

## **Replacement Heifers Costs and Return Calculation Decision Aids**

The purpose of these replacement heifer cost decision aids is to calculate total production costs and return on investment (ROI) to evaluate production, breeding systems and pricing and marketing alternatives. The focus is on feeding and breeding system evaluation including natural service or artificial insemination (AI). This cost can be for heifers going back into the herd or for producing bred heifers for sale. Information can but also be used to negotiate replacement heifer's pricing terms for long term contracting agreements.

To evaluate the accuracy of the budget projection a spreadsheet is provided to do a closeout for the replacement heifers once the heifers are transferred to the cow herd or sold

There are three production alternatives covered by the decision aids including:

### **Replacement Heifer Costs and Returns Budget and Closeout**

1. Replacement Heifer Production – Natural Service
2. Conventional Artificial Insemination Replacement
3. Contract Replacement Heifer Breeding Service
4. Bred Replacement Heifers Natural Service and Pairs

The decision aids include pricing of weaned heifer, and pre-breeding culled heifers and culled open heifers. The initial weaned replacement heifers' cost is the major cost of production (accounts for approximately 50 percent of total bred heifer cost after adjustments for culled heifers that don't breed. A major cost is the inherent inefficiency in replacement heifer reproduction. One can plan that 5-20 percent of the heifers will not breed during the breeding season and have to be culled often at a discounted feeder heifer price that increases the cost of the heifers that breed. When producers are evaluating the alternative to purchase or raise replacements, they often do not take into account only 75-90 percent of the selected heifers will breed and culled heifers sell at a lower value.

The weaned heifer market value is the opportunity cost for not selling the weaned heifer kept for raised replacement heifer production. The first return from a purchased bred heifer will be received approximately a year sooner when her first calf is sold than saving weaned heifers to produce replacements. The time between saving a weaned heifer and her producing a weaned calf is at least two years.

Producers have different breeding alternatives for replacement heifers including natural service or artificial insemination (AI). Replacement heifers bred to produce heifers should have less calving difficulties as birth weights are lower for heifers. If replacement heifers are bred to produce F1 heifers these calves can be more valuable than straight bred calves.

This decision aid calculates the breeding cost for AI Heat Detected to Timed-AI breeding protocols followed by clean up bull's costs. The spreadsheet calculates and reports the breeding cost for all females exposed and bred female. This facilitates comparing alternatives.

---

Prepared by James McGrann, Professor Emeritus, Economist Management, Texas A&M University, 11/26/ 2018.

For the producer of replacement heifers for sale it is an important production and marketing alternative. To be profitable the bred heifer sales price must cover the added cost, management and the higher risk associated with production and marketing.

## **Replacement Heifer Production Cost and Returns**

The main question addressed with this decision aid is: What is the economics of producing bred heifers to build the herd or to sell bred heifers or pairs? This decision aid combines production and financial data to calculate the cost of a bred heifer as well as cost of a bred heifer and first calf pair. This is a long production cycle that begins when the replacement is weaned and finishes when the heifer is pregnancy tested or in the case of the pair when the calf is born or when the first calf heifers is diagnosed pregnant if sold as a three in one.

## **Input Data for the Alternative Decision Aids**

The first data input form gathers the production data that describes the dates and timing of the production cycle from the time the heifer is weaned until a pair would be available for sale. Heifer value at weaning is input as the base cost as the production cycle is completed and costs are accumulated. Reproduction and culling data is used calculate cull sales and the number of calves available for sale.

The definitions of the Standardized Performance Analysis (SPA) measures will assist in recording the dates recorded and reproduction measures. See these definitions at the end on the definition section.

Two breeding systems are considered for producing bred replacements. Natural service and conventional AI with clean up bulls. Using AI has greater managerial requirement but the increased use of timed AI and greater control over genetics has made this a profitable option when the market pays for this added managerial effort and cost. The AI decision aid option allows switching between natural and AI breeding to quickly evaluate the two alternatives. When using the AI option it is critical to get the breeding protocol and associated cost quantified with the technician doing the AI. As will be noted the breeding cost is pretty insignificant in total cost of producing replacement heifers.

Actual production and cost data generated from actual records is desired. Estimated value and use of “what if” capabilities in the spreadsheet are helpful even if data is limited. Critical numbers are success in getting heifers bred and calving success.

Providing **AI heifer contract breeding service** is a production activity that complements breeding raised or purchased heifers. The methodology is the same for calculating profitability of the management, care, feeding a breeding service provided. The heifer owner provided the heifers to breed and may provide the semen. The contractor normally provides the clean-up bulls. The decision aid calculated the head day fee and calculates the ROI at the daily fee. The full cost of the owner’s bred heifer services is calculated.

