommend no fewer than 10 to 15 animals drinking out of this unit. A few animals found it difficult to learn to depress the drinker float to the water in the Mirafount. Manufacturer redesign on later models has reduced this problem. Specific installation instructions and supplies are provided with all waterers and should be followed closely, especially with energy free waterers. Close observation is needed to see that all cattle drink.

Increasing the energy efficiency of currently installed waterers is possible. Extra insulation on the outside can save several dollars in electrical costs each year. Likewise, extra inside insulation and sealing of air leaks can reduce energy loss. Some producers have rotated the waterers 90 degrees to recommended fenceline installation and covered one side to reduce heat loss from air movement under the valve cover. Pride of the Farm offers a thermal blanket, a ¼-inch thick sheet of closed cell foam cut to fit over the water surface to reduce heat loss from surface exposure. Cattle drink by pressing this thermal blanket down. Manually covering fountains with fitted covers or tarps during periods of extreme cold or at night is another energy saving technique.

Several new models of waterers have been introduced recently that are not represented in this trial. Energy saving is the main emphasis of these new designs. New materials and technology offer cattlemen more choices than ever for handling the winter watering chores. Initial cost, energy efficiency, parts availability, presently used waterers and number and kind of animals serviced will all effect what type or brand of waterer is best for each producer. No system is foolproof. All require some attention to insure proper function in the frigid northern plains winters.

This field trial will continue to evaluate new designs in livestock waterers for energy efficiency and reliability under the extreme winter conditions experienced in North Dakota.