high principal and interest payments due to 93% of the initial investment being debt financed. The 80% debt financing of livestock and miscellaneous equipment, and their five year amortization, is the primary contributor to the problem. The principal and interest payments due to 93% breakeven analysis indicates there should be no problem in achieving a breakeven cash flow if herd size, milk production, and milk price reach projected levels. To decrease the chance of cash flow problems, the potential investor should seek longer term lengths for these loans and/or decrease the amounts financed. If more favorable terms were available for this portion of the financing, another analysis could be run by simply plugging the new data into the input area (Exhibit 2) and recalculating the spreadsheet.

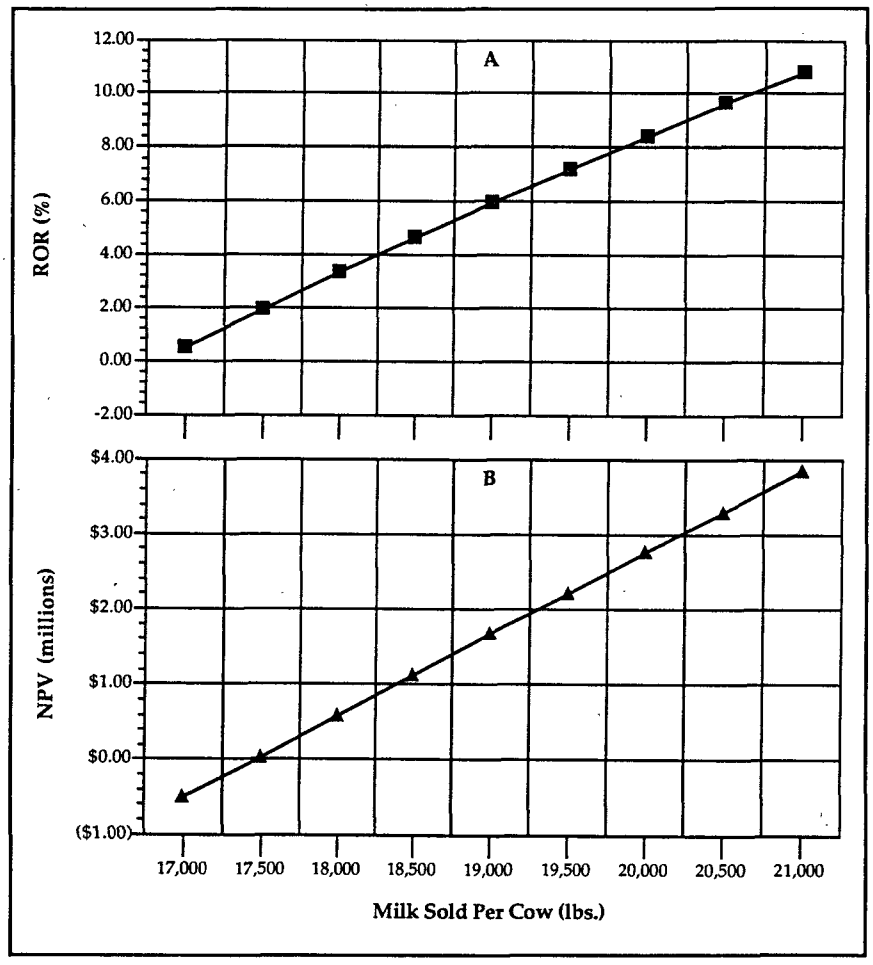

Figure 1. A) Rate of return (ROR), and B) net present value (NPV) as affected by milk sold per cow.

Dealing with risk

Obviously any financial investment has risk associated with it. A primary component of risk is the uncertainty associated with the magnitude of potential net returns. Fortunately, there are some techniques available to deal with this aspect of risk associated with the potential returns from the dairy investment. First, the uncertainty primarily arises from uncertainty about the accuracy and stability of the data involved in producing the capital expenditure budget and estimated cash flows. Therefore, the first step in analyzing uncertainty is to run a variety of "*what-if*" scenarios of the proposed investment using the spreadsheet model. By plugging a variety of values into the capital expenditure budget (Exhibit 1) and/or changing various values (e.g., milk sold per cow, interest rates, discount rate, etc.) in the inputs affecting cash flows and financing (Exhibit 2), the potential investor can discern the impacts on investment value (Exhibit 4).

At a minimum, the potential dairy investor, working with the design team, should formulate three scenarios: 1) best case, 2) worst case, and, 3) most likely case. For example, milk sold per cow is one of the most critical determinants of profitable dairying. Figure 1 shows the changes in NPV and ROR as milk sold per cow changes. This graph makes it clear that, given the assumptions of Exhibits 1 and 2, the investment is not feasible unless milk sold per cow exceeds 17,000 lbs/cow. Similar graphs could be made for changes in milk price, interest rates, percent of investment financed with debt, etc. In this way the investor could determine if acceptable NPV, ROR, etc. are possible over feasible ranges of various input variables (e.g., milk sold per cow or milk price, etc.).

A second method of dealing with uncertain returns is called **simulation modeling.** Simulation modeling allows the analyst to specify the probability distribution for one or all of the inputs to the spreadsheet model. For example, probability distributions for various aspects of capital expenditures (e.g., land, construction, or equipment costs) or cash flow inputs (e.g., milk sold per cow or milk price) could be specified. A probability distribution for an input simply describes the possible values an input may take and the likelihood of each