

Economics for Corn Production

Greg Ibendahl

Corn producers grow corn to make a profit. Thus, an understanding of some basic economic concepts and tools should help them become better managers.

Enterprise Budgets

One of the best tools for planning purposes is an enterprise budget. Enterprise budgets predict profitability by incorporating quantities and prices of all inputs and outputs. Enterprise budgets are started by estimating the expected corn production in bushels per acre and the expected price received. These two pieces of information give the expected gross revenues per acre. Next, all the expected quantities and prices of inputs are listed to provide the expected expenses per acre. Table 1 shows a typical corn budget for Kentucky. This interactive budget is available from the Department of Agricultural Economics at the University of Kentucky. The Web address is: <http://www.uky.edu/Agriculture/AgriculturalEconomics/data/baledcropbudgetinstr495.html>.

The corn budget in Table 1 is divided into three main sections: gross returns, variable costs, and fixed costs. These are all stated on a per acre basis. Gross returns are calculated by multiplying the expected yield per acre by the expected price. For situations where corn is used by a livestock enterprise, a value is still assigned to those bushels.

Expenses are divided into variable and fixed costs by whether the expense varies as the size of the enterprise changes. Most of the expenses, such as seed, fertilizer, chemicals, etc., vary as the enterprise size varies. However, depreciation, insurance, and taxes are not dependent on the size of the corn enterprise. For example, insurance is the same whether the

farm grows 70 acres of corn and 30 acres of soybeans or if 30 acres of corn are grown with 70 acres of soybeans. In establishing a cost for the variable inputs, a usage rate per acre is multiplied by the appropriate price per unit.

The last item for the variable costs is an interest charge. This cost reflects the money needed to plant a crop. When the crop is sold, the money is returned. If the money is borrowed, this is the actual interest expense. When the farmer's own equity is used, this cost is an opportunity cost since the money could have been earning interest. Usually six months is used as the time frame for the interest on variable costs (i.e., planting to harvest is roughly six months).

The difference between gross returns and total expenses is the return to operator labor, land, capital, and management. The return to operator labor and management is compensation for the farmer's time and expertise invested in growing a corn crop. The return to land and capital is an opportunity cost for using the land and other capital. Because the farmer has equity invested in the land, those funds cannot be earning interest in a bank or used for other purposes.

Any preexisting budget should be used with care. More than likely, the quantities and prices will need to be adjusted to fit an individual producer in a given year. In Table 1, the price of corn will almost certainly need to be adjusted. The interactive budget from the Department of Agricultural Economics makes this process easy since it automatically adjusts the computations.

Determining prices and quantities is probably the most difficult aspect of building a corn budget. Input prices can be readily obtained from many agribusinesses. However, the best source for quantity information, is a

farmer's own records. Good production records can provide information about yields and about how much fertilizer and chemicals normally are used.

The Department of Agricultural Economics also provides a tool that can help a farmer develop his or her own corn budget. This budget generator is the "Corn Cost and Return Estimator" and is available at: <http://www.uky.edu/Agriculture/AgriculturalEconomics/data/baledcorninstr495.html>. The tool uses information about how the corn is grown, soil tests, price information from suppliers, etc., to develop a more detailed corn budget.

Estimates of corn prices are probably more uncertain than the other estimates. Prices can vary a lot during the summer due to weather-related events. Proper marketing can help here too. The price on the budget should be the average price received and not the price at harvest. The price should also reflect any government payments that change in response to enterprise size. For example, LDP payments, since these are tied to production, should be added to the budget price.

An additional step to enterprise budget preparation and use is to conduct sensitivity analysis. The original numbers used in the budget were probably the producer's predictions of normal yields and prices. However, as most producers are aware, very few years are average. By conducting a sensitivity analysis, producers can see the effects on their incomes by trying other combinations of yields and prices. At a minimum, a producer should examine a worst case, an average case, and a best case scenario. These results should help farm managers do forward planning. In addition to yields and corn prices, producers might also conduct sensitivity analysis of fertilizer and fuel prices.

Table 1. Typical corn budget.

	Amount	Unit	Price	Total
Gross returns per acre				
Corn	125	bu	\$2.75	\$343.75
Variable costs per acre				
Seed	0.32	bag	\$78.00	\$24.96
Fertilizer	1	acre	\$51.90	\$51.90
Lime	1	ton	\$12.12	\$12.12
Herbicides	1	acre	\$20.00	\$20.00
Insecticides	1	acre	\$15.00	\$15.00
Fungicides	1	acre	\$0.00	\$0.00
Fuel and oil	2.2	hrs	\$6.31	\$13.88
Repairs	1	acre	\$22.77	\$22.77
Custom application	1	applications	\$4.12	\$4.12
Equipment rental	1	acre	\$0.00	\$0.00
Drying	125	bu	\$0.11	\$13.75
Crop insurance	1	acre	\$0.00	\$0.00
Cash land rent	1	acre	\$0.00	\$0.00
Hired labor	0	hrs	\$0.00	\$0.00
Interest on variable costs (½ year)	\$178.50	dollars	4.50%	\$8.03
Total variable cost				\$186.53
Return above variable cost				\$157.22
Budgeted fixed costs/acre				
Depreciation				\$40.00
Taxes and insurance				\$10.00
Total budgeted fixed cost				\$50.00
Return to operator labor, land, capital, and management				\$107.22
Less operator labor	4.5	hrs	\$7.00	\$31.50
Return to land, capital, and management				\$75.72

