



# Analyzing land investments

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# Table of contents

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Introduction .....	1
Video script .....	2
Work sheet 2: case farm .....	15
References .....	20
Appendix table 1 .....	21
Appendix table 2 .....	22
Appendix table 3 .....	23
Appendix table 4 .....	24
Appendix table 5 .....	25
Appendix table 6 .....	26
Appendix table 7 .....	27
Exercise 1 .....	28
Exercise 2 .....	30
Work sheet 1 .....	31
Exercise 3 .....	33
Work sheet 1A .....	35
Work sheet 1B .....	37
Work sheet 1C .....	39
Work sheet 2 .....	42
Answer key 1 .....	44
Answer key 2 .....	47
Work sheet 1 key .....	48
Answer key 3 .....	50
Work sheet 1A key .....	53
Work sheet 1B key .....	55
Work sheet 1C key .....	57
Work sheet 2 key .....	61

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# Land investments

# Analyzing land investments



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## Purpose

The purpose of this module is to help you:

1. deal with two key questions related to buying land: "What is land worth to my business?" and "What can I pay for the land and still have it cash flow?"
2. appreciate four reasons why one of the most important decisions you might ever make, the land purchase decision, deserves careful analysis;
3. learn what gives value to land and learn to think in terms of the form and amount of potential future earnings;
4. gain a working knowledge of four factors to consider in analyzing potential land purchases;
5. learn how to use an income capitalization technique based on nine land variables to determine what value land has to your business;
6. become acquainted with a concept called "discounting" and how to use it as a valuable tool to convert future cash flows into present day dollars allowing comparisons to help you make sound management decisions;
7. become acquainted with and practice using a hand calculated work sheet which you can use for conducting an analysis of land value and arriving at a value of land for your own business;

This is one module of the *Business Management in Agriculture* series and is intended to be used with its corresponding videotape. The script may vary from the actual videotape text.

8. become acquainted with and practice using a hand calculated work sheet to determine the maximum financially feasible price you can afford to pay for land;
9. sharpen your skills in assessing the financial advisability of purchasing land using a case farm example;
10. confidently make land investment decisions based on business principles rather than on impulse or emotion; and
11. gain an appreciation for the financial risks associated with land purchase.

## Videotape script

By Gayle Willett

Let's assume the 120 acres located next to your farm has just come up for sale. You've had your eye on this ground for 20 years knowing how well it would fit in with your operation. Naturally, the seller wants an arm and a leg. But how much is the ground really worth? Will it cash flow? Do you buy now or wait and perhaps never get another chance? These are difficult questions and the answers could well make or break your career in farming.

Typically, many of us make land investment decisions in about the same way we chose the family car. If we want the car and could somehow come up with the necessary financing, we make the purchase. Although this approach may be acceptable for buying a car, it is a dangerous way to buy land, as many folks have unfortunately discovered in recent years.

The land purchase question, perhaps more than any other farm management decision, deserves a thorough financial analysis. Here are four good reasons.

First, a large amount of capital and debt are typically at stake. Making an error may at best result in prolonged cash flow problems, and if serious enough, could lead to failure of the business.

Secondly, many farmers make land investment decisions only once or twice during their career. Without experience, errors in decision making can normally be expected. Thirdly, when buying land it is easy to let emotions get in the way. The average turnover of U.S. farmland is about 4 percent annually, which means a particular piece of ground only comes up for sale about once every 25 years. Thus, you may only get one chance to buy that property down the road. The stress associated with limited purchase opportunities, plus the natural desire many of us have to own land, makes it difficult to adopt a

### **LAND INVESTMENT DESERVES CAREFUL ANALYSIS BECAUSE:**

- Large amount of capital and debt at stake
- Infrequent decisions are subject to errors
- Emotion can overrule sound judgment
- Future can be uncertain

### **WHEN BUYING LAND, CONSIDER:**

1. Market price
2. Value of land to you
3. Financial feasibility
4. Risk of loss

strict business-like attitude about buying land. Finally, uncertainty about the future is a major concern. Land investments are typically long-term investments, increasing our exposure to numerous unforeseen adversities. A drop in commodity prices, a rise in interest rates, a crop failure, etc., can quickly turn a good investment into a nightmare. So, a very thorough land-investment analysis is needed to show how vulnerable the investment is to changing circumstances.

### **Factors in land purchase**

What should your concerns be in analyzing the potential land purchase? Four factors stand out: (1) the market price of the land, (2) the value of the land to your business, (3) financial feasibility and (4) the risk of financial loss.

The market price of land, the first factor, is not determined until the land is actually sold. However, you should obtain a good estimate of the market price prior to the sale. It can help you formulate a bargaining strategy and assess the financial attractiveness of buying the land. Rarely will the asking price be a good estimate of the market price. Consider hiring an appraiser to get a good market-value estimate, especially if it's a large purchase and you are unsure about local market prices.

The second important aspect of analyzing a land purchase is determining the value of the property to you. Value-determining variables that may be specific to your business include enterprise choices, crop yields, cultural practices, production costs, product prices, income tax position, length of planning period, and existing machinery, labor, and management resources. In addition, the land-investment analysis requires that you specify the particular rate of return you want on the land investment. In other words, do you want a rate of return equal to a savings account at the local bank or more? Are you willing to settle for less? Considering all these factors, you will learn in this module how to compute a value of land. This will, in turn, indicate the price that you can pay for the property and realize that desired rate of return, whatever it might be.

The third concern in a land-investment analysis is the financial feasibility of the proposed purchase. This means the ability of your business to finance the purchase with equity and/or debt capital. And if debt is involved, the ability of your business to service that debt. Since it may involve large amounts of debt, it is important to make realistic cash flow projections to decide if funds will be sufficient to make principal and interest payments on the loan.

A fourth consideration is how the land investment will affect your risk-bearing position. Typically, with large amounts of debt, additional strain is imposed on your farm's cash flow from making principal and interest payments on the land loan. These fixed financial commitments, along with the uncertainty of future prices, yields, and land values, may increase risk of financial loss beyond a level you or your lender is willing to assume.

In this module, I will focus on how you may answer two key questions that underlie two of the four issues we have just reviewed: (1) What is land worth to my particular business? and (2) Can I pay for the land? We will use a case situation to illustrate how these questions can be answered.

## **What's land worth?**

First let's consider what land is worth. Land has a value because it entitles the owner to a set of future rights to the land. These rights include a claim to any earnings from that land and the right to sell it. Thus, the value of additional land to you is dependent upon potential earnings from three areas:

1. the stream of after-tax returns from agricultural production,
2. income tax benefits realized by deducting interest on the real estate loan and depreciation on depreciable assets sold with the land and
3. the after-tax value of the land at the end of the ownership period.

Keep these three in mind, because we will come back to them soon.

The value of the land is the sum of these three future benefits, discounted by your required rate of return. The resulting value is the most you can pay for the land and still realize the desired return on investment. Perhaps the idea of discounting is unclear at this point. I will have more to say on this in a few minutes when we look at an example.

## **Nine land valuation variables**

Although there are several different ways land values can be calculated using the income approach, the procedure I will be suggesting uses nine variables. Let's take a look at the first variable—annual return to land from agricultural production.

Land returns should be estimated for the current year based on yields, prices and costs existing under normal circumstances.

## **LAND VALUE VARIABLES**

1. Annual return from ag production
2. Annual rate of change in land returns
3. Annual rate of change in land values
4. Market price of land
5. General price inflation
6. Number of years in planning horizon
7. Income tax bracket
8. Land financing terms
9. Required rate of return on land investment

The return to land is calculated by taking gross receipts and subtracting all production expenses, except interest on the land investment and interest and depreciation on assets included with the land sale. Developing detailed enterprise budgets for crops to be grown can help accurately estimate land returns.

Where the investor intends to rent out rather than farm the land, returns to land may be estimated by taking total rent received minus ownership costs such as property taxes, repairs and insurance, but again exempting interest and depreciation. Additional detail on budgeting returns to land will be provided when we work through the example.

The second variable is **annual rate of change in land returns**. Although under variable one we saw land returns estimated for a current normal year, you might expect a longer-term increase in land returns due to improved varieties, expanded markets and better technology. Our valuation procedure allows you to be optimistic about the future by including your estimate of the average annual percent increase in returns to land.

Variable number three is **annual rate of change in land value**. Since the land's market value at the end of the ownership period is a component of the stream of returns on which the land's value is based, it is important that anticipated changes in the land's market value be considered in our valuation analysis. These changes might result from variation in land use, production technology, price relationships, and availability and terms of financing. If land use is restricted to agricultural activities, the change in the land's market value should be similar to the rate of change estimated for annual agricultural returns which was variable number one. However, where land is subject to a growing demand for industrial, urban, or recreational uses, the rate of change in market value will likely exceed that estimated for agricultural use. Also, there are reasons why annual returns and land prices could decline, including loss of water rights to urban interests, falling water tables and reduction in government program payments. Consequently, it's important that you closely study the factors potentially affecting the land's future market value.

The fourth variable is **market price of land**. The land's market price at the time of the proposed purchase is used as the starting point for computing annual changes in the value and the estimated value at the end of the ownership period. You will, therefore, want to obtain an estimate of recent sales prices for nearby and comparable land.

Variable number five is **general price inflation**. It is necessary to account for changes in the general price level when valuing land since those changes affect the purchas-

ing power of any income from that investment. Purchasing power and wealth are determined by real, not inflated, dollars. If, for example, a land investment yields a 4-percent return during a period of 4-percent general price inflation, your wealth position has not changed. In effect, you have received a zero real return on your investment.

To insure that our valuation reflects your desired real rate of return, it is necessary to include in our analysis an estimate of the average annual rate of general price inflation occurring during the period of land ownership. A good measure of inflation is the anticipated rate of change in the consumer price index.

Variable number six is number of years in your planning horizon. Since the value of land depends on total earnings realized during the period of ownership, the length of that period is an important determinant of land value. The ownership period used in our analysis must be determined by each owner in light of his or her age and business objectives. An older farmer about to retire and liquidate property may have less than a 5-year planning horizon. On the other hand, a 25-year-old farmer about to purchase his or her first piece of property could have a 40-year planning horizon.

The seventh variable is income tax bracket. Federal and state income taxes paid on ordinary income generated annually by land, and on capital gains when appreciated land is sold, reduces the stream of earnings attributable to land. Consequently, just like production expenses, income taxes reduce the value of land to the prospective buyer.

To identify the impact of income taxes on land value, an estimate of the appropriate marginal tax rate is necessary. The marginal tax rate is the rate at which additional income from the land investment is taxed. As of 1988, federal marginal tax rates for married individuals filing a joint return range from 15 to 33 percent, and for corporations from 15 to 34 percent. These federal rates should be adjusted to reflect state income taxes where they apply. Appendix Tables 5 and 6 (pp. 25-26) give more detail.

Variable number eight is land financing terms. Interest paid on money borrowed to finance land is a tax-deductible expense. In a profitable business, interest deductions reduce income tax liabilities and increase the after-tax stream of earnings accruing to land. The interest deduction is based on the size of the loan, interest rate and loan repayment period. The size of the tax benefit can be substantial as illustrated by a \$1,000 per acre loan with a 10-percent interest rate and a 20-year repayment period. Average annual interest for this loan would be \$67.46 per acre. Assuming a 28-percent marginal tax rate, the annual

## WHY DISCOUNT?

Because earnings are realized in the future and future dollars are worth less to you than current dollars.