Where **bred versus pairs** is evaluated natural service is used. Production and cost data is entered in the next sheets for the bred replacement followed by the information for the first calf pair. The final page provides a summary to the production and financial information. One can observe the costs and net income associated with the two options.

## Decision Aids Operation

These are the steps to follow to up the data in the two decision aids. First run the **Bull Cost Calculator sheet**. The breeding cost per head will be use in the cost decision aid. There are two decision aids. One for when conventional semen is used one for sexed semen because of the difference in calculation of the sex of calves born and difference in gender value and semen cost and expected reproduction difference.

The decision aids allow for quick evaluation of natural service by selection the breeding system desired. The natural system uses the cleanup bull breeding costs as the breeding cost. A separate page is used to set up the bull cost and protocol cost of the AI breeding systems. The annual cost of the bull investment is accounted for in depreciation or the investment minus salvage value divided by years of expected service.

The data convention is items in **blue** are **user input** data all the black numbers are calculated numbers and are protected cells. Other data is from links in the spreadsheet or calculated values. The breeding costs per heifer are then transferred to the replacement cost calculator. **Weaned to Bred Heifer Cost** is used to calculate the full costs including capital and target returns from the time of weaning to heifer delivery. Note several critical numbers are entered in the first sheet that is carried over to this sheet.

In most cases pricing of bred replacement should be based on consideration of Weaned to Bred Heifer Cost. If priced at breeding time the pricing should reflect the costs to get too breeding age and weight. Cost of production will most likely be higher than increase in market value. This reality is reflective of the low rate of gain and high cost of gain.

## When Using the Decision Aids Keep in Mind These Factors in the Analysis

- Two key measures to monitor this activity evaluation are the pregnancy rate and the return on investment (ROI). ROI can be calculated for heifers retained or marketed.
- The economic results of breeding systems evaluation will always show that pregnancy rate and weaning rate is everything from an economic point of view. Period!
- The opportunity cost of an open heifer is large when one compares the market value of the open heifer to the bred heifer. For example difference in the value of a bred and open heifer at pregnancy testing time needs to be calculated. Anything that would cost below this value that result in an additional pregnancy is a cost effective option as added revenue would be greater than added cost. Hiring additional labor to assist during the AI breeding period would be very cost effective if that is a

constraint to implement an optimal breeding system. The economic message is don't save costs on the breeding protocol if it reduces pregnancy rate. In addition don't let saving feed interfere with optimal nutrition programs. It's well known body condition score is highly correlated with pregnancy rates.

- The purchase cost or opportunity cost of the raised heifer accounts for the majority of the bred heifer cost. When pricing weaned heifer calves, recognizing these selected heifers have higher value than the average heifer in the weaned herd. These are the best heifers in the herd. Pricing heifers at steer value is a reasonable approach.
- Pricing the weaned heifer is critical in a negotiated supplier relationship. Tying valuation to the feeder steer future market would allow for an adjustment for a changing price cycle when forming long term plans.
- In calculating costs these are full costs including cash operating costs, depreciation of facilities and equipment, purchased bulls, finance, management and labor and general and administrative costs (overhead). In the accounting system the replacement heifers need to be set up in a separate cost center. Leasing rates can be used for feed and grazing costs when costs are not generated by the accounting system.
- Interest on the weaned heifer cost and operating cost, (one-half of operating costs to reflect an average outstanding capital cost) for the period between initiation of the activity and delivery of bred heifers is accounted for.
- One could compare this retained ownership to selling the heifer at weaning by adding, capital return (return on investment ROI) as the target rate of return, reflected in the interest rate included in finance costs, if the bred replacement was marketed at full cost. Anything over full cost would add the margin over weaned heifer sale.
- When calculating the cost of producing replacement heifers it shows “**genetics is a low cost input**”. Good genetics either AI of quality bulls is a good investment.
- It's very important to get breeding costs into proper perspective. Although important, **breeding costs account for less than 10% of total cost of producing replacement heifers when including open value**. One should not be an area to try to reduce these costs if it results in lower pregnancy results.
- There are production and financial inefficiencies when producing replacement heifers. Steer calf mates of replacement type heifers are often lighter and market price is less per pound than terminal cross steers. An example is F-1 Brahman steers compared to Charolais cross steers out of Hereford cows. The straight bred cows designated to produce replacements normally are not as efficient. Cross bred

cows have higher reproduction, weaning weights and longevity than straight bred cows.

