

## RESEARCH IN DITCH LININGS TO SAVE IRRIGATION WATER

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The influence of ditch linings in southern New Mexico on reducing seepage losses and ditch operation and maintenance expenses is being determined in a joint research project with the Agricultural Engineering Department and the Agricultural Economics Department of the New Mexico Agricultural Experiment Station. The research program will concentrate on farm ditches which total approximately 1,400 miles in New Mexico and west Texas under the Elephant Butte Dam.

To determine savings of water, and operation and maintenance costs, an intensive sampling throughout the area including sixteen case farms is being made, pertaining to:

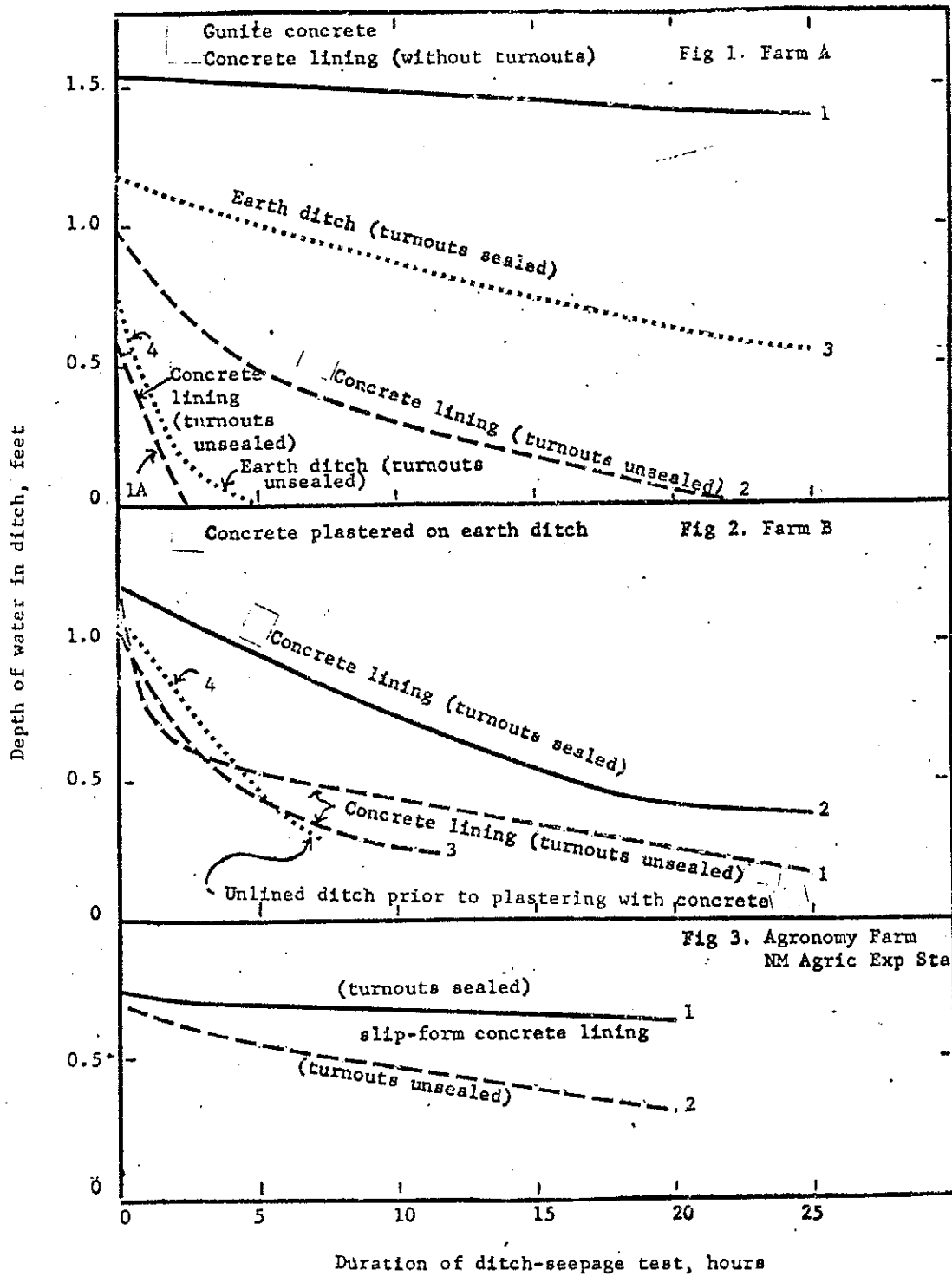
1. Sizes of farm ditches, lined and unlined, and proportion of ditches that have been lined.
2. The proportion of farm ditches that are used as conveyance ditches and head ditches and the relative time of duration that each type of ditch is used throughout the irrigation season.
3. Savings in time, materials, and labor with lined ditches as compared to unlined.
4. Reduction of seepage losses from lined ditches by types of linings and turnouts as compared to unlined ditches.

