

Management and Marketing Series

Series No. 20

Revised March 2002

What is a Dairy Heifer Worth?

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Prices paid for dairy heifers increased sharply in 2001, which prompted some dairymen to question whether such purchases could be profitable. This fact sheet discusses the factors that determine the maximum price a farmer can afford to pay in a situation where an existing dairy facility is not operating at capacity. The attached net income worksheet shows the process for estimating income and expenses and illustrates this with an example. The example presented below is based on information from selected North Carolina farms and results in a maximum bid price of \$1,949. However, NC dairy farm data also show that income, expenses and net income per cow vary widely from farm to farm. Furthermore, milk prices and expenses can change dramatically from one year to the next. Tables 1 through 3 show how changes in income and expenses affect net income and the maximum bid price. In the example provided, estimates of the maximum bid price varies from \$479 to \$3,420 under different expectations about the income a heifer might generate and the expense associated with that heifer. The main conclusion to be drawn is that the maximum bid price can vary dramatically from farm-to-farm and each farmer should determine the maximum bid price under his or her own particular circumstances.

The approach adopted in this fact sheet, and in the accompanying spreadsheet, is that the animals to be purchased can be accommodated in the existing dairy facility. This means the

additional animals do not add to fixed costs or farm overhead. In other words, the choice is one of leaving the dairy facility underutilized or investing in additional animals that would contribute to farm income and incur certain additional operating costs, such as feed. This approach is not appropriate for making decisions about replacing one animal with another when the facility is at full capacity, for example, when culling low producing animals. Also, herd expansion decisions involving additional investments in facilities and equipment are more complex and are beyond the scope of this fact sheet.

Buying a replacement heifer or cow represents an investment. The profitability of this investment depends on the income that the heifer or cow will generate and the expense of maintaining the heifer in the herd. These estimates should be based on historic expenses and income for the farm, adjusted for the level of milk production expected from purchased animals and expected milk prices and farm input prices. A heifer's useful life in the herd and her eventual cull value must also be considered. Other factors include the discount to be applied to net income received in the future and the return the farm operator desires from this proposed investment. One final point, there is uncertainty about the income a heifer may earn and the cost of producing this income, so it is helpful to consider alterna-

tive scenarios. A spreadsheet is available to help dairy farmers evaluate the economic consequences of buying replacement heifers. It is available free of charge at the following web site: <http://www.ag-econ.ncsu.edu/DyHeiferValue.xls>. This spreadsheet was used to generate the examples used in this fact sheet.

A purchased heifer generates additional farm income in the form of milk, the value of her calves and her eventual cull value. Milk is the largest source of added income by far. Milk sales can be estimated from the recent history of the herd. This estimate should be based on actual sales rather than Dairy Herd Improvement records of production. If DHI records are used remember to make an allowance for milk that is produced but must be discarded, for example, colostrum and milk from cows treated with antibiotics. Actual sales often run 4 or 5 percent less than DHI production levels.

Milk prices are highly volatile and very unpredictable month-by-month. However, over the last 10 years or so there has been no pronounced trend. A 5- or 10-year average is a useful starting point when projecting milk prices. Most herds have a calving interval greater than 12 months, so the number of calves born is less than one per year. Early death losses reduce the number further. Bull calves are worth less than heifers and it is appropriate to use an average of the two. The decision about raising these calves is a separate business decision, so it is appropriate to value them as week-old animals. Make an allowance for death losses and sick cows when estimating cull value, which reduces the average value per head compared to prices received for healthy cull cows.

Expenses will certainly include feed costs, both purchased and homegrown, and should cover both the milking and dry periods. The cost of purchased grain, concentrates, commodity feeds, minerals, and vitamins are fairly easy to estimate from farm records. Home produced feed costs are more difficult to get a handle on but

include seed, fertilizer, chemicals, labor and equipment costs. Labor costs may or may not increase, depending on the number of additional animals to be purchased and the way the employees are paid. There will be some additional supplies, utilities, veterinary and breeding costs.

Strictly speaking, income and expenses will vary each year over the life of the animal but predicting milk production, milk prices and cost for each year is difficult to say the least. It may be more practical to make a single estimate of the income and expense that can be expected each year that the heifer will be in the herd, on average. This is the approach taken in the spreadsheet.

Replacements typically remain in the herd for several years but dollar-for-dollar the net income they generate in the more distant future is worth less than the net income they generate in the immediate future. This is the "time value of money" concept. To allow for this, and to be able to calculate the maximum bid price, we need to discount the stream of net income we expect a heifer to earn. The "Present Value" is a lump sum amount that represents the value today of the expected stream of net income the purchased animal will generate over her lifetime¹. The discount rate may be the interest rate the buyer is paying on borrowed money or the opportunity cost of using his or her own money.

There is a risk that a purchased heifer or cow will encounter health problems before she enters the milking herd and so will never become a productive animal. Experience is the best guide but the percentage is probably in the 5% range. The Present Value figure should be reduced to allow for this. Also, the expense included in the calculations does not include any compensation to the dairyman for his or her time and effort (unless this compensation is included under labor costs, as in the case of a corporate farm). The dairyman should specify the minimum amount of compensation required and may wish to include a minimum amount as a contribution to the farm

fixed costs, farm overhead and land ownership. The amount to be included is a matter of personal preference but it must be noted that the higher this amount, the smaller the maximum price that can be paid for replacements.

