Should I Line That Irrigation Ditch?

Dollar Return on Capital Expenditure Is Important Consideration for Farmer

By Rex D. Rehnberg

The job of the farm manager—and that of any other business manager—is getting the largest net returns possible with the land, labor and capital at his command. This requires daily decisions as to how much money can be spent profitably on certain production items.

An error in judgment as to how much seed to plant and how much fertilizer or water to apply will be reflected in that year's income and can easily be corrected in the following year. However, an error in judgment as to how much can profitably be spent on capital improvements such as buildings, fences and irrigation systems, will lower incomes during the life of the installations.

A careful cost-benefit analysis in decisions involving capital expenditures, therefore, is important. Capital expenditures can be analyzed best by viewing them as a purchase of future income. If the future returns fail to equal the present cost, then the advisability of making such an investment is questionable.

Must Consider Returns

Applying the cost-benefit analysis to concrete ditch lining, under varying conditions, shows that there are ditches in Arizona where the money invested in ditch lining would be quickly recovered. There also are conditions under which the benefits from lining will never pay the cost of lining.

To simply assume that every ditch in Arizona should, or should not, be lined is to disregard one of the greatest opportunities managers have to exercise the management function; that is spending each dollar where it promises to yield the greatest return.

The benefits, or savings, from ditch lining are realized year by year during the life of the installation. In order to make a direct cost-savings comparison, the cost also should be on an annual basis.

Suppose a farmer is trying to decide whether or not to line a particular ¼ mile section of ditch. The lining will cost about $1,200 of which $400 will be refunded in the form of conservation payments by the Production and Marketing Administration. An inspection of similar ditches in the area reveals that they can be expected to last 30 years with about $10 maintenance cost per ¼ mile per year.

He thinks that lining the ditch will make about 1/5 of an acre of land available for cultivation that is now occupied by the old ditch, reduce weed control costs on that ditch section by about $10 per year and decrease the costs of irrigator's labor by $10 per year. This section of the ditch has an average annual flow of about 250 acre feet and he values his water at $5 per acre foot. Should he line this ditch?

Estimate Annual Costs

The three major annual costs of the lined ditch will be interest, depreciation and repairs. During the life of the ditch it will depreciate from the original value to practically 0, averaging about ½ the original cost during its useful life. Interest can, therefore, be computed at 5 percent (or whatever interest rate the farmer can secure funds) on the average investment or 2½ percent on the original investment.

If the ditch lasts 30 years the annual depreciation rate will be 3.3 percent per year with an annual repair cost of $10. These costs are summarized in the accompanying table. From it the annual cost of $56.40 is determined.

The benefits are the use of 1/5 acre of land at $50 per acre plus a reduction of $20 annually in the cost of weed control and irrigator's labor. The total savings, excluding water, is about $30. This leaves a cost of $26.40 that must be covered by a saving in water. With water valued at $5 per acre foot a saving of 5.3 acre feet of water, or slightly over 2 percent of the average flow in the ditch section would yield a large enough saving to make ditch lining a sound investment under these conditions. There are many cases in Arizona at the present time where more than 2 percent of the water has been saved by ditch lining.

Check These Factors

Although the figures used in this illustration may not apply to any one particular farm in Arizona, they do bring to mind the factors that influence the advisability of ditch lining. On the cost side, the original cost of the lining, the amount of government payments, the interest rate at which funds can be secured, and the expected life of the ditch are all factors to consider.

In some parts of Arizona the ditch should be written off in 10 years instead of 30 because of the uncertainty of future water supplies. This change alone would nearly triple the annual cost of the ditch.

On the savings side, the amount of the additional land that can be put into cultivation, the savings in weed control and ditch maintenance costs and the decrease in irrigator's labor requirements determine the water

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COST-BENEFIT ANALYSIS

¼ Mile Concrete Lined Ditch

Cost of lining		$1,200
Less Government Payment		400
Net Cost to farmer		$ 800
Annual Costs		
Interest @ 2½%	$20.00	
Depreciation 3.3%	26.40	
Repairs	10.00	
Total Annual Cost		$56.40
Benefits (savings)		
Land 1/5 A @ $50	$10.00	
Weed Control	10.00	
Irrigator's Labor	10.00	
Total Annual Savings (excluding water)		$30.00
Remaining cost (to be paid by savings in water)		$26.40
Value of Water $5 A.F.		5.3 A.F.
Average annual flow through ditch section		250 A.F.

