# Small Ditch Seepage Controlled

## increasing production demands, costs, and water shortages require efficient water use by operators of irrigated farms

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**Good irrigation management** includes minimizing water losses from farm ditches and reservoirs.

One way seepage of water through the bottom and banks of ditches can be reduced is to line them with some suitable material. In this way water can be conserved and—because of the elimination or reduction of weeds—better control and conveyance of the water may be achieved.

It is estimated there are over 44,000 miles of laterals and ditches in California farm distribution systems with the largest percentage unlined. Seepage losses from these ditches may be as high as 30% to 40% of the water initially diverted into them.

Many problems associated with the lining of irrigation ditches make the use of a permanent material—such as concrete—impractical or not economically feasible. Those problems include limited farm equipment for construction and maintenance, intermittent operation, temporary location due to crop rotation and cultivation practices, little or no maintenance, grazing of animals, and presence of outlets in the sides of the ditch for diverting the water onto the land.

A study was made over the past three years on the installation, maintenance, resistance to vegetative growth, seepage control and over-all desirability of certain prefabricated linings from the standpoint of installation and use by the farmer. Only the effect on seepage control is reported here.

Prefabricated Linings

| Type | | Wt., lbs. per sq. yd. |
|---|---|---|
| *Buried* | | |
| Asphalt A | 1/8″ catalytically air-blown asphalt with mineral stabilizer on a 60-lb. Kraft paper backing in 3′ x 36′ rolls .......... | 7.9 |
| Asphalt B | 3/32″ asphalt saturated felt with an aluminum foil selvage covering 1/2 of the width of a roll in 3′ x 36′ rolls ........... | 3.3 |
| Asbestos | 3/32″ asbestos fiber felt impregnated with asphalt in 3′ x 36′ rolls ........ | 3.5 |
| Wood fiber | 1/16″ twisted wood fiber woven mat coated with neoprene in 4 1/2′ x 300′ rolls ................. | 2.4 |
| Laminated paper | Two layer 50-lb. Kraft paper cemented with asphalt and reinforced with glass fibers ........... | 0.52 |
| *Surface* | | |
| Wood fiber | Same as above | |
| Asphalt C | 1/2″ asphalt mat in 3′ x 8′ sheets ................ | 27.0 |
| Plastic | .006″ black polyethylene film .................. | 0.6 |

Two general types of prefabricated linings were investigated—buried and surface linings. Because of certain physical characteristics, the buried linings are not able to withstand the rigors of exposure or other elements to which they are subjected when on the surface of the soil. Therefore, they require some protective soil covering. The surface linings are laid directly on the soil surface of the excavated ditch bank.

A tabulation of the various types of linings on which seepage tests were made is given on this page. Other types and thicknesses of plastics including .004″ and .008″ clear and white vinyl and .0015″, .002″, and .008″ polyethylene were studied, but no seepage tests have been made in the field.

The test sections were prepared for the lining installations by cutting the ditches with a 20″ ditching plow. In the case of the buried linings, an additional excavation of 6″ was made. This was followed by considerable hand trimming in order to remove sharp changes in slope and loose clods.

The asphalt *A*—described in the adjacent table—and asbestos linings were laid, starting at the downstream end, across the ditch, lapped 3″, and sealed with cold asphalt cement. The asphalt *B*, wood fiber, and laminated paper linings were laid longitudinally. The asphalt *B* lining was sealed with an asphalt adhesive and lapped half its width, leaving the 19″ aluminum selvage on the top side. The wood fiber, being relatively wide, required only one lap and was sealed with a rubber base cement. The laminated paper was wide enough to extend across the ditch without a lap.

A soil sterilant—43% sodium chlorate and 57% borax—was applied to the soil foundation on which the lining was laid in portions of the asphalt and asbestos sections. The application rate was one pound of sterilant per two gallons of water with four gallons of solution per 100 square feet. A higher rate of sterilant —one pound per gallon of water with four gallons of solution per 100 square

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Installation of buried type lining—Asphalt B.


Sealing the transverse joints of the surface type lining—Asphalt C.

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feet—was applied to backfill soil over the lining in portions of the asphalt *A*, asbestos, and wood fiber sections.

The surface linings were laid on the surface of the excavated ditch following a minimum of hand labor required to remove loose clods.

The wood fiber and plastic were rolled out longitudinally with no laps or joints and secured on the ditch berm—edge of the ditch at the top of the slope—by piling 4″ to 6″ of soil over a foot or more of the lining. The asphalt *C* material of ½″ × 3′ × 8′ strips was laid across the ditch section, lapped 3″ and sealed with asphalt cement. The 8′ length provided sufficient material to extend approximately 1′ over the berm and this was then covered with soil.

Several seepage tests were made by the ponding method in the lined and unlined sections. The amount of water loss was computed from the field measurements and the results averaged together for all the tests.

All linings reduced the seepage loss over that of the unlined section. The seepage control of asphalt *A*, *B*, and *C* was 36%, 47%, and 78%; asbestos 58%, wood fiber 63%, and the plastic film 96%. All these percentages would have been even greater had the experimental test section been located in a more permeable soil because the seepage loss of the unlined sections would have been greater.