## DISCOUNT RULE

Discount every future dollar at the same rate as earnings sacrificed by not having that dollar today to immediately reinvest.

## DISCOUNT RATE

It is, in effect, the **real rate of return** you want on your land investment.

It should be at least as high as the after-tax cost of debt capital used to finance the land purchase.

tax savings per acre would be \$67.46 times 0.28, or \$18.89 per acre. The actual impact of interest tax savings on land values will, however, depend on the interest rate relative to the discount rate and the marginal tax rate.

The final variable is **required rate of return** on the land investment. Once the after-tax stream of earnings accruing to land has been estimated, the earnings must be discounted to obtain the land's present value—the value of the land to you at the time of the proposed purchase. Discounting, or reducing in value, is necessary since the earnings are realized at future times instead of today. Future dollars are worth less to you than current dollars because you sacrifice the opportunity to reinvest today's dollars and realize returns accruing with the passage of time. This is true even if you assume a zero rate of inflation and overlook the added uncertainty of ever receiving those future dollars. Consequently, future dollars should be discounted at a rate equivalent to the earnings sacrificed by not having the money today to immediately reinvest.

## Selecting a rate of return

The discount rate used to value land is, in effect, the real rate of return you want on your land investment. So an important step, which is also the final step of our valuation process, turns out to be selection of a required real rate of return. If you are a profit-oriented investor, you will want the rate of return or discount rate to be high enough to ensure a profitable land investment. This means the land purchase must yield a rate of return exceeding the cost of the money used to finance the investment. Consequently, the cost of money or capital is a good place to start in selecting a minimal required real rate of return, or discount rate, which we can then use in assigning a final value to the land.

Since the cost of capital, or discount rate, is going to have a big impact on that final value, you should be careful in estimating that cost. The cost should be at least as high as the after-tax cost of debt capital you may have used to finance the land purchase. Of course, if you have an alternative similar-risk use for the funds which has a return exceeding the cost of debt, that return should be used as the discount rate. The real (inflation adjusted) after-tax cost of debt may be calculated in the following manner.

Note that we start with a 12-percent nominal, or stated, interest rate on the land loan. Next, to reflect the income tax savings associated with deducting interest in a 28-percent marginal tax bracket, we multiply the 12-percent nominal rate by 1 minus the marginal tax bracket of 0.28 or

0.72, resulting in an 8.64-percent after-tax loan cost. Finally, we subtract our estimate of 4-percent annual general price inflation to convert the nominal after-tax rate to a real inflation adjusted rate of 4.64 percent. The real after-tax cost of the loan and the minimum discount rate is, therefore, 4.64 percent. In this case, 4.64 would be the minimal starting point in selecting a required real rate of return on that land investment. Now let's do an example analysis.

## An example analysis

To illustrate our valuation process, let's assume you are thinking about buying that 120 acres which borders your existing 300-acre operation. The following assumptions apply:

1. The tract has 120 acres of flood irrigated, cultivated land and no buildings.
2. The likely sale price is \$300,000, or \$2,500 per acre.
3. Your existing machinery and management resources can adequately support the added acreage.
4. You have a 30-year planning horizon.
5. Taking into account the income generated by the existing business, it appears that additional earnings from the land investment will be taxed at a 15-percent rate.
6. Land returns are estimated to grow by 4 percent annually.
7. General price inflation is placed at 4 percent annually.
8. Tentatively, financing will likely require a 20-percent down payment and the remainder covered by a 30-year, 12-percent interest rate loan.
9. Land market value will rise at an annual rate of 4 percent.
10. Required after-tax real rate of return on the land investment is 6 percent. This was obtained by first multiplying the 12-percent interest rate on land loan, times 1 minus the 15-percent marginal tax rate, and then taking the 10.2-percent result minus 4-percent inflation, giving us 6.2 percent.

Now, let's go back and look at our nine land variables. For simplicity, I've grouped them under three different sources of earnings.

## Earnings from ag production

The first step in the valuation process is deciding what crops will be grown on the land and calculating returns to land from agricultural production. Estimated annual receipts, costs and returns for the 120-acre tract, assuming a

### CALCULATING THE DISCOUNT RATE

Current interest rate on land loan	12%
(1 - 0.15 MTR)	X 0.85
After-tax interest rate	10.2%
Inflation	- 4.0%
Discount rate (Real after-tax cost of the loan)	6.2%

**RECEIPTS, COSTS AND  
RETURNS ON 120  
ACRES OF WHEAT, HAY  
AND CORN**

	Total	Per acre
Gross receipts	\$ 52,300	\$ 436
Costs		
Operating	27,400	228
Overhead	+ 8,000	+ 67
Total costs	35,400	295
Return to land	\$ 16,900	\$ 141

six-year rotation of winter wheat/winter wheat/hay/hay/hay/sweet corn, are summarized in Appendix Table 1. These data are based on normalized current yields, prices and costs. Let's study Appendix Table 1 (p. 21). Look closely at the acreage, gross receipts and costs for each crop as well as the composite figures. As indicated, gross receipts are placed at \$52,300, or \$436 per rotation acre.

Cost estimates should include only those outlays expected to increase as a result of the land purchase. Thus, you should include such operating expenses as fuel, oil, repairs, chemicals, seed, custom services, hired and operator labor, irrigation water, wire for baled hay, and interest on these items. These total to \$27,400, or \$228 per rotation acre.

Certain overhead costs may also increase when additional land is purchased. If you buy more machinery, the additional depreciation, interest, property taxes, and insurance costs on that extra machinery should be included. However, if no additional machinery is needed, a lesser increase in machinery overhead expenses can be expected. This lesser increase results from greater machine use and an associated shortening of the useful life which causes annual depreciation expenses to rise. Other overhead costs applying in the example are property taxes on the land and amortized establishment expenses for the hay enterprise. Since the added acreage requires more management by you, the owner-operator, you deserve compensation for these personal efforts. Overhead costs sum to a little over \$8,000, or \$67 per rotation acre. When added to the operating costs of \$228, the total costs become \$295 per acre. Gross receipts per acre (\$436), minus total costs per acre (\$295), equals a return to land of \$141 per acre for the 120-acre tract.

What does this \$141 translate to in terms of land value? Perhaps the most naive answer to that question is obtained by multiplying \$141 times the 30 years the land is going to be owned, which gives you a \$4,230 land value. Of course, paying that much for the ground would be a serious mistake, wouldn't it?

Now remember, if we are going to earn 6 percent on the land investment, we need to discount, or reduce, the \$141 stream of future earnings by that amount. The proper interest factor for discounting is obtained from a handy table found in your study materials, Appendix Table 2 (p. 22). That table shows an interest factor for a 6-percent interest rate and 30-year planning horizon to be 13.765. Multiplication of this interest factor times the \$141 return gives us a value of \$1,941 per acre.

Next, we need to consider that Uncle Sam is going to take 15 percent of the \$141, leaving \$120 after taxes.

Discounting the \$120 by that same interest factor for 6 percent results in a land value of \$1,652.

We made an assumption that the \$120 return would grow by 4 percent annually. The impact of this growth can be estimated by reducing the 6-percent discount rate by the 4-percent growth rate, leaving a 2-percent net discount rate. The interest factor after 30 years and 2 percent is 22.396, which multiplied times \$120 gives a value of \$2,688.

Finally, it was assumed that general price inflation will reduce the buying power of land earnings by 4 percent a year. We can adjust for this development by adding 4 percent to our 2-percent net discount rate, resulting in a revised net rate of 6 percent. Remember that the interest factor for 6-percent interest, 30 years, is 13.765. Multiplication of 13.765 times \$120 again gives us a value of \$1,652 per acre. Let's start a summary table with this figure for agricultural production.

1. earnings from agricultural production	\$1,652
2. _____	_____
3. _____	_____

## Income tax benefits

A second source of earnings, and therefore land value, is the tax savings from deducting interest on the real estate loan. We have assumed a down payment of 20 percent and that 80 percent of the purchase price will be debt financed. Let's assume further that the eventual purchase price will equal the value we are computing in this example. This means the size of the loan, interest paid and associated tax savings are related to the land value. Mathematically, we can determine the value of the tax savings even though they are in turn related to the value of the land. However, to obtain a better understanding of the relationship between land value, interest payments, and tax savings, let's jump ahead of ourselves a bit and assume that while the market price of the land is likely to be \$2,500 per acre, it is only worth \$2,303 to you. This may seem like we are just picking a figure out of the air, but trust me, you will see later how we arrive at this figure.

If 80 percent of the \$2,303 is borrowed, the loan will be \$1,842 per acre. The average annual interest payment per acre is \$167.27, assuming 12-percent interest and 30-year repayment period. Multiplication of the interest payment times the 15-percent marginal tax rate gives us an average annual tax savings of \$25.09 per acre over the next 30 years. As was the case with earnings from crop production, the stream of future tax savings must be discounted. The proper discount rate is the 6-percent required return,

### INCOME TAX BENEFITS

Value/acre	\$ 2,303
Percent financed	X 0.80
Loan/acre	\$ 1,842
Annual interest	
12%, 30 yr	\$ 167.27
Marginal tax rate	X 0.15
Annual tax savings	\$ 25.09
Interest factor	
10%, 30 yr	X 9.427
Present value	\$ 237

### TERMINAL LAND VALUE

Current market price	\$ 2,500
Int. factor (4%, 30 yr)	X 3.243
Terminal value	
before taxes	\$ 8,108
Initial value	- 2,500
Capital gain	\$ 5,608
Marginal tax rate	X 0.15
Capital gain tax	\$ 841
Terminal value	
before taxes	\$ 8,108
Capital gain tax	- 841
Terminal value	
after tax	\$ 7,267
Interest factor	X 0.057
Present value of	
land's terminal value	\$ 414

plus 4-percent general inflation, which is reducing the value of the tax savings—a combined discount rate of 10 percent. According to Appendix Table 2 (p. 22), the interest factor for 10 percent, 30 years, is 9.427. Multiplication of 9.427 times the \$25.09 annual tax savings gives us \$237, the present value of the 30 years of tax savings from deducting interest payments. Let's add this figure to our summary table giving us two of the three.

1. earnings from agricultural production	\$1,652
2. income tax benefits	237
3. _____	_____

### Terminal value of land

The third and final source of earnings on which the land's value is based is the property's terminal value at the end of the 30-year ownership period. It is assumed the land's market price will appreciate 4 percent annually. To determine what the land will be worth in 30 years, it is necessary to look at your study materials and find the compound interest factor in Appendix Table 3 (p. 23) for 30 years and 4-percent interest. Locating the intersection of 4 percent and 30 years gives us an interest factor of 3.243; therefore, the land's terminal value is the land's current market price of \$2,500 times the factor of 3.243, or \$8,108. The terminal value, however, must be reduced by any capital gains taxes. These are computed by multiplying the capital gain of \$5,608 (\$8,108 - \$2,500) by the 15-percent marginal tax rate, giving us a capital gains tax of \$841. The after-tax terminal value is therefore \$8,108 minus \$841, or \$7,267. Since the \$7,267 is not realized for 30 years, it must be discounted. The proper discount rate is the 6-percent required return plus 4-percent general inflation—a combined rate of 10 percent. In Appendix Table 4 (p. 24) we see the interest factor for 10 percent, 30 years, is 0.057. Multiplication of the terminal value of \$7,267 times the factor of 0.057, gives us \$414—the present value of the land's terminal value.