This report presents the results of some of the seepage measurements which have been made. All of the seepage measurements have been made with water stage recorders placed in dammed sections of farm ditches. Figures 1 through 3 present the results of seepage measurements on some of the ditches from three farms.

In Figure 1 for farm A, curves 1 and 1A pertain to two adjacent sections of the same ditch. Curve 1 represents rate of loss in a section that had no turnouts and curve 1A shows the loss measured in a section with turnouts closed but not sealed. The loss from the section with turnouts leaking is approximately 35 times greater than that from the section without turnouts. Curves 2 and 3 compare losses from two ditches located near each other on another section of the same farm. Curve 2 for a concrete lined ditch with turnouts unsealed shows a rate of water loss to be greater than that from the nearby earth ditch indicated by curve 3. The curve for the earth ditch shows only seepage through the soil since the water surface was not sufficiently high to leak through the turnouts in this test. Curve 4 shows

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the seepage rate in a nearby earth ditch from which water was leaking through unsealed turnouts. A comparison of curves 1A and 4 shows a rate of water loss from the lined ditch to be greater than the loss from the unlined ditch.

In Figure 2 for farm B, curves 1, 2, and 3 represent three adjacent sections of a concrete lined ditch which has been plastered with concrete by farm labor. The center section (curve 2) had turnouts sealed and the sections on either side (curves 1 and 3) had turnouts unsealed. The losses from the unsealed sections were more than four times as great as those from the sealed section. Curve 4 represents seepage losses from the ditch as it existed without lining approximately one year before the concrete lining was installed. Soil had been packed by each turnout when this test was made.

Figure 3 shows losses from a concrete lined ditch which was constructed with the slip-form method on the agronomy farm of the New Mexico Agricultural Experiment Station. The seepage loss from the section of the ditch with turnouts unsealed (curve 2) is more than three times as great as the loss from the section with the turnouts sealed (curve 1). The slope of curve 1 on this figure is approximately the same as that of curve 1 in Figure 1 where the ditch had no turnouts. This slope represents approximately the minimum rate of loss that has been measured to date on all farms.

These figures emphasize the need for better low-cost turnouts, and greater care in installing linings and turnouts when lined ditches are constructed.

A summary of 69 tests to date shows that 69 percent of the total losses from lined ditches occurred through leaking turnouts, and in unlined ditches, 62 percent leaked through turnouts. The high rate of leakage through turnouts has largely cancelled the water-saving potential of existing lined ditches. The average losses from lined ditches with turnouts unsealed were only 21 percent lower than losses from unlined ditches with turnouts unsealed. A summary of measurements from the better lined ditches shows that reasonably good concrete linings with "above average" turnouts in the areas where the measurements were made, have a potential of reducing seepage to about one-tenth that occurring in existing unlined farm ditches with unsealed turnouts. The better lined ditches without turnouts, which may be used with siphons, have a potential for reducing the losses to approximately one-thirtieth of the rate occurring from unlined ditches with turnouts unsealed. The reduction of losses would be considerably higher if lined ditches were built with the quality of the ditches which are represented by the curves showing the minimum seepage losses in Figures 1 and 3.