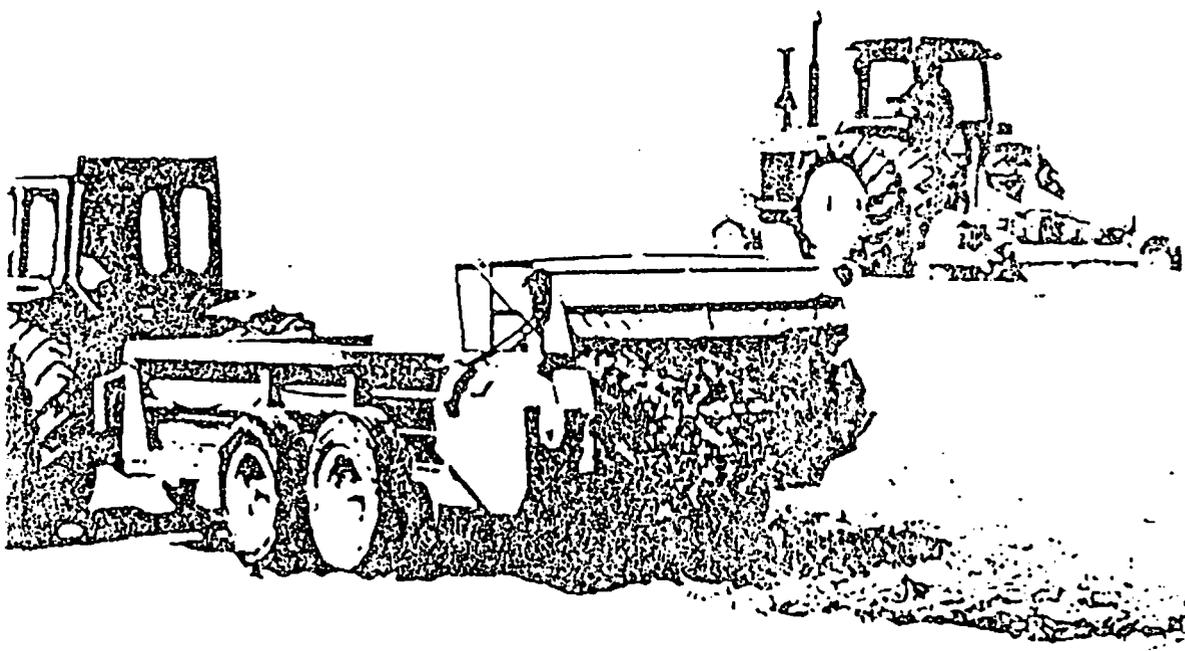


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February 11-12, 1979



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Participants

U.S. Department of Agriculture

U.S. Department of the Interior

State and County Organizations

State Wildlife Agencies

Industry Representatives (Chemical, Equipment, Mining, Seed)

Educational Institutions

Ranchers

Foreign Countries

Water Harvesting Research Implementation

Gary W. Frasier and Keith R. Cooley, *Science and Education Administration*

Water harvesting as a means of water supply is an old concept dating back over 4,500 years. Some of these early systems were used to supply water for the supplemental irrigation of crops. Others, in the form of roof-top collectors, are still being used to supply domestic household water.

The first water harvesting catchments constructed in modern times for animal drinking water usually had aprons of concrete or sheet metal. These units were relatively expensive, but were, in general, a successful means of water supply.

In the early 1950's, butyl rubber sheeting became available for catchment aprons and, based on laboratory tests, were projected to have an effective life of over 25 years. The relatively long life expectancy plus the "simple" installation of the rubber membranes were major factors in the widespread acceptance of the material for water harvesting. Some of these butyl rubber catchments have been successful.

On many of the units, problems were encountered after about 5 years, with the sheeting being damaged by rodents, wildlife, cattle, birds, and wind. Often, problems were compounded by an increased rate of

deterioration of the sheeting caused by improper installation techniques, which placed the rubber under stress. Many of the failures could be attributed to the lack of preventative maintenance. Because of the failures of these catchments, many users became disenchanted with water harvesting as a means of water supply.