### Land value based on earnings

To summarize our valuation analysis, we have identified three items in the stream of returns on which the land's value is based. Those three items and their associated values are:

1. earnings from agricultural production	\$1,652
2. income tax benefits	237
3. terminal value of land	414
for a total value of land equaling	\$2,303

This is the value of the land to you. Remember, I promised that we would get back to this figure. It really didn't come out of the air, did it? It can be concluded, then, that if you pay \$2,303 for the land, and everything turns out the way we projected, you will earn a 6-percent after-tax real rate of return on the land investment. If more than \$2,303 is paid for the land, a lower rate of return can be expected. Alternatively, a higher return is implied if the land is acquired for a price below \$2,303. Since the market price is estimated to be \$2,500, you may have difficulty buying the land at a price providing the desired 6-percent return.

I suggest that you stop at this point and review the three items making up the stream of returns to land. Review all calculations. We went through it pretty fast and it's essential to understanding the next section.

## Playing with the variables

Now that you have reviewed the calculations, I want to introduce you to a more formal tool that should systematically lead you through the same process we have just used in our example farm. You will find a work sheet entitled "Work sheet 1: analysis of land value" that is used in Exercise 2 (p. 31). The work sheet provides step-by-step directions including when and how the interest factors are obtained from the interest tables. Armed with the essential data, a pencil and a calculator, you should be able to complete the work sheet in just a few minutes.

I would encourage you to practice several of these work sheets to determine the impact of adopting different assumptions for such key variables as: (1) the required rate of return, (2) land price change, (3) general price inflation, (4) tax rate, (5) product yield and (6) product prices. Of course, I wouldn't ask you to do anything that I wouldn't do, so I recomputed land values for our example using different assumptions for selected variables. Actually, I cheated a little by using a computer to do the calculations. If you have access to a microcomputer, you may wish to obtain land investment software from a private vendor or from Cooperative Extension at your state's land grant university. There are lots of good programs available across the country.

In changing selected variables, I found some very interesting things. By changing the required return from 6 percent to 5.45 percent, the land's value rises from \$2,303 to \$2,500. Therefore, we can conclude that if you did pay the \$2,500 market price asked for the 120 acres of land, you would have had to accept a lower return of 5.45 percent on your investment. Dropping the land price

### IMPACT OF SELECTED VARIABLES ON LAND VALUE

Variable	Value of variable	Land value
Required rate of return		
Base	6%	\$2,303
Adjusted	5.45%	\$2,500
Land price appreciation		
Base	4%	\$2,303
Adjusted	2%	\$2,098
General price inflation		
Base	4%	\$2,303
Adjusted	6%	\$1,736
Marginal tax rate		
Base	15%	\$2,303
Adjusted	28%	\$2,236
Hay yield		
Base	5.4 T	\$2,303
Adjusted	4 T	\$1,403
Hay price		
Base	\$100/T	\$2,303
Adjusted	\$90/T	\$1,950

appreciation assumption from 4 percent to 2 percent caused the land value to drop from \$2,303 to \$2,098. Increasing the rate of general price inflation from 4 percent to 6 percent reduced the land value by \$567 to \$1,736. The value dropped from \$2,303 to \$2,236 if we increased the marginal tax rate from 15 to 28 percent. Also, dropping hay yields and/or prices caused large reductions in land value. For example, a decrease in yield from 5.4 to 4 tons per acre reduced the value by \$900 per acre. A ten-dollar drop in hay price caused land value to decrease by \$353.

Changing your basic assumptions and recomputing land value provides a good indication of the risk associated with buying the land, as well as identifying your flexibility in negotiating a price with the seller.

We've taken a lot of time to discuss what land is worth. You may want to stop and think about these important ideas. You may want to work through Work sheet 1 several times using different assumptions to see the affects of change.

### What can you pay for land?

Let's get on to the final question—What can you pay for land?

After placing a value on the land you are thinking about buying, you will want to consider how much you can afford to pay for the land. More specifically, you must examine the question as to whether available equity capital reserves and unused borrowing capacity are sufficient to finance the purchase at the expected market price. Furthermore, when debt is involved, your ability to service that debt should be examined.

Financial feasibility could be examined for only the new acreage, or for the entire business which includes current acreage plus the additional land. In the following discussion, I will work with the entire business. Work sheet 2, which we will use in a minute, provides a procedure for determining the maximum financially feasible price the farm business can pay for additional land. I recommend that the work sheet be completed for the expanded (current plus added land) business on an annual basis. The work sheet assumes the maximum financially feasible price is determined by the equity funds available for a down payment, plus the maximum amount of debt the farm's cash flow can service. Let me give you an overview of how the work sheet is structured and then we will return to our example and illustrate its use.

## Introduction to Work sheet 2

The starting point is an estimate of all annual gross cash receipts you are willing to commit to the business. This would include receipts from all agricultural enterprises, plus any other income you may want to put on the line for servicing additional land debt. Next, annual cash costs, excluding interest on the added real estate debt, are estimated and subtracted from the receipts. The resulting net income is adjusted for income taxes, including the tax savings from depreciation (a non-cash cost), and personal exemptions and standard deduction. The resulting after-tax income is then reduced by principal payments on existing term debt, a depreciation reserve, Social Security taxes, and family living expenses. The cash left after making these adjustments is what is available for principal and interest payments on additional real estate debt. Assuming a certain interest rate and repayment period on the new land loan, the cash available for servicing that loan converts to a loan of a given size. That maximum loan, plus the equity capital available for a down payment, equals the maximum financially feasible price for the additional land.

Where the maximum financially feasible price you can pay for the land (the bottom line of Work sheet 2) exceeds the probable market price, the purchase is financially feasible. Conversely where the market price is likely to exceed the maximum financially feasible price, there is a strong likelihood the business will experience cash flow difficulties if the land is purchased.

## Case farm revisited

Referring back to our land purchase example, you will recall that we have determined that the land is worth \$2,303 per acre. The next question we need to address is: How much can you pay for this ground? Let's look at Work sheet 2: analysis of ability to pay for land. You will find an example work sheet for our case farm on pp. 15-16.

The frame of reference assumed for the completion of Work sheet 2 is annual cash flow projections considered to be typical during the first 3 to 4 years of land ownership. Debt will be at a peak and your cash flow will be the most vulnerable during this time, so it is appropriate that our analysis focuses on this period.

Let's take a closer look at this tool. The analysis starts by entering your average annual gross cash receipts on line 1. This estimate should include income from all sources, including current and added land, and any non-farm income you want to put at risk for the land purchase. Based on records, income tax returns and some budgeting,

### WHAT CAN YOU PAY FOR FARMLAND?

	Gross cash receipts
-	Cash costs (exc. int.)
-	Income taxes
-	Principal payments on term debt
-	Depreciation reserve
-	Social Security taxes
-	Family living expenses
=	Cash available for principal and int. on added land debt
=	Amount that can be borrowed
+	Down payment
	Maximum financially feasible price

# Work sheet 2: case farm

## Analysis of ability to pay for land

1. Enter average annual before-tax gross cash receipts from all enterprises in the expanded business .....	\$ <u>183,120</u>
2. Enter average annual before-tax cash costs for all enterprises in the expanded business * .....	\$ <u>108,360</u>
3. Before-tax net cash income (line 1 – line 2) .....	\$ <u>74,760</u>
4. Enter average annual depreciation deducted for income taxes paid on expanded business .....	\$ <u>15,750</u>
5. Enter income tax deduction for personal exemptions and standard or itemized deduction .....	\$ <u>13,000</u>
6. Income tax deductions (line 4 + line 5) .....	\$ <u>28,750</u>
7. Enter your average income tax rate for expanded business. (Express as a decimal) † .....	<u>0.15</u>
8. Tax savings (line 6 X line 7) .....	\$ <u>4,312</u>
9. Enter 1.00 minus your average income tax rate (line 7) .....	<u>0.85</u>
10. After-tax net cash income (line 3 X line 9) .....	\$ <u>63,546</u>
11. Tax-adjusted net cash income (line 8 + line 10) .....	\$ <u>67,858</u>
12. Enter average annual principal payments on term debt (over 1 year). Do not include debt on land purchase .....	\$ <u>18,050</u>
13. Enter average annual depreciation reserve ‡ .....	\$ <u>5,000</u>
14. Enter Social Security taxes paid on self-employment income § .....	\$ <u>6,073</u>
15. Enter annual family living expenses .....	\$ <u>20,000</u>
16. Add lines 12, 13, 14, and 15 .....	\$ <u>49,123</u>
17. Cash income available for additional R.E. debt service (line 11 – line 16) .....	\$ <u>18,735</u>
18. Enter interest factor from Appendix Table 2 for interest rate equaling after-tax contractual rate of interest on loan and number of years in loan repayment period ¶ .....	<u>9.427</u>

19. Amount which can be borrowed to finance additional land purchases (line 17 X line 18) .....	\$ <u>176,615</u>
20. Enter equity capital available for down payment on land purchase .....	\$ <u>60,000</u>
21. Maximum price that can be paid for total acreage (line 19 + line 20) .....	\$ <u>236,615</u>
22. Maximum per-acre price (line 21 + number of acres in land purchase) .....	\$ <u>1,972</u>

\* Cash costs should include hired labor, fuel, lubricants, repairs, all materials (e.g., seed, fertilizer, herbicides, pesticides), custom services, rent on machinery and/or land, crop insurance, property taxes, general overhead (e.g., telephone, utilities, travel, accounting, legal), and interest paid on all loans. Interest paid on the loan to finance the land purchase should not be included. If livestock enterprises are present, cash costs related to these enterprises should be included.

† Can be estimated by subtracting line 6 from line 3 to obtain taxable income and referring to Appendix Table 5 or 6 for the average tax rate on that taxable income.

‡ Estimate of annual capital needed to replace depreciable assets.

§ See *Farmer's Tax Guide*, IRS publication 225, for definition of self-employment income and tax rate. The tax should not exceed the legal maximum.

¶ The after-tax interest rate equals the before-tax rate multiplied by 1 minus the marginal income tax rate.

**AFTER-TAX COST OF  
THE LAND LOAN**

$$\begin{aligned} & 12\% \times (1 - 0.15 \text{ MTR}) \\ = & 12\% \times 0.85 \\ = & 10\% \end{aligned}$$

gross cash receipts are estimated to be \$183,120. The second line is your estimate of cash costs for all activities used to generate the receipts. The cost estimate of \$108,360 includes interest on current loans. It does not include principal payments on current term (over one year) loans nor principal or interest on the potential added real estate debt.

Line 3 is merely a subtraction of the two to get a net before-tax cash income figure of \$74,760. Lines 4 through 11 contain information and calculations needed to adjust the net before-tax cash income for federal and state income taxes. Depreciation claimed for tax purposes (line 4) is estimated to be \$15,750. Deductions for personal exemptions and standard deduction are \$13,000 on line 5. These two items added together equal \$28,750 (line 6). Your average tax rate (0.15) for the expanded business entered on line 7, times the \$28,750 deductions, equals \$4,312 in tax savings (line 8). The average tax rate is used rather than the marginal rate we used in the valuation analysis since we are now dealing with the entire business and not just the added acreage. Line 9 is 1 minus the average tax rate, or 0.85. Multiplication of 0.85 times \$74,760 before-tax net cash income on line 3 gives us \$63,546 that is left after paying income taxes (line 10). This figure (\$63,546) is added to tax savings (\$4,312) to get a tax-adjusted net cash income figure of \$67,858 (line 11).

