B-1539

Texas Agricultural Extension Service

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FURROW DIKING IN TEXAS

Texas Agricultural Extension Service • The Texas A&M University System • Zerle L. Carpenter, Director • College Station, Texas

Cover: These furrow dikes in a newly established field of cotton are holding approximately 3 inches of rainfall.

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Farmers have long been interested in moisture conservation, and have sought methods of conserving and storing the maximum amount of water for crop use. They recognize that, during most years, drought limits crop yields in almost all areas of Texas. Rainfall is erratic over the eastern two-thirds of the state, but generally follows a bi-modal pattern with rainfall peaks occurring in late spring and in late summer or early fall. In far West Texas, approximately three-fourths of the annual rainfall occurs during the summer crop season. Much of this rain falls during high intensity storms. Only a small part of the rain from these storms infiltrates the soil, which causes excessive runoff and erosion.

One way of conserving soil moisture is by means of a cultural practice called furrow diking.

What is Furrow Diking?

Furrow diking is a mechanical tillage operation that places mounds of soil at intervals across the furrow between beds to form small water storage basins. As rain falls, it is trapped and stored in the basins so that it soaks into the soil rather than running off. This is especially important since the rainfall rate often exceeds the soil infiltration rate.

Furrow diking is sometimes referred to as basin tillage, row diking, ridge ties, basin listing, dammer diking, furrow damming or furrow blocking. It is not a new concept, but was begun during the early 1930s in the Great Plains. By 1950, furrow diking had been abandoned by most farmers because a complete system of production using dikes had not been developed. Reasons for dropping the practice included: 1) lack of adequate herbicides and poor weed control, requiring frequent removal and replacement of dikes during cultivation; 2) tillage and harvest difficulties; 3) poorly designed and constructed diking units; and 4) slow operating speed.

Research in the late 1970s on the Texas High Plains showed that furrow diking can be practical, especially when coupled with other developments such as terracing and contour farming (or use on slopes less than 2.5 percent), and chemical weed control. The development of front-mounted sweeps to remove dikes, and of dikers that require much less maintenance than earlier models and that can be operated at faster speeds (4.5 to 7 miles per hour) also have made furrow diking more practical.

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These furrow dikes in a field of grain sorghum were established after cultivation.

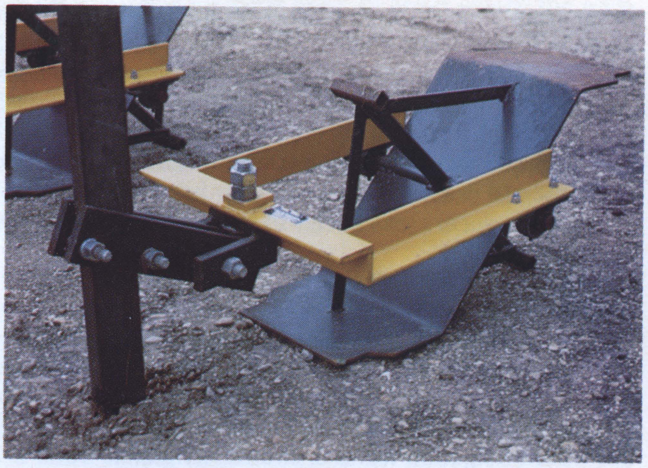
After a rainfall, water is stored in diked rows but has run off undiked rows.

Furrow Diking Equipment

Diking equipment is currently available from a number of different manufacturers and distributors. Furrow dikers differ considerably in design, function and cost. The following criteria are desirable when selecting a diker:

1. Sturdy construction with low maintenance requirements.
2. Easily attachable (and detachable) to listers or bedders, cultivators or planters to combine diking with other field operations.
3. Capable of high speed operation.
4. Capable of constructing a dike of sufficient size and basin capacity to prevent runoff from intense rainfall.
5. Economical to purchase, maintain and operate.