University of Kentucky, College of Agriculture, Cooperative Extension Service.

Break even price **\$1.49** per bu to cover variable costs at **125** bu per acre

Break even yield **67.8** bu to cover variable costs at **\$2.75** per bu

Partial Budgets

Enterprise budgets are great for showing how an enterprise contributes to profitability. However, sometimes a producer might be interested in examining how some adjustment to an enterprise or combination of enterprises affects profitability. Examples include growing high-oil corn instead of conventional corn or replacing soybean acres with corn acres. Partial budgeting is a good tool for these situations because only those costs, incomes, and resource needs that change with a proposed adjustment are examined. The resources, costs, and income that are not affected with the proposed change are ignored.

Partial budget analysis is a three-step process. Step one determines

what increases the profits of the farm business when a change is implemented. This increase in profitability can come from either greater income or less costs. Step two determines what decreases the profits of the farm business. A reduction in income and an increase in costs can decrease the profitability of the farm business. Step three determines the net change in profits. This step compares the increase in profits from step one to the decrease in profits from step two. If the increase in profits are greater than the decrease in profits, then the change should be made.

An example should help clarify the process. Consider a farmer looking at replacing 40 acres of conventional corn with 40 acres of high-oil corn. Step one requires the farmer to deter-

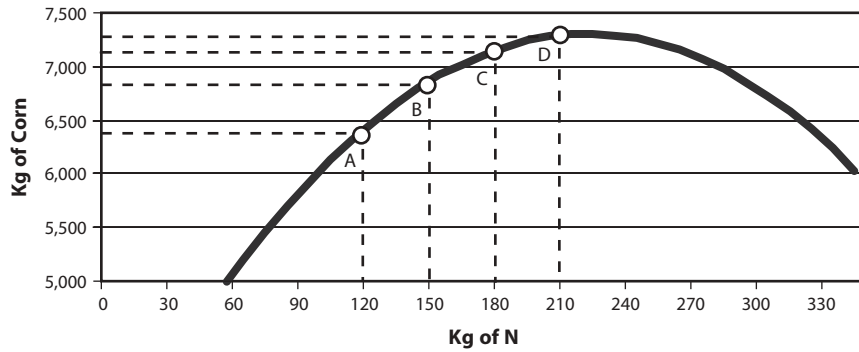
mine the increase in farm business profits. For step one, the farmer should have greater income from the 40 acres of high-oil. This is calculated as 40 acres times yield per acre times price received. Growing high-oil may not have any reduced costs, so the only contribution to step one is the increase in income. Step two has the farmer determining the decreases in farm business profits. Here, there are two contributions, less income and more costs. Reduced income is from giving up the 40 acres of conventional corn (acres x yield x price). Increased costs occur from likely higher costs for seed, transportation, and storage associated with high-oil corn production. If the benefits from step one outweigh the decreases in step two, the farmer should make the switch to high-oil corn.

Cost Concepts

Input costs are a concern for many producers since it seems that the prices of inputs rise faster than the price of corn. Corn producers should be aware of at least two cost concepts, fixed versus variable costs, and long-run versus short-run costs. The two concepts are related and help explain the rationale behind many farm decisions.

As Table 1 shows, budgets are divided into variable and fixed costs. Variable costs change with the volume of corn produced. You can think of variable costs as those that the manager has control over at a given point in time. Seed, fertilizer, herbicides, fuel and oil, etc., are directly related to how much corn is produced and are directly controlled by the manager. As more of the input is used, more output is produced. However, there is some limit to most inputs where additional input use does not increase corn yield. For example, fertilizer helps increase yield up to a point. Once this point is reached, additional fertilizer may actually decrease corn yields. At most, a farm manager would only use a level of the input until yields are maximized. As

Figure 1. Corn yield response to nitrogen.



shown later, however, the profit-maximizing level of an input is probably below the yield-maximizing level of that input.

Fixed costs, on the other hand, do not change with the volume of corn produced. These are the costs incurred even if the input is not used. Another characteristic of fixed costs is that they are not under control of the manager. As shown in Table 1, depreciation, taxes, and insurance are all fixed costs since they must be paid even if no corn is produced.