Lines 12 through 16 list additional drains on the business' cash flow. Those cash obligations include \$18,050 principal payments on already existing debt (line 12), \$5,000 that must be set aside to provide down payments on depreciable assets as they wear out (line 13), \$6,073 Social Security taxes (line 14), and finally, \$20,000 for family living expenses (line 15). The total of these outflows is \$49,123. When we take \$67,858 tax-adjusted net cash income, minus \$49,123 additional outflows, we get \$18,735 (line 17). This is the amount projected to be available for annual principal and interest payments on the added land debt.

Assuming a 12-percent interest rate and 30-year repayment period on the land loan, the \$18,735 annual payment will service a certain amount of debt. To find what that supportable debt is, we first look up an interest factor in Appendix Table 2 (p. 22), for 10-percent interest and 30 years. Why 10-percent interest instead of 12? Ten percent is used rather than 12 percent because the interest is tax deductible and 10 percent is the after-tax cost of the land loan, assuming a 15-percent marginal tax rate. Since we are now looking at the tax impact of additional debt, the marginal, rather than average, tax rate should be used. In

this case, we are in the lowest tax bracket where the marginal and average tax rates are both 15 percent. Appendix Table 2 shows the interest factor for 10 percent and 30 years to be 9.427 and is entered on line 18.

Multiplication of the 9.427 interest factor times the \$18,735 available for debt service (line 17) gives us \$176,615 (line 19), which is how much you can borrow to finance the added land. The annual principal and interest payment on this loan is the \$18,735 we said was available for that use. Adding the \$60,000 (line 20) of equity capital available for a down payment to the \$176,615 loan (line 19), gives us \$236,615 (line 21), which is the maximum price that can be paid for the total acreage. Divided by 120 acres, the acreage in your proposed purchase, \$1,972 (line 22) is the maximum per acre price you can afford.

This \$1,972 is the most you can pay for the ground and expect the investment to cash flow. If you pay more than \$1,972, you will not have enough funds to make payments on a larger loan. Also, even if the property can be purchased for \$1,972, it should be noted that we did not set aside a contingency reserve. Consequently, if something goes wrong (and of course, it never does in farming!) you will likely have cash flow problems. Buying the ground for \$1,972 per acre and incurring a total loan of \$176,615 involves considerable financial risk, but is feasible as long as everything turns out the way we assumed in the analysis. Again, it is suggested that several work sheets be completed using different assumptions for such key variables as product prices and yields, cash production costs, and real estate loan terms. By expanding the analysis in this manner, you can obtain a better feel for the range of debt (and therefore, maximum land price) the business can support under various business circumstances.

This would be a good time to review the entries for the case farm's Work sheet 2 making sure you understand it fully. Next, we'll discuss what to do with the results of Work sheets 1 and 2 and what they mean.

## Interpretation of analysis

Once Work sheets 1 and 2 have been completed, you are in a good position to assess the financial advisability of buying the land. If the analysis indicates the land's value from Work sheet 1 and maximum financially feasible price from Work sheet 2 both exceed the expected market price, the land purchase will appear attractive. Conversely, if the value and/or maximum financially feasible price falls below the likely market price, the land investment will not yield the desired profit and/or cash flow.

### FINAL INTERPRETATION

Market price	\$ 2,500
Land value	\$ 2,303
Max. feasible price	\$ 1,972

This case farm analysis provides a good example of a financially unattractive investment. Both the value (\$2,303) and the maximum financially feasible price (\$1,972) lie below the expected market price (\$2,500). If you paid \$2,500 for this property, you would not realize the desired 6-percent return on investment and most certainly would experience difficulty in servicing the added real estate debt.

This concludes our discussion on analyzing an investment in land. Deciding whether to buy land or lease land, which is a separate topic dealt with in Appendix Table 7 is one of the most important decisions made by farmers. Errors in decision making can have a devastating impact on the farm business and family. Although a thorough analysis such as we have outlined in this module will not guarantee a successful land investment, it should help prevent major disasters.

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# Appendix table 1

## Estimated annual receipts, costs and returns for 120-acre tract

Item	Wheat	Hay	Sweet corn	115 acres	Per acre (120 ac)
<b>1. Gross receipts</b>					
Acres	38	58	19	115	—
Yield	100 bu	5.4 tons	8 tons	—	—
Price	\$ 3.00	\$ 100	\$ 63	—	—
Gross receipts	\$ 11,400	\$ 31,320	\$ 9,576	\$ 52,296	\$ 435.80
<b>2. Costs</b>					
<b>A. Operating</b>					
Machinery					
(fuel, oil, repairs)	\$ 2,380	\$ 2,895	\$ 1,291	\$ 6,566	\$ 54.72
Fertilizer	2,212	3,608	1,535	7,355	61.29
Pesticides	67	232	33	332	2.77
Seed	608	—	618	1,226	10.22
Custom services	2,208	1,015	276	3,571	29.76
Labor	1,506	2,056	813	4,375	36.46
Water	608	928	304	1,840	15.33
Wire	—	1,085	—	1,085	9.04
Interest (13%)	515	282	219	1,016	8.47
<b>TOTAL</b>	<b>\$ 10,176</b>	<b>\$ 12,101</b>	<b>\$ 5,089</b>	<b>\$ 27,366</b>	<b>\$ 228.06</b>
<b>B. Overhead</b>					
Mach. depreciation	\$ 491	\$ 1,137	\$ 206	\$ 1,834	\$ 15.28
Real estate taxes	304	464	152	920	7.27
Management (5% of gross receipts)	570	1,566	479	2,615	21.80
Amortized stand establishment	—	2,698	—	2,698	22.48
<b>TOTAL</b>	<b>\$ 1,365</b>	<b>\$ 5,865</b>	<b>\$ 837</b>	<b>\$ 8,067</b>	<b>\$ 67.23</b>
<b>3. Total cost</b> (A + B)	\$ 11,541	\$ 17,966	\$ 5,926	\$ 35,433	\$ 295.28
<b>4. Returns to land</b> (1 - 3)	\$ (141)	\$ 13,354	\$ 3,650	\$ 16,863	\$ 140.52

# Appendix table 2

## Present value of \$1 annuity per year for selected years and rates of interest per year\*

Interest rate	Years in planning or loan repayment period							
	5	10	15	20	25	30	35	40
20.0	2.991	4.192	4.675	4.870	4.948	4.979	4.992	4.997
19.0	3.058	4.339	4.876	5.101	5.195	5.235	5.251	5.258
18.0	3.127	4.494	5.092	5.353	5.467	5.517	5.539	5.548
17.0	3.199	4.659	5.324	5.628	5.766	5.829	5.858	5.871
16.0	3.274	4.833	5.575	5.929	6.097	6.177	6.215	6.233
15.0	3.352	5.019	5.847	6.259	6.464	6.566	6.617	6.642
14.0	3.433	5.216	6.142	6.623	6.873	7.003	7.070	7.105
13.0	3.517	5.426	6.462	7.025	7.330	7.496	7.586	7.634
12.0	3.605	5.650	6.811	7.469	7.843	8.055	8.176	8.244
11.0	3.696	5.889	7.191	7.963	8.422	8.694	8.855	8.951
10.5	3.743	6.015	7.394	8.231	8.739	9.047	9.235	9.348
10.0	3.791	6.145	7.606	8.514	9.077	9.427	9.644	9.779
9.5	3.840	6.279	7.828	8.812	9.438	9.835	10.087	10.247
9.0	3.890	6.418	8.061	9.129	9.823	10.274	10.567	10.757
8.5	3.941	6.561	8.304	9.463	10.234	10.747	11.088	11.315
8.0	3.993	6.710	8.559	9.818	10.675	11.258	11.655	11.925
7.5	4.046	6.864	8.827	10.194	11.147	11.810	12.273	12.594
7.0	4.100	7.024	9.108	10.594	11.654	12.409	12.948	13.332
6.5	4.156	7.189	9.403	11.019	12.198	13.059	13.687	14.146
6.0	4.212	7.360	9.712	11.470	12.783	13.765	14.498	15.046
5.5	4.270	7.538	10.038	11.950	13.414	14.534	15.391	16.046
5.0	4.329	7.722	10.380	12.462	14.094	15.372	16.374	17.159
4.5	4.390	7.913	10.740	13.008	14.828	16.289	17.461	18.402
4.0	4.452	8.111	11.118	13.590	15.622	17.292	18.665	19.793
3.5	4.515	8.317	11.517	14.212	16.482	18.392	20.001	21.355
3.0	4.580	8.530	11.938	14.877	17.413	19.600	21.487	23.115

\* Use this table when you are receiving or paying the same amount of money for each of several future periods and you would like to know the present value of those amounts.

# Appendix table 3

## Compound value of \$1 at the end of selected years and for various rates of interest\*

Interest rate	Years in planning period							
	5	10	15	20	25	30	35	40
15	2.011	4.046	8.137	16.367	32.919	66.212	133.176	267.864
14	1.925	3.707	7.138	13.743	26.462	50.950	98.100	188.884
13	1.842	3.395	6.254	11.523	21.231	39.116	72.069	132.782
12	1.762	3.106	5.474	9.646	17.000	29.960	52.800	93.051
11	1.685	2.839	4.785	8.062	13.585	22.892	38.575	65.001
10	1.611	2.594	4.177	6.727	10.835	17.449	28.102	45.259
9	1.539	2.367	3.642	5.604	8.623	13.268	20.414	31.409
8	1.469	2.159	3.172	4.661	6.848	10.063	14.785	21.725
7	1.403	1.967	2.759	3.870	5.427	7.612	10.677	14.974
6	1.338	1.791	2.397	3.207	4.292	5.743	7.686	10.286
5	1.276	1.629	2.079	2.653	3.386	4.322	5.516	7.040
4	1.170	1.480	1.801	2.191	2.666	3.243	3.946	4.801
3	1.159	1.344	1.558	1.806	2.094	2.427	2.814	3.262
2	1.104	1.219	1.346	1.486	1.641	1.811	2.000	2.208
1	1.051	1.105	1.161	1.220	1.282	1.348	1.417	1.489

\* Use this table when you are receiving or paying a single sum of money at the present time and you would like to know the future dollar value of that amount.

# Appendix table 4

## Present value of \$1 due in selected years and rates of interest\*

Interest rate	Years in planning period							
	5	10	15	20	25	30	35	40
20	.402	.162	.065	.026	.010	.004	.002	.001
19	.419	.176	.074	.031	.013	.005	.002	.001
18	.437	.191	.084	.037	.016	.007	.003	.001
17	.456	.208	.095	.043	.020	.009	.004	.002
16	.476	.227	.108	.051	.024	.012	.006	.003
15	.497	.247	.123	.061	.030	.015	.008	.004
14	.519	.270	.140	.073	.038	.020	.010	.005
13	.543	.295	.160	.087	.047	.026	.014	.008
12	.567	.332	.183	.104	.059	.033	.019	.011
11	.593	.352	.209	.124	.074	.044	.026	.015
10	.621	.386	.239	.149	.092	.057	.036	.022
9	.650	.422	.275	.178	.116	.075	.049	.032
8	.681	.463	.315	.215	.146	.099	.068	.046
7	.713	.508	.362	.258	.184	.131	.094	.067
6	.747	.558	.417	.312	.233	.174	.130	.097
5	.784	.614	.481	.377	.295	.231	.181	.142
4	.822	.676	.555	.456	.375	.308	.253	.208

\* Use this table when you are receiving or paying a single sum of money at a future point in time and would like to know the present value of that amount.