**Summary of Seepage Control**

| Lining | Ditch Dimensions: Mean depth | Ditch Dimensions: Mean wetted perimeter | Seepage loss | Seepage control* |
|---|---|---|---|---|
| | ft. | ft. | cu. ft/ft²/24 hrs. | % |
| Asphalt A | .94 | 4.3 | .47 | 36 |
| Unlined | .88 | 4.2 | .63 | |
| Asphalt B | 1.09 | 4.8 | .28 | 47 |
| Unlined | 1.05 | 4.4 | .59 | |
| Asphalt C | .86 | 3.5 | .55 | 78 |
| Unlined | .55 | 2.9 | 2.48 | |
| Asbestos | 1.03 | 4.9 | .29 | 58 |
| Unlined | .90 | 4.4 | .67 | |
| Wood fiber | .90 | 4.1 | .45 | 64 |
| Unlined | .91 | 3.9 | 1.31 | |
| Plastic | 1.00 | 4.0 | .09 | 96 |
| Unlined | .55 | 2.9 | 2.48 | |

* Difference between the seepage loss of the unlined section and the lined section divided by the seepage loss of the unlined section multiplied by 100.

Laminated paper did not prove to be satisfactory because bacterial attack and decay of the paper resulted in a complete breakdown of the material in less than two months. Coating with plastic and incorporation of materials to combat bacterial attack might produce a satisfactory lining.

A comparison of seepage control of buried and surface linings shows the buried linings to be less effective. This is attributable to the large number of joints which cannot be made completely water tight. Also, in the case of the asphalt *A*, roots of plants and gophers penetrated the lining and reduced its effectiveness.

A high percentage of control by the plastic film was indicated by the tests. Problems such as proper formulation to give reasonable life when exposed to the sun and wetting and drying in the ditch and resistance to certain forms of mechanical damage are yet to be worked out. These materials are still considered to be in the experimental stage of development.

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## NEMATODE

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delivering the nematocide to a depth of 8″; and immediately following treatment, the surface was rolled with a ring roller.

Comparative results of the 1953–1954 tests with DD, EDB, N-339, and OS-1897 are shown in the table to the right. It was found that N-339 did not equal DD or EDB in nematode control or increased yield of cotton, but that OS-1897 compared favorably with them. With OS-1897, as shown in the accompanying table, the dosage rate of 1.25 gallons per acre—as an area treatment—required to achieve satisfactory increases in yield was lower than with DD or EDB, and the degree of nematode control—based upon root examinations made at the end of the season—was higher. The effective dosage rate—in row treatments—was within the range of 0.5 to 1.0 gallon per acre, and the effective rate may vary with soil type.

Investigations are being continued with OS-1897 as a nematocide to determine its effectiveness in controlling cotton root-knot nematode.

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**Experimental Plots Showing per Cent Control, Bales of Lint Cotton per Acre, Bales Increase, Estimated Cost of Treatment, Estimated Net Profit from Treatment**

| Treatment per acre | % Control | Bales lint cotton per acre | Bales increased per acre | Estimated cost of treatment | Estimated net profit[1] |
|---|---|---|---|---|---|
| **1953 Kern County Plot—Row Treatment** | | | | | |
| Untreated | 0.0 | 1.26 | ... | ..... | ..... |
| 339 (5 gal.) | 6.2 | 1.46 | .20 | experimental | ..... |
| 339 (10 gal.) | 16.5 | 1.63 | .37 | experimental | ..... |
| EDB (1.65 gal., 83%)[2] | 28.7 | 1.72 | .46* | $12.90 | $67.87 |
| OS-1897 (1 gal.) | 93.1 | 1.80 | .54* | 16.50 | 87.18 |
| OS-1897 (2 gal.) | 96.0 | 1.90 | .64* | 30.00 | 92.88 |
| DD (8 gal.) | 75.0 | 1.95 | .69* | 16.00 | 104.27 |
| **1954 Tulare County Plot—Row Treatment** | | | | | |
| Untreated | 0.0 | 1.38 | ... | ..... | ..... |
| DD (9 gal.) | 88.5 | 1.83 | .45* | 18.00 | 60.72 |
| EDB (2.5 gal., 83%) | 67.3 | 1.70 | .32 | 18.00 | 38.04 |
| OS-1897 (1 gal.) | 92.3 | 1.79 | .41* | 16.50 | 62.22 |
| OS-1897 (0.5 gal.) | 93.1 | 1.75 | .37* | 9.75 | 60.29 |
| **1954 Kern County Plot No. 1 (one picking)—Row Treatment** | | | | | |
| Untreated | 0.0 | 1.71 | ... | ..... | ..... |
| DD (9 gal.) | 88. | 2.04 | .33** | 18.00 | 48.00 |
| OS-1897 (1 gal.) | 92.5 | 1.91 | .20** | 16.50 | 23.50 |
| OS-1897 (1 gal.) (gravity-flow) | 95.2 | 1.89 | .17** | 16.50 | 16.55 |
| OS-1897 (0.5 gal.) | 81. | 1.85 | .14 | 9.75 | 18.30 |
| OS-1897 (0.5 gal.) (gravity-flow) | 90. | 1.82 | .11 | 9.75 | 13.25 |
| **1954 Kern County Plot No. 2—Area Treatment** | | | | | |
| Untreated | 0.0 | 2.45 | ... | ..... | ..... |
| OS-1897 (1.25 gal.) | 96.9 | 2.76 | 0.31 | 19.80 | 34.00 |
| OS-1897 (2.5 gal.) | 98.5 | 2.75 | 0.30 | 36.60 | 15.76 |
| EDB (5.5 gal., 83%) | 76.0 | 2.75 | 0.30 | 36.00 | 16.50 |
| DD (20 gal.) | 97.4 | 2.68 | 0.23 | 36.00 | 4.47 |

[1] Calculated on lint cotton at $0.30 per pound and seed at $60.00 per ton.
[2] Dosage rate of EDB reduced from 2.5 to 1.65 gal. per acre by error in application.
* Increase in yield over untreated significant at 1% level.
** Increase in yield over untreated significant at 1% level; OS-1897 at 0.5 gal. per acre significant at 5% level.