Water Livestock
the AUTOMATIC Way

by
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MISSOURI FARM ELECTRIFICATION COUNCIL INC., COOPERATING
Tests Prove Worth of Tempered Water

(From USDA, Iowa, California, Purdue Experiment Stations and 1960 Yearbook of Agriculture)

Pigs supplied water at 45°F gained 10 pounds more than pigs watered twice daily during a six-week period when weather was cold enough to freeze water much of the time.

Automatic waterers for dairy cows increased yields of milk 3.5 to 4.0 percent and butterfat 10.7 percent over twice-daily hand watering.

Warm water increased steer gains by 8.9 lbs. for a 112 day test, reducing hay, silage and barley feed intake at the same time.

Summer drinking water cooled to 65°F increased beef cattle gains by 0.26 to 0.44 pounds per day per animal compared with steers getting uncooled water at 88°F.

Automatic waterers eliminated one-fifth of the hog feeding chore work, compared with hand watered operations.

Acknowledgment

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Water Livestock

the Automatic Way

Advantages of Automatic Waterers

A constant supply of water is one of the most essential factors in livestock feeding programs; yet it is often overlooked. Drinking water helps to regulate the body temperature of animals. The temperature of the water is important for maximum efficiency in converting feed into energy, pounds of gain, and livestock products. Both large and small feedlot operators recognize automatic waterers as a must in any confinement feedlot or structural planning.

Automatic livestock waterers assure animals a continuous year-round water supply at low cost. In winter, a small amount of heat keeps the surface ice-free. As the trough holds only a few gallons, the water is kept cool in summer. Clean, fresh water flows in automatically. This eliminates the drudgery of hauling water and conserves time and human energy. There is no fuel to carry or ice to chop during cold weather.

The cost of warming water for livestock and poultry is low. Based on Missouri studies, it will vary from one to eight cents per unit per day.

Once adjusted, automatic electric waterers require little attention. They can be used safely in or near farm buildings. With 100 steers, the cost of owning and operating an electric waterer is about 20 to 25 cents per animal per year.

Research data will help you estimate specific dollars and cents value of automatic waterers for your present or proposed livestock enterprise. You can use the current price of beef, pork, or milk in your calculations. But be sure to use the right operating time factor.

In Missouri, we would normally expect a four and-a-half-month heater operating period, November 15 to April 1, with advantages from warm water based on this period of use. Cool water advantages can be estimated from California data but it is questionable whether these would be as great under normal summer conditions in Missouri or for as long a period of time.
Waterer Tests--Missouri

Different types of automatic electric livestock waterers have been studied in north and central Missouri to obtain performance data under typical Missouri winter conditions. Primary factors considered in an evaluation of operating costs were: type, location, and design of waterer; water temperature, length of test period, and number of livestock served. All waterer operating costs are based on an energy cost of two cents per kilowatt-hour. Outdoor temperatures during the test periods were within 5° of season normal. The following data were obtained from a study of 27 waterers which included four basic types.

GENERAL PURPOSE DRINKING BOWLS were of cast aluminum, mounted on a concrete pedestal. Each unit used a 150-watt heating element equipped with a non-adjustable thermostat. Bowls located in semi-enclosed barns served from 7 to 10 calves and operated from January 1 to March 12 at a unit cost of $3.75. Outside bowls serving an average of 3 to 4 mature dairy cows operated during the same period for a unit average cost of $4.20.

HOG-TYPE WATERERS commonly have two or four trough compartments each with removable lids and designed for fence line installation. One 2-trough unit, with 325-watt heating element and adjustable thermostat served 100 fattening hogs in an open lot. The operating cost of $11.70 for a 71-day period was higher than normal for two reasons: water temperature was kept above that of incoming water and lids were not kept in place. Another unit, mounted on a pedestal, served four dairy cows for $1.45.

CATTE WATERERS: All of these were located outside. Five, installed in protected areas, served an average of 25 milk cows at a cost of $6.78 per unit for the season. Average water temperature was 54° F. One waterer located below a farm pond served 46 dairy cows at a cost of $8.15. Water temperature averaged 51° F. All units were equipped with adjustable thermostats. Heating elements varied in size from 600 to 750 watts. None had covers but three were insulated.
COMBINATION CATTLE-HOG WATERERS: These were similar to cattle waterers but had hog troughs on the sides. Eight outside units averaged $8.05 for the test period; two inside units averaged $47° F in upper and $49° F in lower troughs. From seven hogs and twelve beef cattle to 70 hogs and 48 beef cattle were served by various units. Heating elements varied from 787 to 1250 watts. All were controlled by adjustable thermostats. Most had lids on lower but not on upper troughs.