The calculations presented here do not consider income taxes. Additions to net income will add to taxable income and the investment in purchased heifers is recouped through additional deductions in the form of depreciation allowances. Dairy men should discuss any tax concerns with their tax advisor.

The maximum bid price is the maximum a dairyman can pay and still expect to recover the cost of the heifer and obtain the minimum return. If the market price for cows or heifers exceeds this maximum bid price, the dairyman is better off leaving the facilities underutilized. If the market price is less than the estimated maximum bid, the difference represents an added return over and above the minimum the dairyman specified.

There is always uncertainty about future milk production, milk prices and expenses. It is useful to consider the sensitivity of the results to changes in these factors. Tables 1, 2 and 3 illustrate the effects of differences in income and expense levels on average annual

net income, on the present value of the net income stream and on the maximum bid price. The "base case" is the same example presented in the Net Income Worksheet. The other figures in the table show the effects if income and expenses change by 10 percent, up or down. For example, a 10 percent reduction in income and a 10 percent increase in expenses would reduce average annual net income to \$529 per head, Table 1., compared to the base case of \$1,118. This scenario then translates into a Present Value amount of \$1,652 in Table 2, compared to the base case of \$3,197. Continuing this scenario, the maximum bid price is reduced to \$479, Table 3, down from \$1,949.

Two final caveats are in order. The costs and returns included in this discussion are all economic costs and returns and the focus is on profitability. If a significant number of animals are to be purchased with borrowed funds, a dairyman should develop cash flow projections to ensure that the proposed loan payments can be made on schedule and that family living needs can be met. Also, the fact that the analysis shows that the purchased animals will make a positive contribution to the net income of the farm does not imply that the overall financial position of the farm is healthy. An annual financial check-up of the entire operation is recommended.

¹ The principle of discounting is the opposite of earning interest on a financial instrument, such as a CD. In this case, the investor receives more money in the future because of the interest payments paid as compensation for not having use of the money today, the expected inflation rate and risk. Discounting reduces the value of a dollar received in the future to a dollar value at the present. Spreadsheet programs include the discount function among their tools. The formula

$$is \quad PV = \sum_{N=1}^K \frac{I_n}{(1+d)^n}$$

Where S represents the sum over all the time periods, there are n time periods, I_n is net income in time period n, and d is the discount rate.

Net Income Worksheet

Number of years cows last in the milking herd, on average, in years	<u>3.0</u>
Estimated cull value of the heifer/cow you plan to buy, \$	<u>\$350</u>
Loss rate on bought animals, pre-milking, percent	<u>5%</u>
Minimum return desired for management, overhead & risk, \$/head/year	\$365
Discount rate applied to the income stream.	9.0%

Item	Unit	Quantity	Unit Value	Amount
Average Annual Income per Cow:			\$	\$
Milk	100 lb.	223	15.00	3,345
Calf	Head	0.8	200	160
Other				<u>0</u>
Total Operating Receipts				\$3,505

Average Annual Operating Expense per Cow:

Chemicals for crop production	Head	1	35	35
Feed Purchased--grains, concs & byprod.	Head	1	925	925
Feed Purchased--forages	Head	1	0	0
Fertilizer and lime	Head	1	60	60
Freight & trucking	100 lb.	223	0.75	167
Gas, fuel, oil	Head	1	60	60
Labor hired, non-family (incl.employer taxes)	Head	1	415	415
Labor hired, family (incl.employer taxes)	Head	1	0	0
Repairs- machinery and equipment	Head	1	70	70
Repairs- buildings and improvements	Head	1	60	60
Seed	Head	1	35	35
Supplies	Head	1	75	75
Utilities	Head	1	85	85
Veterinary, medicine, breeding, BST	Head	1	200	200
Other	Head	1	200	<u>200</u>
Total Operating Expense				<u>\$2,387</u>

Average Annual Net Income per Cow \$1,118

Present Value of the net income stream \$3,197

Maximum breakeven price, after losses, delivered \$3,044

Maximum bid price to provide minimum return, delivered \$1,949

Table 1. Sensitivity Analysis of Average Annual Net Income

	10% Reduction In Income	Base Case For Income	10% Increase In Income
10% Reduction In Expenses	\$1,006	\$1,356	\$1,707
Base Case For Expenses	\$767	\$1,118	\$1,468
10% Increase In Expenses	\$529	\$879	\$1,230

Table 2. Sensitivity Analysis of Present Value of Net Income Stream

	10% Reduction In Income	Base Case For Income	10% Increase In Income
10% Reduction In Expenses	\$2,904	\$3,822	\$4,741
Base Case For Expenses	\$2,278	\$3,197	\$4,115
10% Increase In Expenses	\$1,652	\$2,571	\$3,490

Table 3 Sensitivity Analysis of Maximum Bid Price

	10% Reduction In Income	Base Case For Income	10% Increase In Income
10% reduction In Expenses	\$1,670	\$2,545	\$3,420
Base Case For Expenses	\$1,075	\$1,949	\$2,824
10% Increase In Expenses	\$479	\$1,354	\$2,228