- When contracting delivery timing needs to be negotiated. Bred heifers need to be diagnosed as soon as possible and delivered to the buyer. Early pregnancy confirmation using ultra sound technology will allow earlier delivery and reduce carrying cost.
- The focus must be on getting the heifers bred and to produce live calves that are market acceptable and for the heifer to rebreed for the second calf. Using low EPD birth weight bull semen or bulls is of course a good management practice.
- **It's not a breeding cost issue** it's getting replacement heifers bred, weaning a calf and breeding back and first calf heifers where attention needs to be focused. Synchronization can result in more heifers being bred early in the breeding season. This will mean higher average weaning weights and potential for cows to have more productive lives with early calves.

### **Producing Replacement – Its “Replacement Cows”**

For the cow-calf producer one of the most costly activities and most important investment activities is producing replacement heifers. The cow calf activity is a long term investment activity as opposed to retained ownership that is a short term margin investment. Selecting the genetics reflected in the replacement is a decision that hopefully will be a 7-10 year investment decision. There is absolutely no management activity more important from a cow-calf operations perspective than the replacement activity. It's of course miss named as **it's a replacement cow activity**. Success is measured in terms of how many of the weaned heifers selected actually produce a weaned calf after calving as two years of age and are bred back to produce the second calf. Too many times saving costs in efforts to produce “replacement cows” is a poor and costly decision.

The market for replacements is not as efficient as for feeder cattle, a short term margin investment. It is difficult to receive a “proper market price” given the potential of AI bred heifers that will have less difficulty calving, calve early in the season and produce a potential replacement. Of course this is no excuse for not achieving this when a producer is producing their own replacements cows.

### **A Marketing Note: Why Producers Should Purchase Replacement Heifer**

Many beef cattle producers have production and economic incentives to buy replacement heifers rather than raise them. Producing or buying replacement heifers is a long term investment decision. This is especially true for producers using terminal cross feeder calves. An example is using Angus or Charolais bulls on Brangus females. These cows produce feeders that meet market demand and have heterosis advantage reflected in weaning weights. Small producers (less than 200 cows) seldom can economically justify producing their own replacements. The

breeding herd composition and purchasing sires to produce replacements and breed the heifers plus added management makes production very costly. Large herds can also benefit for purchasing replacements, specializing in producing terminal cross feeders and simplify the production system. Frequently when producers are evaluating the alternative to purchase or raise replacements, they do not consider only 75-90 percent of the selected heifers will breed and culled heifers sell at a lower value. The weaned heifer market value is the opportunity cost for not selling the weaned heifer kept for raised replacement heifer production. The first return from a purchased bred heifer will be received approximately a year sooner when her first calf is sold. The time between saving a weaned heifer and her producing a weaned calf is at least two years.

The purchase cost or opportunity cost of the raised heifer accounts for the majority of the bred heifer cost. Pricing the weaned heifer is critical in a negotiated supplier relationship

There are production and financial inefficiencies when producing replacement heifers. Steer calf mates of replacement type heifers are often lighter and market price is less per pound than terminal cross steers. An example is F-1 Braford steers compared to Charolais cross steers out of Braford cows. The straight bred cows designated to produce replacements normally are not as efficient. Cross bred cows have higher reproduction, weaning weights and longevity than straight bred cows.

The success rate “**pregnancy percentage**” is critical as open heifers sell at a discount that raises the cost of bred heifers. Marketing and purchasing inputs are year round activity and must with finding ways to reduce feed costs. Forward planning has never been a more profitable activity.

**The cow-calf sector is poorly supported by benchmarks and cost data. Recall what is measured is managed. Make the numbers do the talking.**

## **Appendix A: Replacement Cost and Returns Calculation Decision Aids**

1. Replacement Heifer Natural Service Budget
  - a. Natural Service Projection
  - b. Natural Service Closeout
  - c. Bred Replacement Heifers Natural Service and Pairs
  
2. Conventional Artificial Insemination (AI) Heifer Budget
  - a. AI Heifer Projection
  - b. AI Heifer Closeout
  - c. AI Heifer Contract Breeding Service
  
3. Replacement Heifer SPA Reproduction Performance Heifer Data Collection
  - a. Replacement Heifer SPA Reproduction Calculator

4. Replacement Heifer Budgeting Support Aids
  - a. Feed and Grazing Cost Calculator
  - b. Replacement Heifer Purchase and Sales Record
  - c. Replacement Heifer Monthly Inventory – Hd. Days & AUMs
  - d. Replacement Heifer Indirect Cost Calculator, IRS Based Ranch Direct and Indirect Cost Allocation