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## Appendix table 5

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**Average and marginal federal income tax rates  
for married individuals filing a joint return,  
selected taxable incomes, 1988**

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<b>Taxable income \$</b>	<b>Average tax rate % <sup>1</sup></b>	<b>Marginal tax rate %</b>
0 — 29,750	15	15
29,751 — 71,900	20.4	28
71,901 — 171,090 <sup>2</sup>	26.9	33
Over 171,090	28.5 <sup>3</sup>	28

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<sup>1</sup> Calculated at the midpoint of the taxable income range.

<sup>2</sup> The top of the 33% bracket is extended by \$10,920 for each dependent claimed on the return.

<sup>3</sup> Calculated at a \$200,000 taxable income.

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## Appendix table 6

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### Average and marginal federal income tax rates for regular corporation, selected taxable incomes, 1988

Taxable income \$	Average tax rate %	Marginal tax rate %
0 — 50,000	15	15
50,001 — 75,000	17 <sup>1</sup>	25
Over 75,000 <sup>3</sup>	22.2 <sup>2</sup>	34

<sup>1</sup> Computed at \$62,500 taxable income.

<sup>2</sup> Computed at \$100,000 taxable income.

<sup>3</sup> A corporation with taxable income over \$100,000 must pay an additional tax equal to 5% of the amount in excess of \$100,000, up to a maximum additional tax of \$11,750.

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# Appendix table 7

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## Purchasing versus leasing land

Some advantages of purchasing and leasing land.

### **Ownership advantages**

- Pride of ownership
- Security of tenure
- Preferred security for loans
- Appreciation of land value

### **Leasing advantages**

- Less capital
- Shift risk to land owner
- Flexibility

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# Exercise 1

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## Video questions

Indicate whether each of the following statements is true (T) or false (F).

- T   F   1. A profitable land investment should also be financially feasible (cash flow).
- T   F   2. A land investment that is financially feasible should also be profitable.
- T   F   3. The income capitalization approach to valuing land is based on projecting future earnings generated by the land.
- T   F   4. A dollar of earnings realized from a land investment in year 1 contributes the same to land value as a dollar of earnings realized in year 10.
- T   F   5. If you are in a 15-percent marginal tax bracket, the after-tax cost of a 10-percent interest loan is 8.5 percent.
- T   F   6. A higher required rate of return (discount or capitalization rate) on a land investment will translate to a lower land value, everything else held constant.
- T   F   7. If the same acre is farmed in the same manner by two different farmers, the land value should be the same for both farmers.
- T   F   8. Three primary sources of land earnings, and therefore land value, are income from agricultural production, income tax benefits and terminal value of land.
- T   F   9. Since land is generally a long-term investment, and it's difficult to accurately project what's going to happen in agriculture, analyzing a land investment based on future performance is a futile exercise.
- T   F   10. Since depreciation is a non-cash cost, it can be ignored in determining how much cash flow you have to service added real estate debt.
- T   F   11. The risk of variation in crop yields and prices is greater for the farmer who owns land than it is for the farmer who leases land under a crop-share arrangement.
- T   F   12. In budgeting a return to land, interest on the land investment should be considered a cost.
- T   F   13. The discount (or capitalization) rate used to compute a land value should be based on the cost of the money used to finance the land purchase.

- T F 14. Using more debt and less equity capital to finance a land purchase will cause the land's value to decrease.
- T F 15. If the annual percentage rate (APR) on a land loan is 13 percent and general price inflation is 5 percent, the approximate real (inflation adjusted) APR is 8 percent.
- T F 16. If you have surplus machinery resources, annual depreciation on the machinery shouldn't increase if you add more land to your existing operation.
- T F 17. Management costs shouldn't change if you increase the size of your farming operation.
- T F 18. Four major factors to consider in deciding whether to buy land are market price of land, value of land to potential buyer, financial feasibility and risk of financial loss.
- T F 19. The age of a potential buyer of farmland should have little impact on the value of the land to that buyer.
- T F 20. If returns to land from agricultural production increase by 4 percent annually, then the value of the land should increase by 4 percent per year.

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# Exercise 2

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## Analysis of land value

In the videotape, we used the income capitalization approach to place a value on an example piece of ground. Work sheet 1 (next page) will help you make these same calculations. Please use the work sheet and the Appendix Tables to place a value on the example property. You may recall that the following assumptions applied to the 120-acre example:

Before-tax gross receipts per rotation acre .....	\$436
Total before-tax costs per rotation acre (excluding interest on land loan) .....	\$295
Marginal income tax rate .....	15%
Likely sales price per acre .....	\$2,500
Financing is 20-percent down payment, remainder with 30-year, 12-percent interest loan	
General increase in price inflation .....	4% /year
Average annual increase in land returns .....	4%
Planning horizon .....	30 years
Increase in land market price .....	4% /year
Required after-tax rate of return on land investment (discount rate) .....	6%

# Work sheet 1

## Analysis of land value

1. Enter average annual before-tax gross receipts .....	\$ _____
2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....	\$ _____
3. Before-tax returns to land (line 1 – line 2) .....	\$ _____
4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....	_____
5. After-tax returns to land (line 3 X line 4) .....	\$ _____
6. Enter your required after-tax real rate of return on the land investment .....	_____ %
7. Enter your estimate of the average annual rate of general price inflation .....	_____ %
8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....	_____ %
9. Adjusted discount rate (line 6 + line 7 – line 8) .....	_____ %
10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....	_____
11. Land value attributable to agricultural production (line 10 X line 5) .....	\$ _____
12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....	_____
13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period .....	_____
14. Divide line 12 by line 13 .....	_____
15. Divide line 12 by number of years in loan repayment period .....	_____
16. Subtract line 15 from line 14 .....	_____
17. Multiply line 16 times your marginal income tax rate .....	_____
18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....	_____
19. Multiply line 18 times line 17 .....	_____

- |   |          |
|---|----------|
| 20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....   | _____    |
| 21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period ..... | _____    |
| 22. Enter current market price of comparable land (\$/acre) .....   | \$ _____ |
| 23. Before-tax terminal market price of land (line 21 X line 22) .....  | \$ _____ |
| 24. Enter your capital gains tax rate (express as a decimal) .....  | _____    |
| 25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....  | \$ _____ |
| 26. After-tax terminal value of land (line 23 – line 25) .....  | \$ _____ |
| 27. Land value attributable to terminal value of land (line 20 X line 26) .....   | \$ _____ |
| 28. Add line 11 and line 27 .....   | \$ _____ |
| 29. Enter 1.000 minus line 19 .....   | _____    |
| 30. Land value attributable to interest income tax deductions<br>[(line 28 + line 29) – line 28] .....  | \$ _____ |
| 31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....   | \$ _____ |

**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

# Exercise 3

## Land investment analysis

### Problem situation

A farmer is considering the purchase of a nearby 160 acres (all tillable) of dryland ground. He has obtained the following information on the property:

	Crops in rotation	
	Wheat	Dry peas
1. Estimated annual receipts, costs and returns to land:		
A. Gross receipts		
(a) Acres .....	80	80
(b) Yield .....	70 bu	1,740 lbs
(c) Price (per unit of yield) .....	\$ 2.50	\$ 0.10
B. Costs (per acre)		
(a) Machinery (fuel, oil and repairs) .....	\$ 14.90	\$ 20.01
(b) Hired labor and operator labor .....	\$ 8.19	\$ 9.79
(c) Seed .....	\$ 9.00	\$ 25.00
(d) Fertilizer .....	\$ 34.40	\$ 0.00
(e) Herbicides & insecticides .....	\$ 27.94	\$ 30.00
(f) Custom services .....	\$ 2.10	\$ 9.10
(g) Crop insurance .....	\$ 3.24	\$ 7.44
(h) Interest on operating capital .....	\$ 3.46	\$ 1.50
(i) Machinery depreciation .....	\$ 4.00	\$ 6.10
(j) Real estate taxes .....	\$ 3.90	\$ 3.90
(k) Operator management .....	\$ 14.70	\$ 12.18
(l) Miscellaneous .....	\$ 0.00	\$ 0.00
2. Farmer's marginal tax rate .....	15 %	
3. Required after-tax real rate of return .....	5 %	
4. Annual rate of general price inflation .....	6 %	
5. Annual growth rate of net land returns .....	4 %	
6. Farmer's planning horizon .....	35yrs	
7. Proportion debt financed .....	70 %	
8. Real estate loan repayment period .....	35yrs	
9. Interest rate (APR) on real estate loan .....	11 %	
10. Annual inflation rate for land (property has long-term subdivision potential) .....	7 %	
11. Estimated market price of land .....	\$1,000	

## Assignment

1. Use Work sheet 1 to:

A. Determine the value of land.

\$ \_\_\_\_\_ Value per acre (use attached Work sheet 1A)

B. Identify the value of the land if land inflates at 5 percent instead of 7 percent. (Hint: Adjust value on line 21 of work sheet and following related calculations.)

\$ \_\_\_\_\_ Value per acre (use attached Work sheet 1B)

C. Assuming a 5-percent required return (discount rate) and land value inflation of 7 percent, identify the impact on the value of land if the wheat price is \$3.00 rather than \$2.50 per bushel.

\$ \_\_\_\_\_ Value per acre (use attached Work sheet 1C)

2. Return to the assumptions initially outlined in the problem situation and answer the following questions about the cash-flow performance of the investment in additional land. Note that these questions refer to the cash-flow position of only the additional 160 acres. (That is, the land already owned by the farmer is not considered in the analysis.)

A. Assuming the farmer purchased the land at the value computed in question 1-A above, what is his annual per-acre payment on debt? (Hint: Annual principal and interest payments on a \$1 loan equals 1 divided by interest factor in Appendix Table 2 for interest rate on loan and years in loan repayment period.)

\$ \_\_\_\_\_ Payment per acre

B. If the land is purchased for \$1,000 per acre, what is the annual per-acre payment?

\$ \_\_\_\_\_ Payment per acre

C. What is the before-tax cash flow surplus (deficit) per acre if the land is purchased for \$1,000?

\$ \_\_\_\_\_ Surplus (deficit)

D. How much debt (11 percent, 35 years) per acre can be supported by the before-tax income generated by the additional land?