OTHER WATERERS: Most sheep waterers are quite similar to cattle waterers in design, construction and in cost of operation. The primary difference is trough height. The first cost of a conventional two-trough sheep waterer is about $45 to $60; for the larger six-foot-long feedlot size, from $100 to $130.

A continuously circulating hog watering system serving 36 pens at the Missouri Swine Testing Station operated for a cost of $8.92 per month during a normal winter period. It must be kept in mind, however, that this underground piped system keeps water in the bowls warm in winter and cool in summer. Consequently, the annual operating costs must be calculated on a year-round basis. The initial cost of the circulating water-bowl-tank assembly varies from $200 to $400, depending upon pressure head against which the pump must operate. Each water bowl assembly costs about $22 for the hog and $27 for the cattle bowl unit.
Effect of Location

Figure 1 shows the average amount of electricity used for each of four types of waterers. The figure after each type tells how many of that type were included in the test.

Waterers in protected areas used less electricity than those in exposed locations. Excepting the outside hog waterer, larger units used more electricity. The size of the heating element had little or no effect upon operating costs. Insulation on the inside of some units and covers on the hog throughs of combination waterers reduced heat losses.
Temperature Setting Influences Cost

Figure 2 shows the increase in operating cost due to an increase in water temperature. All costs are figured at two cents per kilowatt-hour. Cattle waterers had adjustable thermostats. The general-purpose bowls had non-adjustable thermostats. All waterers were located on a University farm, in adjacent lots and on the south side of an open shed with an equal amount of protection from winds.

The average air temperature between January 12 and February 6 was $26^\circ F$. The average temperature for the January 12-February 27 period was $33^\circ F$.

While none of the costs are excessive, the $4.5^\circ F$ higher temperature in one cattle waterer increased operating costs 93 percent. Keeping the temperature in bowl-type waterers at $77.5^\circ F$ increased cost 114 percent, compared with the cost of keeping it at $56.5^\circ F$. 
Select Waterers Carefully

When selecting a waterer, consider the number and kind of livestock to be watered. Choose the size of waterer that best fits your needs. Waterers suitable for open lots may not always be best for fence-line locations or for enclosed livestock structures.

The electric heating element should be moisture resistant. Sides that can be vented in summer will reduce condensation on parts under the drinking bowl. An adjustable thermostat is recommended. Waterers should be sturdily built to withstand rough livestock treatment as found in confined feeding operations. Insulation and covers are desirable to save electricity and keep water clean. Repair parts should be designed for easy cleaning and located where waste water will move directly to drain or pit.

The inlet valve should have enough capacity to refill the trough as fast as animals drink water from it. Submerged inlets should be avoided, especially when purchased for use on farms producing Grade A milk, as they will not meet with the approval of all milkshed authorities. If waterers are attached to any public water supply, they must be a National Sanitation Foundation (NSF) approved unit and should be approved by the local water supply district.

Drinking bowls water from 25 to 30 animals and cost about $50 each. Hog-type waterers serve from 50 to 200 hogs and cost from $50 to $90, depending upon the size, shape, and construction features.

Cattle waterers serve from 75 to 100 animals with initial cost ranging from $90 to $150. Combination waterers are similar to these except that one or more hog troughs are built into the sides. Normally used, combination units will water up to 150 head of cattle and 250 hogs and cost from $100 to $200. A six-foot-long commercial feedlot waterer will handle more cattle and will cost about $300. Drinking troughs made of cast iron, stamped steel, or fiber may be obtained on many units of either type. Most of these are now equipped with one inch of fiberglass insulation with covers optional.

Where housed in modified environmental structures, heated waterers are not usually needed. Here, drinking cups for individual animals or for use in small pens may be the best solution. These units may cost from $8 to $15 each.

Install Properly

Place waterers in protected areas when possible. Fenceline locations will serve two or more lots. Installation costs are less when waterers can be located near existing water and electric lines. On a scaled drawing of your farmstead, mark the location of underground water pipe and electric wiring so that you and future operators will have a permanent record of this equipment. Install waterers as shown in Figure 3. Be sure to mount the waterer on a concrete base to avoid mudholes. Set waterer on a 2 to 4 inch pedestal to prevent water from entering tile and to reduce corrosion of waterer base. A tight-fitting base is needed to seal out cold winds.