The concepts of variable versus fixed costs need to be discussed within some sort of time frame. Short-run and long-run are time concepts, but they are not defined by a specific length of time. Short-run is defined as a period of time during which one or more of the inputs is fixed in amount and cannot be changed. Long-run is defined as that period of time during which the quantity of all inputs can be changed.

These concepts are important because costs that are defined as fixed in the short-run become variable in the long-run. Likewise, variable costs may become fixed if the short-run is defined to be a small enough time frame. The corn budget in Table 1 uses a short-run time frame of a year. Thus, most of the input costs are variable and can be changed by the farm manager. If a long enough time frame was considered, then depreciation, insurance, and taxes would also become variable since a long enough time

span allows the manager to consider selling assets as part of the decision process.

The short-run versus long-run concept is particularly important for those decisions where the short-run is a very small time interval. In these situations, most of the costs are fixed and only a few are variable. An example is a decision of whether to harvest corn in a very severe drought year. The short-run decision rule for farm managers is to cover variable costs. If the corn has already grown, the only variable costs are harvesting, drying, transportation, and storage. Decisions about fertilizer, herbicides, etc., are already fixed. Thus, as long as the value of the corn exceeds these few remaining costs, the harvest should continue. Even though the crop may be so small that not all costs are accounted for, at least the variable costs at the time are covered.

Economic Concepts

One of the basic questions facing corn producers is how much corn to produce on an acre. Because farmers are growing corn to make money, they want to maximize profits per acre. This is probably not the same as maximizing yield. The marginalism principle is very important for helping producers decide on the optimal amount of an input. The basic idea concerns the last unit of an input utilized or of an output produced. As an example, the cost of the fertilizer to produce the last bushel of corn should

be less than the price per bushel. Another way of looking at this is that the value of corn produced from the last pound of fertilizer used should be greater than the cost of that pound of fertilizer.

Figure 1 shows how corn yield responds to N fertilizer. The four points in the figure have the following yield responses:

Point	Kg of nitrogen	Kg of corn
A	120	6495
B	150	6917
C	180	7185
D	210	7301

The yield-maximizing point is D; however, this is not the profit-maximizing point. Here's how the marginalism principle works if corn is worth \$2.50 per bushel and N costs \$0.20 per pound. For each additional 30 pounds of additional N applied, the farmer pays \$6. By increasing yield from point A to B, the farmer earns \$17.50 in additional revenue (7 bushels of corn times \$2.50 per bushel). From point B to C, the farmer earns \$10 in additional revenue. From point C to D, the farmer earns \$2.50 in additional revenue. Thus, point C is the profit-optimizing point. Moving from 110 to 140 and from 140 to 170 pounds on N is profitable because each 30 pounds of N increases costs less than the value of corn produced. However, the move from 170 to 200 pounds of N is unprofitable because this 30 pounds of N increases costs \$6 but only increases corn profits by \$2.50.

Figure 1 is for illustration only. Actual corn response to N will depend on many factors such as soil type, date of N application, N carryover, etc. The point here is that the benefits from the additional input should outweigh the costs from the additional input. These techniques apply to all inputs and not just N fertilizer.

A few general assumptions can be made about marginalism. The first is

that yield-maximizing goals are not the same as profit-maximizing goals. The second is that an increase in the cost of an input relative to the price of corn causes a producer to use less of that input. For example, if N fertilizer increases in price while corn does not, then the farmer should use less N. In addition, if the corn price increases while the N price stays the same, then the farmer should use more N.

Opportunity Cost

Finally, corn producers should be aware of opportunity cost. This concept was briefly discussed in relation to return to land and capital from the enterprise budgets. Producers are probably most concerned about accounting profits and cash flow. How-

ever, opportunity costs should be considered as well. Producers who provide equity for their farming operations should be rewarded for using that equity. That is why the enterprise budgets have these returns to equity and management lines.

Opportunity cost can be defined as the maximum net return that is sacrificed because the resource is not employed in its next most profitable alternative. Producers who own their own land sacrifice the return they could earn by investing their land equity in the bank. Producers can almost think of opportunity costs as the cost for borrowing money from themselves.

This concept really is apparent for producers who own rather than rent. Renters have a rental cost as part of

the enterprise budget, while producers who own will have a zero for the rent charge. At first glance, farmers who own their land might appear to have a tremendous advantage over renters, and in some ways they do. Farmland owners will almost certainly have greater cash flow and earn larger profits from a cash accounting perspective. However, farmland owners should be sure to include the opportunity cost of the land when looking at economic profits.

These are just some of the economic issues that corn producers should consider. Proper planning and a good understanding of the true costs of corn production should help farmers increase their long-term profitability.