\$ \_\_\_\_\_ Debt per acre

# Work sheet 1A

## Analysis of land value

- |   |          |
|---|----------|
| 1. Enter average annual before-tax gross receipts .....   | \$ _____ |
| 2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....  | \$ _____ |
| 3. Before-tax returns to land (line 1 – line 2) .....   | \$ _____ |
| 4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....   | _____    |
| 5. After-tax returns to land (line 3 X line 4) .....  | \$ _____ |
| 6. Enter your required after-tax real rate of return on the land investment .....   | _____ %  |
| 7. Enter your estimate of the average annual rate of general price inflation .....  | _____ %  |
| 8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....   | _____ %  |
| 9. Adjusted discount rate (line 6 + line 7 – line 8) .....  | _____ %  |
| 10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....                          | _____    |
| 11. Land value attributable to agricultural production (line 10 X line 5) .....   | \$ _____ |
| 12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....                           | _____    |
| 13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period ..... | _____    |
| 14. Divide line 12 by line 13 .....   | _____    |
| 15. Divide line 12 by number of years in loan repayment period .....  | _____    |
| 16. Subtract line 15 from line 14 .....   | _____    |
| 17. Multiply line 16 times your marginal income tax rate .....  | _____    |
| 18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....                  | _____    |
| 19. Multiply line 18 times line 17 .....  | _____    |

- |   |          |
|---|----------|
| 20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....   | _____    |
| 21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period ..... | _____    |
| 22. Enter current market price of comparable land (\$/acre) .....   | \$ _____ |
| 23. Before-tax terminal market price of land (line 21 X line 22) .....  | \$ _____ |
| 24. Enter your capital gains tax rate (express as a decimal) .....  | _____    |
| 25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....  | \$ _____ |
| 26. After-tax terminal value of land (line 23 – line 25) .....  | \$ _____ |
| 27. Land value attributable to terminal value of land (line 20 X line 26) .....   | \$ _____ |
| 28. Add line 11 and line 27 .....   | \$ _____ |
| 29. Enter 1.000 minus line 19 .....   | _____    |
| 30. Land value attributable to interest income tax deductions<br>[(line 28 + line 29) – line 28] .....  | \$ _____ |
| 31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....   | \$ _____ |

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**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

# Work sheet 1B

## Analysis of land value

1. Enter average annual before-tax gross receipts .....	\$ _____
2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....	\$ _____
3. Before-tax returns to land (line 1 – line 2) .....	\$ _____
4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....	_____
5. After-tax returns to land (line 3 X line 4) .....	\$ _____
6. Enter your required after-tax real rate of return on the land investment .....	_____ %
7. Enter your estimate of the average annual rate of general price inflation .....	_____ %
8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....	_____ %
9. Adjusted discount rate (line 6 + line 7 – line 8) .....	_____ %
10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....	_____
11. Land value attributable to agricultural production (line 10 X line 5) .....	\$ _____
12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....	_____
13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period .....	_____
14. Divide line 12 by line 13 .....	_____
15. Divide line 12 by number of years in loan repayment period .....	_____
16. Subtract line 15 from line 14 .....	_____
17. Multiply line 16 times your marginal income tax rate .....	_____
18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....	_____
19. Multiply line 18 times line 17 .....	_____

- |   |          |
|---|----------|
| 20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....   | _____    |
| 21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period ..... | _____    |
| 22. Enter current market price of comparable land (\$/acre) .....   | \$ _____ |
| 23. Before-tax terminal market price of land (line 21 X line 22) .....  | \$ _____ |
| 24. Enter your capital gains tax rate (express as a decimal) .....  | _____    |
| 25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....  | \$ _____ |
| 26. After-tax terminal value of land (line 23 – line 25) .....  | \$ _____ |
| 27. Land value attributable to terminal value of land (line 20 X line 26) .....   | \$ _____ |
| 28. Add line 11 and line 27 .....   | \$ _____ |
| 29. Enter 1.000 minus line 19 .....   | _____    |
| 30. Land value attributable to interest income tax deductions<br>[(line 28 + line 29) – line 28] .....  | \$ _____ |
| 31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....   | \$ _____ |

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**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

# Work sheet 1C

## Analysis of land value

1. Enter average annual before-tax gross receipts .....	\$ _____
2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....	\$ _____
3. Before-tax returns to land (line 1 – line 2) .....	\$ _____
4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....	_____
5. After-tax returns to land (line 3 X line 4) .....	\$ _____
6. Enter your required after-tax real rate of return on the land investment .....	_____ %
7. Enter your estimate of the average annual rate of general price inflation .....	_____ %
8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....	_____ %
9. Adjusted discount rate (line 6 + line 7 – line 8) .....	_____ %
10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....	_____
11. Land value attributable to agricultural production (line 10 X line 5) .....	\$ _____
12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....	_____
13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period .....	_____
14. Divide line 12 by line 13 .....	_____
15. Divide line 12 by number of years in loan repayment period .....	_____
16. Subtract line 15 from line 14 .....	_____
17. Multiply line 16 times your marginal income tax rate .....	_____
18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....	_____
19. Multiply line 18 times line 17 .....	_____

- |   |          |
|---|----------|
| 20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....   | _____    |
| 21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period ..... | _____    |
| 22. Enter current market price of comparable land (\$/acre) .....   | \$ _____ |
| 23. Before-tax terminal market price of land (line 21 X line 22) .....  | \$ _____ |
| 24. Enter your capital gains tax rate (express as a decimal) .....  | _____    |
| 25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....  | \$ _____ |
| 26. After-tax terminal value of land (line 23 – line 25) .....  | \$ _____ |
| 27. Land value attributable to terminal value of land (line 20 X line 26) .....   | \$ _____ |
| 28. Add line 11 and line 27 .....   | \$ _____ |
| 29. Enter 1.000 minus line 19 .....   | _____    |
| 30. Land value attributable to interest income tax deductions<br>[(line 28 + line 29) – line 28] .....  | \$ _____ |
| 31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....   | \$ _____ |

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**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

3. Using Work sheet 2 and the following information on the farmer's whole-farm (current plus added land) cash flow position, answer the questions below.

Annual before-tax gross cash receipts from all enterprises .....	\$ 231,000
Annual before-tax cash costs for all enterprises .....	\$ 164,000
Annual depreciation deduction .....	\$ 30,500
Personal exemptions and deductions .....	\$ 10,000
Annual principal payments on term debt (excluding new land debt) .....	\$ 22,275
Annual depreciation reserve .....	\$ 8,000
Social Security taxes .....	\$ 3,500
Annual family living expenses .....	\$ 20,000
Land loan interest rate .....	11 %
Marginal income tax rate on expanded business .....	15 %
Average income tax rate on expanded business .....	15 %
Land loan length .....	35 yrs
Equity capital available for down payment .....	\$ 48,000

- A. What is the maximum price per acre the farmer can pay for the property and expect it to cash flow?

\$ \_\_\_\_\_ Maximum price per acre

- B. To what levels must family living expenses be reduced to make the purchase financially feasible at a price of \$1,000 per acre?

\$ \_\_\_\_\_ Living expenses

- C. Assuming family living expenses are \$20,000 per year, what before-tax interest rate on the land loan must be obtained to make the purchase financially feasible at \$1,000 per acre?

\_\_\_\_\_ %

# Work sheet 2

## Analysis of ability to pay for land

1. Enter average annual before-tax gross cash receipts from all enterprises in the expanded business .....	\$ _____
2. Enter average annual before-tax cash costs for all enterprises in the expanded business * .....	\$ _____
3. Before-tax net cash income (line 1 – line 2) .....	\$ _____
4. Enter average annual depreciation deducted for income taxes paid on expanded business .....	\$ _____
5. Enter income tax deduction for personal exemptions and standard or itemized deduction .....	\$ _____
6. Income tax deductions (line 4 + line 5) .....	\$ _____
7. Enter your average income tax rate for expanded business. (Express as a decimal) † .....	_____
8. Tax savings (line 6 X line 7) .....	\$ _____
9. Enter 1.00 minus your average income tax rate (line 7) .....	_____
10. After-tax net cash income (line 3 X line 9) .....	\$ _____
11. Tax-adjusted net cash income (line 8 + line 10) .....	\$ _____
12. Enter average annual principal payments on term debt (over 1 year). Do not include debt on land purchase .....	\$ _____
13. Enter average annual depreciation reserve ‡ .....	\$ _____
14. Enter Social Security taxes paid on self-employment income § .....	\$ _____
15. Enter annual family living expenses .....	\$ _____
16. Add lines 12, 13, 14, and 15 .....	\$ _____
17. Cash income available for additional R.E. debt service (line 11 – line 16) .....	\$ _____
18. Enter interest factor from Appendix Table 2 for interest rate equaling after-tax contractual rate of interest on loan and number of years in loan repayment period ¶ .....	_____

19. Amount which can be borrowed to finance additional land purchases  
(line 17 X line 18) .....
20. Enter equity capital available for down payment on land purchase .....
21. Maximum price that can be paid for total acreage (line 19 + line 20) .....
22. Maximum per-acre price (line 21 + number of acres in land purchase) .....

\$ \_\_\_\_\_

\$ \_\_\_\_\_

\$ \_\_\_\_\_

\$ \_\_\_\_\_

\* Cash costs should include hired labor, fuel, lubricants, repairs, all materials (e.g., seed, fertilizer, herbicides, pesticides), custom services, rent on machinery and/or land, crop insurance, property taxes, general overhead (e.g., telephone, utilities, travel, accounting, legal), and interest paid on all loans. Interest paid on the loan to finance the land purchase should not be included. If livestock enterprises are present, cash costs related to these enterprises should be included.

† Can be estimated by subtracting line 6 from line 3 to obtain taxable income and referring to Appendix Table 5 or 6 for the average tax rate on that taxable income.

‡ Estimate of annual capital needed to replace depreciable assets.

§ See *Farmer's Tax Guide*, IRS publication 225, for definition of self-employment income and tax rate. The tax should not exceed the legal maximum.

¶ The after-tax interest rate equals the before-tax rate multiplied by 1 minus the marginal income tax rate.

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# Answer key 1

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## Video questions

Indicate whether each of the following statements is true (T) or false (F).

- T    **F**    1. A profitable land investment should also be financially feasible (cash flow).

**Comment: False.** The land investment may be profitable, but not generate sufficient cash earnings to make principal and interest payments on the land loan. This could occur for several reasons, including a large component of profit could be capital gains (a non-cash return unless land is sold) and a large land loan with an abbreviated repayment schedule.

- T    **F**    2. A land investment that is financially feasible should also be profitable.

**Comment: False.** If very little or no debt is used to finance a land purchase, the land may generate enough returns to service debt (if any), but not produce enough returns to be profitable.

- T**    F    3. The income capitalization approach to valuing land is based on projecting future earnings generated by the land.

- T    **F**    4. A dollar of earnings realized from a land investment in year 1 contributes the same to land value as a dollar of earnings realized in year 10.

**Comment: False.** Land value is the present value of future land earnings. The present value of year 1 earnings is much greater than the present value of year 10 earnings. Postponed earnings are worth less in present value terms because you give up earnings by not having the money in hand, inflation reduces the value of money, and there is the greater uncertainty of receiving future dollars.

- T**    F    5. If you are in a 15-percent marginal tax bracket, the after-tax cost of a 10-percent interest loan is 8.5 percent.  $10 \times (1 - 0.15) = 8.5$

- T**    F    6. A higher required rate of return (discount or capitalization rate) on a land investment will translate to a lower land value, everything else held constant.

- T    F    7.** If the same acre is farmed in the same manner by two different farmers, the land value should be the same for both farmers.

**Comment: False.** The farmers may be in different tax brackets, have different planning horizons, want different rates of return on their land investment, etc., all of which contribute to the different land value.

- I    F    8.** Three primary sources of land earnings, and therefore land value, are income from agricultural production, income tax benefits and terminal value of land.

- T    F    9.** Since land is generally a long-term investment, and it's difficult to accurately project what's going to happen in agriculture, analyzing a land investment based on future performance is a futile exercise.