Seepage loss per ½ mile requires to equal

$$5{:}3 \text{ A.F.} = \frac{5.3}{250} = 2.1\%$$

ON THE COVER is a photo of a lined irrigation ditch near Tucson.

Irrigation Of Alfalfa

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During the season of 1948, more water was applied at each irrigation than was called for in the plan due to a mistake in measuring the size of the plots. The following table gives the irrigation data, yield of hay per acre and per acre foot of water, up to the present time.

It appears from the above data that the point of diminishing returns is not reached on alfalfa until about 5 acre feet of water per acre has been applied, i.e., about twice as much hay is produced per acre when 5 acre feet are applied as when only 2.5 acre feet are used. When amounts greater than 5 acre feet are applied, the yield per acre foot of water is reduced considerably.

On the Mesa farm, the water is delivered to the experimental plots through underground pipelines. The fields are leveled so there is no run-off. Under these irrigating conditions, a 100 percent efficiency is approached. However, under actual field conditions, where 70 percent effifiency is about the maximum that can be obtained, the point of diminishing returns would be reached when about 7 acre feet of water has been applied.

The yield on Treatment 4 was reduced each year, the big reduction coming in 1950. The stand on Treatment 4 had thinned out considerably by 1950, and grass was coming up in the bare spots. On soil as heavy or heavier than that of the Mesa Farm, an irrigation practice of 3 waterings between cuttings will start to reduce the stand after two years.

Light Irrigations Best

A study of the results of 1948, where much heavier irrigations were given than other years, shows that 2 light irrigations are better than one heavy irrigation. It is believed this is true because the cooling effect of irrigation water in the upper foot of soil produces a more favorable environment for growth of plant roots.

Under normal field conditions of about 70 percent efficiency, there is no appreciable decrease in yield per acre foot of water until 7 acre feet are applied. However, irrigations totaling more than 7 acre feet per acre will result in a reduction of yield.

In order to obtain the greatest utilization of water and to get the best economic returns, the ideal irrigation practice would be as follows: Apply 2 acre feet of water per acre during the winter months, and follow up with two 6-inch irrigations between each cutting, for a total year's use of 7 acre feet.

However, if either a cement-lined ditch or a pipeline is used for the delivery of water, and the land is prepared in such a way as to get a high efficiency, then the water applied could be reduced as follows:—A 1½-acre foot application during the winter months, followed by two 4½-inch irrigations between cuttings, or a total year's use of 5 acre feet.

These irrigation procedures are applicable only when a maximum crop yield of alfalfa is desired. However, under conditions of a limited water supply, irrigating for maximum production may not be possible. If this is true, the main benefit of alfalfa is not in its value as a cash crop, but as a soil builder resulting in a higher yield of subsequent crops.

—Karl Harris is Irrigation Engineer cooperating with the University of Arizona.

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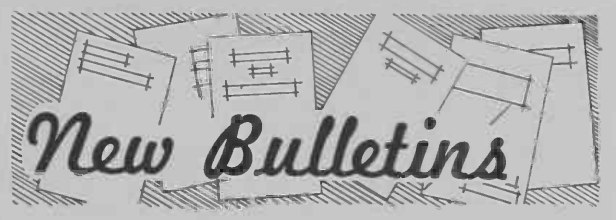
saving necessary to make ditch lining a sound investment. The value of water per acre foot, the seepage loss in the ditch section and the amount of water flowing in the ditch section are the factors that finally determine whether or not ditch lining is a sound investment.

A similar approach can be used for underground pipe irrigation systems. This, along with a discussion of seepage losses and methods of valuing water are presented in Bulletin 137, "Irrigation Ditch Management on Arizona Irrigated Farms." A copy of this bulletin can be obtained from your County Agricultural Agent or by writing the University of Arizona, Tucson, Arizona.

—Rex D. Rehnberg is Assistant Agricultural Economist.



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Agricultural Experiment Station

General Bulletin 236—Part I. Establishing a High Egg Producing Strain of S. C. White Leghorns. Part II. The 365-Day Egg Production Equivalent Table.

61st Annual Report for Fiscal Year Ending June 30, 1950.

Agricultural Extension Service

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