Two basic designs of furrow dikers are commercially available. One design features a single paddle, also called a shovel or disk, on the end of a lever arm that is raised and lowered at regular intervals (leaving a soil dam) by a spoke or step on a large-diameter wheel mounted on the lever. This type of unit is the raising shovel diker. Another style of furrow diker is the tripping shovel design. Tripping shovel dikers have two or three shovels (paddles) and are often designed to trip due to soil pressure of the dam being constructed, causing the shovel to roll over. A recent innovation on tripping shovel dikers is the use of a hydraulic motor to trip the shovel (disk).



With the tripping shovel diker, soil pressure of the dam being constructed causes the shovel to roll over.

The raising shovel diker features a shovel or disk on the end of a lever arm that is raised and lowered at regular intervals by a step on a large-diameter wheel mounted on the lever.

Dikers vary considerably in diking interval (2.5 to 7 feet), size of dike, volume of basin formed, operating speed, cost per row and ability to form functional dikes in a wide range of soil textures. Dikes 6 to 8 inches high at a maximum interval of 6 to 8 feet may be required to prevent runoff from an intense 2-inch rain on most soils.

A plow-out attachment is needed if furrow diking is to be used in every furrow. Hydraulically lifted sweeps should be run in front of the tractor wheels to plow out existing dikes and allow a smooth ride. Sweeps are also required ahead of implement gauge wheels to maintain proper depth control of planter units, cultivator units or bedders (listers).

Proper Use of Furrow Diking

Since all areas of Texas are subject to drought at some time during the growing season, furrow diking can improve production throughout the state. In 1985 an estimated 4 million acres of cropland in West Texas was diked (including both dryland and irrigated farms).

Under dryland conditions, dikes should be in place prior to and during the periods of normal high rainfall, when runoff is most likely to occur. On the Texas High Plains and in far West Texas, runoff is most likely to occur from June through August. In the remainder of the state, runoff is most likely to occur in spring and again in late summer and early fall. Dikes should be established as soon after harvest as possible, but prior to the period of expected high rainfall. Depending on location in the state, dikes should be established from August (South Texas) to March (Rolling and High Plains). Dikes should be reestablished at planting and cultivation to impound rainfall during the growing season. In areas where excessive soil moisture sometimes delays planting (Coastal Bend, Upper Coast or Blacklands), dikes should be established after planting. In soils with poor internal drainage, alternate-row furrow diking may be preferred. To avoid dike plow out during cotton harvest, producers may prefer to reestablish growing season dikes on alternate furrows.

Under irrigated conditions, it is a good practice to reestablish dikes as soon as feasible after harvest to reduce the necessity for pre-plant irrigation. Every-row furrow diking should be used for maximum water storage. With furrow irrigation, dikes should be established on alternate rows and water should be applied to the undiked furrows. Thus, alternate-row diking allows for retention of half the runoff water from rainfall.

The USDA — Agricultural Research Service has developed the Limited Irrigation Dryland (LID) system for use where irrigation water is limited. Irrigation water is applied to all furrows, which are diked the length of the field. Water accumulates in each basin, breaks over and spills into the next basin through the upper half of the field. The lower half of the field is dependent on tailwater irrigation and/or rainfall.

Every-row diking in conjunction with sprinkler irrigation holds rainfall and irrigation water in place on the soil, permitting heavier water application without runoff or uneven distribution. The Low Energy Precision Application System (LEPA), developed by the Texas Agricultural Experiment Station, uses furrow diking in conjunction with low pressure application of water through a drop tube from an overhead sprinkler system.

Impacts of Furrow Diking

The importance of conserving water by trapping and storing it where it falls is well documented. For each additional inch of moisture stored in the soil, yield increases of 30 pounds of lint cotton or 350 pounds of grain sorghum per acre may be expected. At Bushland (in the Northern High Plains), as much as 5.5 inches of additional stored water has been measured as a result of furrow diking. Yield increases from diking at Chillicothe (in the Rolling Plains) indicate that approximately the same amount of additional moisture has been stored there.