**Comment: False.** Although long-term projections may prove to be incorrect, valuable information and experience is gained by completing the analysis. Also, by varying key assumptions, the vulnerability of the investment to changing conditions can be determined. Having some idea about the value of land, its cash flow performance, and risk should result in fewer decision-making errors than buying on impulse and the availability of funds.

- T    F    10.** Since depreciation is a non-cash cost, it can be ignored in determining how much cash flow you have to service added real estate debt.

**Comment: False.** Depreciation must be covered by cash earnings in the long run or the business will be unable to replace depreciable assets as they wear out. Also, depreciation is a tax deductible expense which reduces taxes and increases after-tax cash flow.

- I    F    11.** The risk of variation in crop yields and prices is greater for the farmer who owns land than it is for the farmer who leases land under a crop-share arrangement.

- T    F    12.** In budgeting a return to land, interest on the land investment should be considered a cost.

**Comment: False.** Interest on the land investment is accounted for when land returns are discounted (capitalized). If interest is entered as a cost when land returns are budgeted and then the returns are discounted, there is a double counting of interest costs.

- I    F    13.** The discount (or capitalization) rate used to compute a land value should be based on the cost of the money used to finance the land purchase.

- T    F    14.** Using more debt and less equity capital to finance a land purchase will cause the land's value to decrease.

**Comment: False.** The value may or may not decrease. If the discount (capitalization) rate is greater than the interest rate on debt, using more debt will increase the value of land. In contrast, if the interest rate on debt exceeds the discount rate, using more debt will reduce the land value.

**T F** 15. If the annual percentage rate (APR) on a land loan is 13 percent and general price inflation is 5 percent, the approximate real (inflation adjusted) APR is 8 percent.

**T E** 16. If you have surplus machinery resources, annual depreciation on the machinery shouldn't increase if you add more land to your existing operation.

**Comment: False.** The machinery will be used more hours when used to farm more ground. This should lead to shorter lives and more annual depreciation.

**T E** 17. Management costs shouldn't change if you increase the size of your farming operation.

**Comment: False.** Farming more land should require additional management. Accordingly, a portion of the added land earnings should be set aside to compensate the increased management contribution.

**T F** 18. Four major factors to consider in deciding whether to buy land are market price of land, value of land to potential buyer, financial feasibility and risk of financial loss.

**T E** 19. The age of a potential buyer of farmland should have little impact on the value of the land to that buyer.

**Comment: False.** Since land value is based on earnings realized during the land ownership period, the length of that period has an impact on value. Accordingly, a young farmer with a long planning horizon may place a higher value on land than an older farmer.

**T E** 20. If returns to land from agricultural production increase by 4 percent annually, then the value of the land should increase by 4 percent per year.

**Comment: False.** General price inflation could reduce the real buying power of the increase in returns, resulting in less than a 4-percent increase in land value. Also, nonagricultural factors (e.g., a growing demand for industrial, urban or recreational uses) could result in value changes unrelated to agricultural returns.

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# Answer key 2

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## Analysis of land value

In the videotape, we used the income capitalization approach to place a value on an example piece of ground. Work sheet 1 (next page) will help you make these same calculations. Please use the work sheet and the Appendix Tables to place a value on the example property. You may recall that the following assumptions applied to the 120-acre example:

Before-tax gross receipts per rotation acre .....	\$436
Total before-tax costs per rotation acre (excluding interest on land loan) .....	\$295
Marginal income tax rate .....	15%
Likely sales price per acre .....	\$2,500
Financing is 20-percent down payment, remainder with 30-year, 12-percent interest loan	
General increase in price inflation .....	4% /year
Average annual increase in land returns .....	4%
Planning horizon .....	30 years
Increase in land market price .....	4% /year
Required after-tax rate of return on land investment (discount rate) .....	6%

# Work sheet 1 key

## Analysis of land value

1. Enter average annual before-tax gross receipts .....	\$ 436
2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....	\$ 295
3. Before-tax returns to land (line 1 – line 2) .....	\$ 141
4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....	0.85
5. After-tax returns to land (line 3 X line 4) .....	\$ 120
6. Enter your required after-tax real rate of return on the land investment .....	6 %
7. Enter your estimate of the average annual rate of general price inflation .....	4 %
8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....	4 %
9. Adjusted discount rate (line 6 + line 7 – line 8) .....	6 %
10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....	13.765
11. Land value attributable to agricultural production (line 10 X line 5) .....	\$ 1,652
12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....	0.80
13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period .....	8.055
14. Divide line 12 by line 13 .....	0.099
15. Divide line 12 by number of years in loan repayment period .....	0.027
16. Subtract line 15 from line 14 .....	0.072
17. Multiply line 16 times your marginal income tax rate .....	0.011
18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....	9.427
19. Multiply line 18 times line 17 .....	0.103

20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....	<u>0.057</u>
21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period .....	<u>3.243</u>
22. Enter current market price of comparable land (\$/acre) .....	\$ <u>2,500</u>
23. Before-tax terminal market price of land (line 21 X line 22) .....	\$ <u>8,108</u>
24. Enter your capital gains tax rate (express as a decimal) .....	<u>0.15</u>
25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....	\$ <u>841</u>
26. After-tax terminal value of land (line 23 – line 25) .....	\$ <u>7,267</u>
27. Land value attributable to terminal value of land (line 20 X line 26) .....	\$ <u>414</u>
28. Add line 11 and line 27 .....	\$ <u>2,066</u>
29. Enter 1.000 minus line 19 .....	<u>0.897</u>
30. Land value attributable to interest income tax deductions [(line 28 + line 29) – line 28] .....	\$ <u>237</u>
31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....	\$ <u>2,303</u>

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**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

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# Answer key 3

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## Land investment analysis

### Problem situation

A farmer is considering the purchase of a nearby 160 acres (all tillable) of dryland ground. He has obtained the following information on the property:

	Crops in rotation	
	Wheat	Dry peas
1. Estimated annual receipts, costs and returns to land:		
A. Gross receipts		
(a) Acres .....	80	80
(b) Yield .....	70 bu	1,740 lbs
(c) Price (per unit of yield) .....	\$ 2.50	\$ 0.10
B. Costs (per acre)		
(a) Machinery (fuel, oil and repairs) .....	\$ 14.90	\$ 20.01
(b) Hired labor and operator labor .....	\$ 8.19	\$ 9.79
(c) Seed .....	\$ 9.00	\$ 25.00
(d) Fertilizer .....	\$ 34.40	\$ 0.00
(e) Herbicides & insecticides .....	\$ 27.94	\$ 30.00
(f) Custom services .....	\$ 2.10	\$ 9.10
(g) Crop insurance .....	\$ 3.24	\$ 7.44
(h) Interest on operating capital .....	\$ 3.46	\$ 1.50
(i) Machinery depreciation .....	\$ 4.00	\$ 6.10
(j) Real estate taxes .....	\$ 3.90	\$ 3.90
(k) Operator management .....	\$ 14.70	\$ 12.18
(l) Miscellaneous .....	\$ 0.00	\$ 0.00
2. Farmer's marginal tax rate .....	15 %	
3. Required after-tax real rate of return .....	5 %	
4. Annual rate of general price inflation .....	6 %	
5. Annual growth rate of net land returns .....	4 %	
6. Farmer's planning horizon .....	35yrs	
7. Proportion debt financed .....	70 %	
8. Real estate loan repayment period .....	35yrs	
9. Interest rate (APR) on real estate loan .....	11 %	
10. Annual inflation rate for land (property has long-term subdivision potential) .....	7 %	
11. Estimated market price of land .....	\$1,000	

## Assignment

1. Use Work sheet 1 to:

A. Determine the value of land.

\$ 848 Value per acre (see attached Work sheet 1A key)

B. Identify the value of the land if land inflates at 5 percent instead of 7 percent. (Hint: Adjust value on line 21 of work sheet and following related calculations.)

\$ 724 Value per acre (see attached Work sheet 1B key)

C. Assuming a 5-percent required return (discount rate) and land value inflation of 7 percent, identify the impact on the value of land if the wheat price is \$3.00 rather than \$2.50 per bushel.

\$ 1,057 Value per acre (see attached Work sheet 1C key)

2. Return to the assumptions initially outlined in the problem situation and answer the following questions about the cash-flow performance of the investment in additional land. Note that these questions refer to the cash-flow position of only the additional 160 acres. (That is, the land already owned by the farmer is not considered in the analysis.)

A. Assuming the farmer purchased the land at the value computed in question 1-A above, what is his annual per-acre payment on debt? (Hint: Annual principal and interest payments on a \$1 loan equals 1 divided by interest factor in Appendix Table 2 for interest rate on loan and years in loan repayment period.)

\$ 67.02 Payment per acre

8.855 Interest factor, Appendix Table 2, for 11-percent interest, 35-year repayment period

$\frac{1}{8.855} = 0.1129$  Annual principal and interest payment on \$1 loan, 11% interest, 35 years

\$593.60 Loan (\$848 X 0.70 debt)

0.1129 Adjusted interest factor

\$ 67.02 Annual principal and interest payment

B. If the land is purchased for \$1,000 per acre, what is the annual per-acre payment?

\$ 79.03 Payment per acre

\$ 1,000 Price

0.70 Debt

\$ 700 Loan

0.1129 Adjusted interest factor (see 2A above)

\$ 79.03 Annual principal and interest payment

C. What is the before-tax cash flow surplus (deficit) per acre if the land is purchased for \$1,000?

\$(29.96) Surplus (deficit)

\$ 174.50 Gross receipts (line 1, Work sheet 1A key)

– 125.43 Costs (line 2, Work sheet 1A key)

\$ 49.07 Before-tax income available for debt service

– 79.03 Annual payment on \$700 loan (answer 2B above)

(29.96) Deficit

D. How much debt (11 percent, 35 years) per acre can be supported by the before-tax income generated by the additional land?

