



Weekly Farm Economics: Evaluating Returns Necessary to Justify Installation of Tile Drainage

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Tile drainage improves yields on most installations by reducing moisture from fields. Herein, we present a methodology for determining the yearly break-even benefit required to cover the installation investment in tile. This methodology is based on the payment function in Microsoft Excel. For example, a \$1,000 per acre installation investment requires a yearly break-even benefit of \$81.74 per acre, given an 8% interest rate and a 50-year life. Higher interest rates increase yearly benefits to recover the investment.

Background

Tile drainage removes water from soils, improving yields and field operation timeliness. Studies on tile effectiveness are limited, but those that exist report yield increases. A recent study found that soybean yields increased between 4 and 8% (see [here](#)). Most who install tile report yield improvements after drainage. Benefits from tile drainage are site-specific.

Tile drainage usually has a long life, with a significant outlay occurring at installation time. Installation investment includes the purchase of the tile and the costs of installing the drainage. Relative to the installation investment, maintenance costs associated with tile systems will be minimal. Herein, we present a methodology to determine the yearly break-even benefit needed to cover the installation investment. Realized financial benefits need to exceed yearly break-even benefits to justify the investment in drainage.

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The methodology is based on the same methodology used to calculate the uniform payment on a loan incorporating 1) installation investment, 2) discount rate, and 3) length of time drainage will provide benefits. The methodology calculates the yearly, uniform benefit whose present value equals the installation investment. The methodology does not consider the tax consequences of the investment. Nor does it consider the debt repayment cash flows. Therefore, this methodology should be viewed as a screening tool for evaluating potential tile investments. Usually, a more detailed present value analysis of tax, and debt considerations will not materially change break-even benefits.

The methodology will show the impacts that changing investment costs and interest rates have on needed benefits for drainage to be monetarily beneficial. In particular, rising interest rates will increase the yearly break-even benefits needed to cover the investment.

Methodology

Three values are needed to calculate the break-even value:

1. The installation investment in the tile, including the installation costs. Our example will use a value of \$1,000 per acre.
2. The discount rate for determining break-even values. The discount rate can equal the interest rate on debt. Alternatively, a desired rate of return can be used as the discount rate. We will use an 8% discount rate, close to the current interest rate on agricultural loans.
3. Years of life of the tile drainage. Tile drainage usually has a long life. A 50-year life is used here. Longer lives have little impact on yearly break-even benefits.

The break-even benefit can be calculated using the payment function (PMT) in Microsoft Excel (=pmt(rate, number of periods, present value). Figure 1 below shows the implementation in a Microsoft Excel spreadsheet using the values given above.

Figure 1. Microsoft Excel Implementation of Yearly Benefit Calculation

	A	B	C	D	E	F
1						
2						
3		Installation investment	1,000			
4		Discount rate	0.08			
5		Years of life	50			
6						
7		Yearly benefit	\$81.74	< formula is	"=-PMT(C4,C5,C3)"	
8						

Interpretation

For the above example, the break-even yearly benefit is \$81.74 per acre. Installation investment represents a relatively extensive systematic tile system. Much of the benefit comes from yield increases. Long-run prices for corn and soybeans likely are around \$4.50 per bushel for corn and \$10.50 for soybeans. Given these long-run prices, corn yields need to increase by 18.2 bushels per acre ($18.2 = \$81.74 \text{ break-even yearly benefit} / \4.50 corn price). Soybean yields need to increase by 7.8 bushels per acre ($7.8 = \$81.74 / 10.50$).

The eight percent discount rate roughly reflects the current interest rates on agricultural loans. If debt is not used, the desired return on capital could be used in break-even benefit calculations.

Sensitivity

Yearly benefits are sensitive to discount rates. In the last year, interest rates have increased as the Federal Reserve Bank has implemented policies of lower inflation. Last year, the cost of debt was closer to 4%. A 4% discount factor results in a \$46.55 per acre break-even level, 43% lower than the \$81.74 level given an 8% rate.

Yearly break-even benefits are not sensitive to changes in the yearly life of the investment. We used a 50-year life in the above example. Annual benefits for longer lives are:

- \$81.74 per acre for a 50-year life,
- \$80.25 per acre for a 75-year life, and
- \$80.04 per acre for a 100-year life.

Tax Consequence of Tile Investments

Tile investment is depreciable. Often, tile investment is written off against current year income using section 179 expensing or bonus depreciation if eligible to be used by the taxpayer. Any remaining basis in the tile investment is deducted using regular depreciation methods over time.

Other items associated with tile investments can have taxable consequences.:

1. Interest on debt used to finance installation investments is tax deductible.
2. Benefits from tile drainage, either in yield increases or cost reductions, that increase net income also will have tax liability impacts.

Including tax and debt consequences of drainage requires additional analysis, usually involving present value methods. The FAST spreadsheet entitled Capital Budgeting can be used to do these analyses.

Landowner Consequences

Tile drainage is a land improvement, which is the landowner's responsibility. For cash-rent landowners, yearly benefits come from increases in cash rent. For share rent landowners, benefits come in increased yields and reduction in costs. When the landowner is not the farmer, aligning benefits with costs becomes problematic.

Environmental Impacts

Nitrates and phosphorus have been measured coming from tile drainage, causing tile drainage to come under scrutiny from an environmental standpoint. Farmers and landowners may consider environmental considerations as they install tile.

Summary

We present a method for calculating the break-even benefits of tile drainage investments, thereby providing a gauge of the benefits necessary to recover the investment in tile drainage. As interest rates have risen in recent months, considerations of calculating these break-even levels have become more critical.

References

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