Trick Tanks: Water Developments for Range Livestock

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Highlight

Trick tanks with large rain collectors may provide water for livestock at half the cost of hauling, with an added benefit of shelter.

Rangelands often are virtually useless unless livestock drinking water is hauled in. It may be more efficient to collect precipitation in such areas. This note describes precipitation-collecting devices and water storage tanks, commonly called "trick tanks," used on the Wild Bill range[2] in northern Arizona.

General Construction

The water collector was constructed from corrugated roofing material; a metal tank of the desired storage capacity was placed underneath (Fig. 1). This elevated precipitation collector was developed especially for near-level terrain, or extremely rocky conditions where underground installations would be prohibitive. A 6- to 8-inch steel rim was placed level on the ground and filled with cinders to support the tank. Treated timbers were used for the frame and supports of the collector. Since the tanks are aboveground, livestock drinkers are filled by gravity flow (Fig. 2). Pipes (B) and valves can be protected from freezing by connecting the vertical pipe (A), which extends above the collector surface. Water will then drain from the pipes on demand as though the tank were empty.

FIG. 1. Intermediate-size (8,600 gal) trick tank for storing livestock drinking water.

Three sizes of trick tanks were constructed on the Wild Bill range. Costs varied from $0.38 to $0.45 per gallon of tank capacity (Table 1).

Collector Size

To determine the collector size, several steps are required: (1) Establish amount of water needed, when, and

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[1] Forest Service, U.S. Department of Agriculture. The study was conducted in cooperation with Northern Arizona University; central headquarters maintained at Fort Collins in cooperation with Colorado State University. Manuscript received September 26, 1968; accepted for publication January 10, 1969.

[2] Pearson, Henry A., and Donald A. Jameson. Relationship between timber and cattle production on ponderosa pine range: The Wild Bill range. 10 p. USDA Forest Serv., Rocky Mountain Forest and Range Exp. Sta., Fort Collins, Colo. 1967.

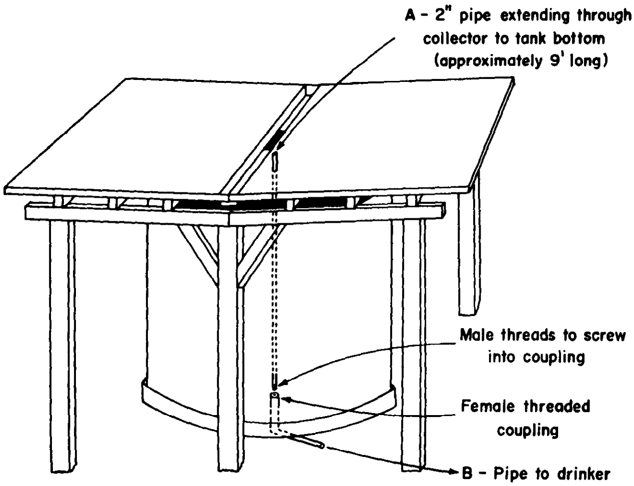

FIG. 2. A 2-inch pipe serves as the water cutoff when drinker and float valve are not in use. When pipe A is connected to pipe B, the pipe and valve assembly will drain as though the tank were empty.

for how long, (2) establish size of storage tank to meet these requirements, and (3) determine the amount of precipitation during dry years, including how much may be expected each month. The formula for collector size is:

$$W = \frac{C}{L \times P}$$

where:
- W is collector size required in ft^2,
- C is capacity of the storage tank in ft^3 (1 ft^3 = 7.48 gal),
- L is proportion of precipitation not lost due to wind and evaporation, and
- P is total annual precipitation (or any precipitation period) in feet.

In the ponderosa pine type in Arizona, experience to date indicates 90% efficiency for L, or that 90% of precipitation is collected. Loss due to evaporation is minor. The annual precipitation should be broken down into normal wet and dry periods of the year, especially if water use is for definite periods (for instance, summer use only). If precipitation is adequate the tank may be filled more than once a year. For example, the Wild Bill range, which provides summer grazing only, has an average dry-year precipitation of 18 inches. About half falls in the form of snow during the winter; the remainder falls as rain during the summer. The Wild Bill range tanks were designed to fill twice during the year. Winter precipitation fills the tanks initially by May and summer rains refill the tanks during July and August. Therefore, the collector size for a 5,000-gal-capacity tank that will fill with 9 inches of precipitation such as on the Wild Bill range is calculated as follows:

$$\frac{5{,}000 \text{ gal}}{7.48 \text{ gal/ft}^3} = 668 \text{ ft}^3$$

$$W = \frac{C}{L \times P} = \frac{668}{.9 \times .75} = 990 \text{ ft}^2$$

Therefore, with 9 inches precipitation, a collector 30 × 33 feet would catch enough rain to fill a 5,000-gallon tank. Actual trick tank construction size is dictated by available materials but the capacities should approximate those calculated by the formula. The Wild Bill tanks (Table 1) are near enough the calculated needs for practical purposes.

Table 1. Comparative costs of materials and construction for three sizes of 6-foot-high trick tanks.

Specifications and costs	Tank diameter (ft)		
	12	16	24
Tank capacity (ft^3)	650	1,156	2,601
(gal)	4,862	8,647	19,455
Collector size (ft)	24 × 30	30 × 44	52 × 64
Costs (total)	$2,175	$3,910	$7,400
(per gal)	$0.45	$0.45	$0.38

Table 2. Costs for hauling livestock water compared with trick tank construction, based on annual consumption of 39,000 gal water for a 10-year period.

Source of water	Annual cost	10-yr cost
Hauling:		
39,000 gal water at $1/1,000 gal	$ 39	$ 390
20 annual trips w/2,000-gal tanker		
4 hr/trip at $17.50/hr	1,400	14,000
2,000 gal storage tank[1]		400
Total[2]		$14,790
Trick tank[1, 3]		$ 7,400

[1] Based on 10-year serviceability.
[2] Does not include road costs.
[3] 19,500 gal capacity; will fill twice annually to supply 39,000 gal/yr.

Advantages

This type of trick tank reduces water evaporation because the water is not open to direct sunlight. Evaporation has been reduced from 17% to 25% with chemical films[3] on stock ponds; somewhat similar results could be expected with complete shading.

After 4 years, no maintenance has been necessary on the trick tanks described. No damage resulted from heavy snows (7 ft weighing 36 lb/ft^2) in December 1967. It appears that maintenance will continue to be low.

The inverted roof over the storage tanks can provide protection from weather for livestock or supplemental feeds. Overflow drains on the tanks will prevent wetting the ground underneath the structures during years of excessive precipitation.

Trick tanks not only serve as water supply for livestock in inaccessible areas, but also for deer and other wildlife. In fire-danger areas, these tanks can serve as a water supply for pumpers or slurry drops. These water structures can also be dismantled when no longer needed, and the material salvaged for setup in other locations.

Cost comparisons, of course, should be based on local costs and availability of equipment. On the Wild Bill range, calculations prior to construction showed trick tanks would provide water more economically than hauling (Table 2). Actual construction and maintenance costs have substantiated those calculations.

[3] Waldrip, Wm. J. Chemical films for evaporation retardation under field conditions. Abstracts of Papers. Amer. Soc. Range Manage. Proc. 14:33–34. 1961.