In 1960, the U.S. Water Conservation Laboratory of the Science and Education Administration at Phoenix, Ariz., initiated a research program to develop better methods and lower cost materials for water harvesting systems. A water harvesting system is defined as the collection apron, the water storage facility, evaporation control of the stored water, and peripheral items such as fencing and drinking troughs. The main areas of investigation in these studies were:

- Materials for use as catchment aprons.
- Reducing evaporation loss from stored water.
- Optimum design of the relative sizes of the catchment apron and the water storage facility.
- Methods and materials for water storage.

In 1978, part of the water harvesting research investigations was transferred to the Science and Education Administration Southwest Rangeland Watershed Research Center at Tucson, Ariz. Studies were initiated in the use of water harvesting techniques as (1) a tool for range management in providing dispersed water facilities to better distribute livestock and wildlife on the range and to allow for better use of pasture rotation during periods when other water

¹ Brewer, H. L. 1978. Automatic transplanter system for field crops. ASAE Paper No. 78-1011 (mimeo.), 19 p.

² Brewer, H. L. 1978. Bandoleered containers for automatic transplanter systems. Abstract to be published in Proceedings of SA Forest Tree Nurserymen's Conference, Hot Springs, Ark., July 24-27, 1978.

³ Moden, W. L., Jr., T. W. Chappell, and F. H. Pickett. 1978. An intermittent double-type container planter. ASAE Paper No. 78-1070 (mimeo.), 26 p.

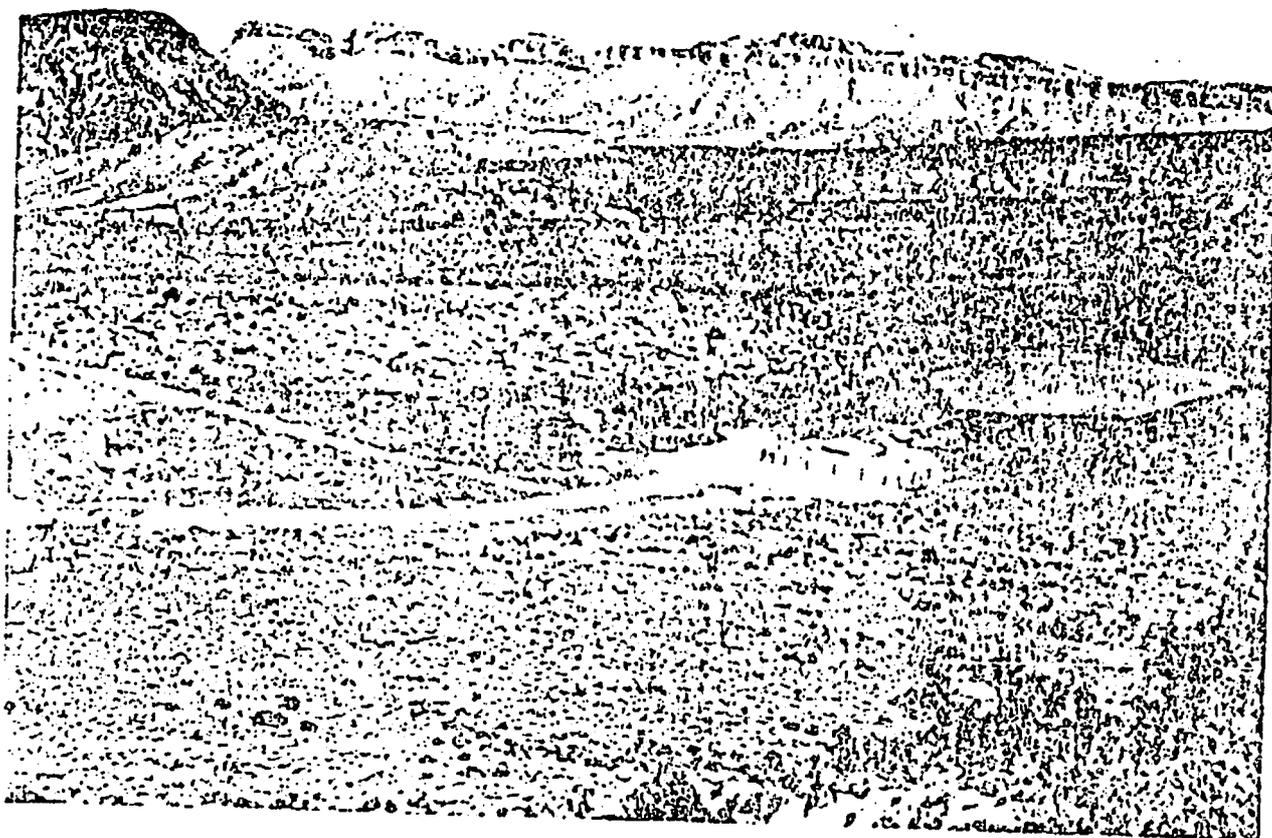
supplies are not adequate, and (2) the use of water harvesting-runoff farming techniques as a means of increasing forage production and for the establishment of desirable range plants.