Considerable furrow diking research has been conducted recently on cotton and grain sorghum in Texas. Typical yield responses to furrow diking are shown in Table 1. Average grain sorghum yields under continuous cropping were doubled, whereas cotton lint yield increases ranged from 16 to 32 percent. The Bushland data indicate that where grain sorghum followed fallow, yield responses to diking were much lower than where sorghum was cropped continuously. The fallow period allowed an additional year of moisture storage, which is not possible with continuous cropping.

Where furrow dikes are used on gentle slopes (less than 2.5 percent), soil erosion from runoff water may be lessened. Experience has shown that wind erosion also may be reduced by furrow diking because of increased ridge roughness. This may be helpful in maintaining crop stands. In sloping fields, more uniform crop stands may be obtained by holding water in place and preventing or reducing ponding in low areas of the field.

Furrow diking is a very cost-effective practice. Initial purchase price of the equipment is relatively low ($125 to $275 per row). Studies have shown that the initial cost of the equipment can be recovered in one growing season with the increased yields from the first 40 to 75 acres of cotton or grain sorghum. Another advantage to furrow diking is the low horsepower requirement and the fact that it can be combined with other operations such as listing, planting and cultivation. No additional trips across the field are required.

For maximum benefit, the crop production program should be developed around furrow diking. It should not be an "also" or "add on" operation. It can be the center of a minimum tillage system that permits reductions in production costs while increasing yields.

In some cases, certain precautions must be taken when furrow diking is used. In areas where the additional soil moisture results in more favorable growth conditions, crop insect monitoring may be more critical.

In the past there have been problems associated with cotton harvest in fields utilizing every-furrow diking. But with the development of practical plow-out equipment these problems have been reduced. If use of the plow-out device is not feasible on the cotton stripper, alternate-row furrow diking can be practiced to eliminate harvest problems associated with diking.

Table 1. Response of Cotton and Grain Sorghum to Furrow Diking.

			Average			
Location	Crop	Years of study	Yield (pounds/acre) (diked)	(undiked)	% Yield increase with diking	Added returns with diking ($/acre)*
Vernon	Cotton	2	431	326	32	52.50
	Sorghum	3	2,131	1,083	97	41.92
Lubbock	Cotton	4	341	293	16	24.00
Bushland**	Sorghum	8	2,100	1,870	12	9.20
Etter	Sorghum	2	2,215	895	147	52.80

**Assumes cotton prices of $0.50/pound and grain sorghum prices of $4.00/cwt.*
***Sorghum following 1 year fallow period. All others continuous cropped.*

Research conducted by the Texas Agricultural Experiment Station and USDA—Agricultural Research Service.

Summary

1. Furrow dikes are effective only if runoff-producing rainfall occurs while the dikes are in place.

2. Furrow dikes have been shown to increase soil water storage up to 5.5 inches per year.

3. Research and producer experiences have shown a linear relationship between moisture stored by furrow diking and increased yields of cotton and grain sorghum.

4. Every-row furrow diking has been shown to store twice as much water as alternate-row diking. This is reflected in comparably increased yields.

5. Large dikes store more water than small dikes, and reduce the likelihood of dam breakage in heavy rains.

6. Furrow diking is adapted to both dryland and irrigated row crop production.

7. Furrow diking requires no additional trips across the field and should be combined with other operations such as listing, planting or cultivation.

8. Furrow diking is a low cost, high return practice that may increase profitability.

For additional information on furrow diking, please refer to the following publications:

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Ruesink, L. E. 1984. Storing soil moisture. *In* Texas Water Resources Institute Water Currents. Vol. 3, No. 3.

Published by the Texas Agricultural Extension Service (TAEX) and the Texas Agricultural Experiment Station (TAES) in cooperation with the Texas Water Resources Institute (TWRI).

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Zerle L. Carpenter, Director, Texas Agricultural Extension Service, The Texas A&M University System.
10M — New, 3-86