\$ 434.51 Debt per acre

\$ 49.07 Before-tax income available for debt service (see 2C above)

8.855 Interest factor, Appendix Table 2, 11 percent, 35 years

\$ 434.51 Debt supported by \$49.07

# Work sheet 1A key

## Analysis of land value

1. Enter average annual before-tax gross receipts .....	\$ 174.50
2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....	\$ 125.43
3. Before-tax returns to land (line 1 – line 2) .....	\$ 49.07
4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....	0.85
5. After-tax returns to land (line 3 X line 4) .....	\$ 41.71
6. Enter your required after-tax real rate of return on the land investment .....	5 %
7. Enter your estimate of the average annual rate of general price inflation .....	6 %
8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....	4 %
9. Adjusted discount rate (line 6 + line 7 – line 8) .....	7 %
10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....	12.948
11. Land value attributable to agricultural production (line 10 X line 5) .....	\$ 540.06
12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....	0.70
13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period .....	8.855
14. Divide line 12 by line 13 .....	0.079
15. Divide line 12 by number of years in loan repayment period .....	0.02
16. Subtract line 15 from line 14 .....	0.059
17. Multiply line 16 times your marginal income tax rate .....	0.009
18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....	8.855
19. Multiply line 18 times line 17 .....	0.080

20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....	<u>0.026</u>
21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period .....	<u>10.677</u>
22. Enter current market price of comparable land (\$/acre) .....	\$ <u>1,000</u>
23. Before-tax terminal market price of land (line 21 X line 22) .....	\$ <u>10,677</u>
24. Enter your capital gains tax rate (express as a decimal) .....	<u>0.15</u>
25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....	\$ <u>1,452</u>
26. After-tax terminal value of land (line 23 – line 25) .....	\$ <u>9,225</u>
27. Land value attributable to terminal value of land (line 20 X line 26) .....	\$ <u>240</u>
28. Add line 11 and line 27 .....	\$ <u>780</u>
29. Enter 1.000 minus line 19 .....	<u>0.92</u>
30. Land value attributable to interest income tax deductions [(line 28 + line 29) – line 28] .....	\$ <u>68</u>
31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....	\$ <u>848</u>

**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

# Work sheet 1B key

## Analysis of land value

1. Enter average annual before-tax gross receipts .....	\$ 174.50
2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....	\$ 125.43
3. Before-tax returns to land (line 1 – line 2) .....	\$ 49.07
4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....	0.85
5. After-tax returns to land (line 3 X line 4) .....	\$ 41.71
6. Enter your required after-tax real rate of return on the land investment .....	5 %
7. Enter your estimate of the average annual rate of general price inflation .....	6 %
8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....	4 %
9. Adjusted discount rate (line 6 + line 7 – line 8) .....	7 %
10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....	12.948
11. Land value attributable to agricultural production (line 10 X line 5) .....	\$ 540.06
12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....	0.70
13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period .....	8.855
14. Divide line 12 by line 13 .....	0.079
15. Divide line 12 by number of years in loan repayment period .....	0.02
16. Subtract line 15 from line 14 .....	0.059
17. Multiply line 16 times your marginal income tax rate .....	0.009
18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....	8.855
19. Multiply line 18 times line 17 .....	0.080

20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....	<u>0.026</u>
21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period .....	<u>5.516</u>
22. Enter current market price of comparable land (\$/acre) .....	\$ <u>1,000</u>
23. Before-tax terminal market price of land (line 21 X line 22) .....	\$ <u>5,516</u>
24. Enter your capital gains tax rate (express as a decimal) .....	<u>0.15</u>
25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....	\$ <u>677.40</u>
26. After-tax terminal value of land (line 23 – line 25) .....	\$ <u>4,838.60</u>
27. Land value attributable to terminal value of land (line 20 X line 26) .....	\$ <u>125.80</u>
28. Add line 11 and line 27 .....	\$ <u>666</u>
29. Enter 1.000 minus line 19 .....	<u>0.92</u>
30. Land value attributable to interest income tax deductions [(line 28 + line 29) – line 28] .....	\$ <u>58</u>
31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....	\$ <u>724</u>

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**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

# Work sheet 1C key

## Analysis of land value

1. Enter average annual before-tax gross receipts .....	\$ 192
2. Enter average annual before-tax costs. Do not include interest on land loan or investment .....	\$ 125.43
3. Before-tax returns to land (line 1 – line 2) .....	\$ 66.57
4. Enter 1.00 minus your marginal income tax rate (Appendix Table 5 or 6). Express as a decimal .....	0.85
5. After-tax returns to land (line 3 X line 4) .....	\$ 56.58
6. Enter your required after-tax real rate of return on the land investment .....	5 %
7. Enter your estimate of the average annual rate of general price inflation .....	6 %
8. Enter your estimate of the average annual rate of change in land returns appearing on line 5 .....	4 %
9. Adjusted discount rate (line 6 + line 7 – line 8) .....	7 %
10. Enter interest factor from Appendix Table 2 for interest rate on line 9 and number of years in land investment planning period. ....	12.948
11. Land value attributable to agricultural production (line 10 X line 5) .....	\$ 732.60
12. Enter the proportion of the purchase price to be financed with debt. Express as a decimal. (If no debt used, skip to line 20) .....	0.70
13. Enter interest factor from Appendix Table 2 for interest rate equaling before-tax rate of interest on loan and number of years in loan repayment period .....	8.855
14. Divide line 12 by line 13 .....	0.079
15. Divide line 12 by number of years in loan repayment period .....	0.02
16. Subtract line 15 from line 14 .....	0.059
17. Multiply line 16 times your marginal income tax rate .....	0.009
18. Enter interest factor from Appendix Table 2 for interest rate equaling line 6 plus line 7 and number of years in loan repayment period .....	8.855
19. Multiply line 18 times line 17 .....	0.080

20. Enter interest factor from Appendix Table 4 for interest rate equaling line 6 + line 7 and number of years in planning period .....	<u>0.026</u>
21. Enter interest factor from Appendix Table 3 for interest rate equaling your estimate of annual rate of increase in land market price and number of years in planning period .....	<u>10.677</u>
22. Enter current market price of comparable land (\$/acre) .....	\$ <u>1,000</u>
23. Before-tax terminal market price of land (line 21 X line 22) .....	\$ <u>10,677</u>
24. Enter your capital gains tax rate (express as a decimal) .....	<u>0.15</u>
25. Capital gains tax on future sale of land (line 23 – line 22 X line 24) .....	\$ <u>1,451.55</u>
26. After-tax terminal value of land (line 23 – line 25) .....	\$ <u>9,225.45</u>
27. Land value attributable to terminal value of land (line 20 X line 26) .....	\$ <u>239.86</u>
28. Add line 11 and line 27 .....	\$ <u>972.46</u>
29. Enter 1.000 minus line 19 .....	<u>0.92</u>
30. Land value attributable to interest income tax deductions [(line 28 + line 29) – line 28] .....	\$ <u>84.56</u>
31. <b>LAND VALUE</b> (line 11 + line 27 + line 30) .....	\$ <u>1,057</u>

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**Note:** Lines 11, 27 and 30 represent the three sources of earnings to land introduced on pp. 8-11.

3. Using Work sheet 2 and the following information on the farmer's whole-farm (current plus added land) cash-flow position, answer the questions below.

Annual before-tax gross cash receipts from all enterprises .....	\$ 231,000
Annual before-tax cash costs for all enterprises .....	\$ 164,000
Annual depreciation deduction .....	\$ 30,500
Personal exemptions and deductions .....	\$ 10,000
Annual principal payments on term debt (excluding new land debt) .....	\$ 22,275
Annual depreciation reserve .....	\$ 8,000
Social Security taxes .....	\$ 3,500
Annual family living expenses .....	\$ 20,000
Land loan interest rate .....	11 %
Marginal income tax rate on expanded business .....	15 %
Average income tax rate on expanded business .....	15 %
Land loan length .....	35 yrs
Equity capital available for down payment .....	\$ 48,000

- A. What is the maximum price per acre the farmer can pay for the property and expect it to cash flow?

\$ 883 Maximum price per acre (see line 22, Work sheet 2 key)

- B. To what levels must family living expenses be reduced to make the purchase financially feasible at a price of \$1,000 per acre?

\$ 18,147 Living expenses

\$ 160,000 Sale price (\$1,000 X 160 acres)

- 48,000 Down payment

\$ 112,000 Land loan

+ 10.087 Interest factor, line 18, Work sheet 2 key

\$ 11,103 Cash that must be available to make payment on \$112,000 loan, 9-1/2%, 35 years

\$ 63,025 Cash available for principal on term debt, depreciation reserve, Social Security taxes, and living expenses (line 11, Work sheet 2 key).

- 33,775 Principal on term debt, depreciation reserve, and Social Security taxes (lines 12, 13, and 14, Work sheet 2 key)

\$ 29,250 Cash available for family living expenses and servicing new land loan

- 11,103 Cash needed to service debt on new land loan

\$ 18,147 Family living expenses if land investment is to cash flow

- C. Assuming family living expenses are \$20,000 per year, what before-tax interest rate on the land loan must be obtained to make the purchase financially feasible at \$1,000 per acre?

9 %

\$ 160,000 Sales price (\$1,000 X 160 acres)

– 48,000 Down payment

\$ 112,000 Land loan

+ 9,250 Available for annual debt service, line 17, Work sheet 2 key

12.108 Interest factor needed to amortize debt

Go to Appendix Table 2 and find the interest rate which intersects 35-year column at interest factor 12.108.

The interest rate closest to 12.108, 35 years is 7.5. This is the after-tax rate. To convert to before-tax rate, divide 7.5 by 1 minus 0.15 (marginal tax rate).

$$7.5 \div (1 - 0.15) = 8.8$$

Therefore, the before-tax rate must be about **9 percent**.

# Work sheet 2 key

## Analysis of ability to pay for land

1. Enter average annual before-tax gross cash receipts from all enterprises in the expanded business .....	\$ <u>231,000</u>
2. Enter average annual before-tax cash costs for all enterprises in the expanded business * .....	\$ <u>164,000</u>
3. Before-tax net cash income (line 1 – line 2) .....	\$ <u>67,000</u>
4. Enter average annual depreciation deducted for income taxes paid on expanded business .....	\$ <u>30,500</u>
5. Enter income tax deduction for personal exemptions and standard or itemized deduction .....	\$ <u>10,000</u>
6. Income tax deductions (line 4 + line 5) .....	\$ <u>40,500</u>
7. Enter your average income tax rate for expanded business. (Express as a decimal) † .....	<u>0.15</u>
8. Tax savings (line 6 X line 7) .....	\$ <u>6,075</u>
9. Enter 1.00 minus your average income tax rate (line 7) .....	<u>0.85</u>
10. After-tax net cash income (line 3 X line 9) .....	\$ <u>56,950</u>
11. Tax-adjusted net cash income (line 8 + line 10) .....	\$ <u>63,025</u>
12. Enter average annual principal payments on term debt (over 1 year). Do not include debt on land purchase .....	\$ <u>22,275</u>
13. Enter average annual depreciation reserve ‡ .....	\$ <u>8,000</u>
14. Enter Social Security taxes paid on self-employment income § .....	\$ <u>3,500</u>
15. Enter annual family living expenses .....	\$ <u>20,000</u>
16. Add lines 12, 13, 14, and 15 .....	\$ <u>53,775</u>
17. Cash income available for additional R.E. debt service (line 11 – line 16) .....	\$ <u>9,250</u>
18. Enter interest factor from Appendix Table 2 for interest rate equaling after-tax contractual rate of interest on loan and number of years in loan repayment period ¶ .....	<u>10.087</u>

19. Amount which can be borrowed to finance additional land purchases (line 17 X line 18) .....	\$ <u>93,305</u>
20. Enter equity capital available for down payment on land purchase .....	\$ <u>48,000</u>
21. Maximum price that can be paid for total acreage (line 19 + line 20) .....	\$ <u>141,305</u>
22. Maximum per-acre price (line 21 + number of acres in land purchase) .....	\$ <u>883.16</u>

\* Cash costs should include hired labor, fuel, lubricants, repairs, all materials (e.g., seed, fertilizer, herbicides, pesticides), custom services, rent on machinery and/or land, crop insurance, property taxes, general overhead (e.g., telephone, utilities, travel, accounting, legal), and interest paid on all loans. Interest paid on the loan to finance the land purchases should not be included. If livestock enterprises are present, cash costs related to these enterprises should be included.

† Can be estimated by subtracting line 6 from line 3 to obtain taxable income and referring to Appendix Table 5 or 6 for the average tax rate on that taxable income.

‡ Estimate of annual capital needed to replace depreciable assets.

§ See *Farmer's Tax Guide*, IRS publication 225, for definition of self-employment income and tax rate. The tax should not exceed the legal maximum.

¶ The after-tax interest rate equals the before-tax rate multiplied by 1 minus the marginal income tax rate.

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