Much of the emphasis of the early studies was on the development of new materials that could be used for the catchment apron. Of the many materials evaluated, two treatments have proven effective for waterproofing the catchment. These treatments are the asphalt-fiberglass membrane and the paraffin wax soil treatment.

The asphalt-fiberglass membrane is installed by laying a matting of chopped fiberglass on the prepared catchment surface. The matting is treated with two coats of a roofing-grade asphalt emulsion. The first coating penetrates through the fiberglass matting and helps bond the membrane to the soil surface. The second coating provides the final waterproofing sealcoat to the surface. These membranes have been evaluated under operational field conditions for over 10 years. They have been installed in a wide range of climatic conditions, from the lower desert areas of Arizona to the high mountains of Colorado.

The paraffin wax soil treatment consists of melting and spraying a low-melting point refined paraffin on the prepared catchment surface. The molten wax solidifies upon contact with the soil, but the sun's heat remelts the wax, allowing it to soak into the soil to a depth of about $\frac{1}{4}$ to $\frac{1}{2}$ inch. The wax does not plug the soil pores, but instead coats each individual soil particle, forming an effective water repellent layer of soil that prevents the water from infiltrating. The wax treatment is still being evaluated to determine under what soil and climate conditions it will be suitable.

Two methods of evaporation control for use on water harvesting systems have been evaluated. One method, which may be suitable for the hotter desert areas, consists of applying molten paraffin to the water surface. Sufficient wax is placed on the water to form a layer about $\frac{1}{8}$ to $\frac{1}{4}$ inch thick. This layer will crack in the winter, but as the sun warms the water surface, the wax partially remelts and forms a continuous cover. The second method of evaporation control consists of using a floating cover of foamed synthetic rubber. These covers have been used in a wide range of climatic conditions very successfully on tanks up to 30 feet in diameter.



Operational water harvesting system in the Arizona Strip furnishes water needs for several hundred head of livestock.

A simple computer program was developed to determine the optimum size of the catchment and storage required based on unit costs using an estimate of the precipitation and animal water requirements by month. This program is being used to assist water harvesting users to properly design water harvesting systems to fit the precipitation patterns and water requirements of the local area. Suitable water storage methods are currently the most expensive item of a water harvesting system. Limited studies have been conducted with improved methods and materials that can be used for the water storage, but we are still lacking a completely suitable means.

Today, water harvesting systems are being installed in increasing numbers as a means of water supply for wildlife and livestock. Some units are an acre in size with over 80,000 gallons of storage and are capable of furnishing all the water requirements for several hundred head of livestock.

The costs of the systems are highly variable, depending upon the types of material used and the local site conditions. Typical wildlife units (5,000 square feet catchment, 15,000 gallons of storage) are costing \$5,000 to \$10,000, while large livestock watering systems (50,000 square feet catchment, 80,000 gallons of storage) are costing over \$20,000.

Even with the relatively high cost, the water provided by these systems costs less than when obtained by other means, such as pipelines or hauling. In many areas, a water harvesting system is providing the water that is facilitating effective utilization of the forage produced on the land.

Studies of using water harvesting-runoff farming techniques for establishing or increasing forage production are still in the small plot stage. Many techniques have to be developed before field application can become a reality.