PLACE WATER LINE risers inside a length of 8 to 12 inch diameter tile. Install a shut-off valve in the line to facilitate removal or repair of the waterer. A faucet with hose connection may be installed under a large waterer to eliminate the need for a nearly frostproof yard hydrant.

ELECTRIC WIRING to the waterer may be of the underground type. In some instances, both underground and overhead cable will be used, as shown in Figure 3. When electrical conductors are buried, use type UF (Underground Feeder) or type USE (Underground Service Entrance) cable at a minimum depth of 18 inches. The selection of wire size for satisfactory operation of each waterer is of utmost importance. Wire size depends upon the size of electrical load, line voltage, and distance between waterer electric meter. The tables in Figure 4 show the proper size of both underground and overhead weatherproof, copper conductors to use for given distances and for typical waterer heating loads. If not sure of heater wattage,
FIG. 3—IMPORTANT FEATURES OF PROPER WATERER INSTALLATION

Install wiring to meet all safety requirements. Consult the farm service representative of your local power supplier or a competent electrician.
FIG. 4—TABLES BELOW CAN BE USED TO DETERMINE WIRE SIZE FOR ELECTRIC WATERERS

Table I. Copper Conductor Size for 115-120 Volt Heater Loads Shown\(^{(a)}\) (Minimum Size vs Length of Run in Feet for Underground Conductors)

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<th>Load in Watts</th>
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<th>100' in</th>
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\(^{(b)}\) Note: If overhead wire is used, wire size in shaded area must be increased to No. 10 AWG, minimum.

Table II. Aluminum Conductor Size for 115-120 Volt Heater Loads Shown\(^{(a)}\) (Minimum Size vs Length of Run in Feet for Underground Conductors)

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\(^{(a)}\) Wire size based on 3 percent voltage drop.

\(^{(b)}\) Either Copper or Aluminum conductors in overhead-spans must be at least No. 10 AWG for spans up to 50 ft; No. 8 is minimum for longer spans.
check with the manufacturer. Keep in mind that overhead wiring must be strong enough to withstand wind, ice and snow loads. Therefore, never use smaller than No. 10 AWG copper weatherproof conductors for overhead use.

Figure 3 shows many important installation features. For instance, each waterer should have its own rain-tight disconnect switch. Fuse only the "hot" wire with the size fuse recommended by the manufacturer (maximum size is usually 5 amp for small and 10 amp for large waterers). Where underground conductors extend up a pole, place in a smooth pipe or conduit to protect from livestock or mechanical equipment damage.

All electric waterers must be properly grounded to prevent electrical shocks and reduce lightning damage. Underground metal water pipes do not serve as an adequate ground under all soil conditions. Some waterers have an insulating gasket at the pipe-waterer connection. Therefore, when either metallic or plastic water pipe is used, drive a separate ground rod or pipe into the soil to a minimum depth of 8 feet. Use a ¾-inch galvanized iron pipe, a ⅝-inch steel rod, or a ½-inch copper rod. Then bond the waterer frame, the ground rod and the switch box to the electrical system neutral conductor, preferably with a No. 8 or larger bare copper conductor. Always use approved grounding clamps.

Regular Maintenance Important

Proper care can greatly increase the operating efficiency and life expectancy of your automatic waterers. Here are a few important points to remember:

1. Clean and flush drinking troughs frequently for good sanitation and operating efficiency. Keep waterer base clean to prevent excessive corrosion.

2. Maintain a water temperature warm enough to prevent freezing. While some livestock producers feel that a higher temperature is justified, a thermostat setting of 45°F is usually satisfactory. Check water temperature in early winter and adjust accordingly. Check and adjust float periodically to reduce water losses.

3. In the fall, look for loose electrical connections, cracks in cable insulation and broken grounds. With fuse removed, make repairs before the heating season. Replace any loose or damaged insulation with a mastic seal when weather is still warm. Replace broken lids.

4. In early spring, turn switch off. If so equipped, open vents to allow summer air movement through unit, reducing condensation, and keeping unit in good condition for the next season.

A report on Department of Agricultural Engineering
Research Project 282-1, Farm Electricity.