### **Definition of Replacement Heifer Economics Terms**

**Annualized Net Return on Investment ROI** is the annualized return on investment (ROI), including net margin objective, and is the net income plus cash interest cost plus the target margin objective divided by annualized capital (asset) requirement to support the enterprise. The reason interest is added back is interest paid represents a return the debt capital. ROI is a return to capital invested irrespective of capital ownership. Capital is adjusted for the time cattle are grazed or on feed. Investment required is estimated by taking one half of the investment is non-cattle costs plus the total payweight cost of the feeder cattle times days on feed divided by 365 days.

**Average Daily Gain (ADG)** is the net payweight weight gain divided by head days. This weight is adjusted for death loss (deads are in) as only live cattle payweight are counted. Average daily gain is total gain divided by days grazed feed.

**Total Production and Breeding Cost** or breakeven component divided by the number of bred replacement heifers. The costs included must be defined before a breakeven can provide useful information to a decision maker. **A break-even that does not cover full cost is very misleading.** Feedyards never calculate a “full cost” breakeven. It is a feedyard direct cost breakeven. Producers must add to direct costs full cost of the heifer and the business’s general and administrative (G & A) and finance costs. They must have **total unit cost** to have a true measure of profitability. Having G&A and actual interest cost will mean the replacement heifer profitability and TUC is consistent with the total business income statement or profit and loss (P&L) statement.

**Depreciation** is the value that accounts for the use of a capital asset over time. Depreciation of a bred replacement heifer divided by her productive cost is what the depreciation would be for breeding cows. This is a major cost of production.

**Direct Expenses** are expense items that are directly related to production activity such as grazing, feed, yardage, health, breeding and heifer cost.

**Economic Cost** is, in addition to the financial or accounting cost, an opportunity cost that is charged for owned land (what it could be leased for) and owner equity capital (what it would earn in an alternative investment or by how much it would reduce interest if used to repay debt). Opportunity cost represents the return that could be received for a resource in its next best use. Economic cost represents the cost “if all resources” earned their opportunity cost or a use forgone.

**Financial Analysis** focuses on determining the accounting cost (cash and non-cash), profitability or change in equity, and repayment capacity of the enterprise or business being evaluated.

**Financial Costs** include cash costs, depreciation, and non-cash adjustments, such as accounts payable, accrued interest, etc. These costs are recorded and reported in the business accounting system. The financial cost does not include opportunity cost of resources like lease equivalent or owned land and interest on equity capital.

**Indirect Costs** include asset ownership and operating costs. Depreciation and repair and maintenance of improvements vehicles, machinery and equipment, labor and management, and property tax are examples of indirect costs. Indirect costs continue as the number of cattle increase or decrease. **General and Administrative Costs (G&A)** are included in indirect costs to run the business such as bookkeeping, professional fees for accounting and legal services, dues, utilities, general insurance, office supplies and administrative personnel salary and payroll and benefits. There is management time spent on planning, implementation and marketing issues for the cattle custom feeding retained ownership activity. Indirect cost are also referred to as overhead costs or fixed cost.

**Owner Operator Labor and Management** compensation should be included in the production cost calculation at a level equivalent to the salary required to hire a non-family member to provide an equivalent service. Compensation in excess of this amount must be considered capital distributions in order to reconcile the retained earnings and statement of cash flows. Owner manager costs need to be included in production costs. Leaving it out implies the owner works for nothing.

**Profit (Loss).** Great care must be exercised in reading reports in the cattle sector labeling the value profit or loss. Most frequently in feedyard and other cattle reporting, these numbers are gross margins (gross revenue minus direct costs) and do not include overhead and owner labor and management costs, which are required to calculate a true profit or return to business equity.

**Rate of Return on Equity (ROE)** measures the rate of return on equity capital employed in the farm business. The higher this value, the more profitable is the business.

**Sunk Cost** – is used to describe a cost that has incurred or has taken place that cannot be reversed. At the time to harvest a crop the cost of the seed and fertilizer are sunk costs and are irrelevant in the decision the harvest the crop or not. At the weaning time the costs to produce the calf are sunk costs. These costs do not determine if the weaned calves should be retained or not. It's a question will the added revenue be greater than the added costs from retained ownership in greater than just selling the unweaned calf.

**Total Unrealized Sales Value** (opportunity cost) is the net sales revenue that is projected if the calves are sold at weaning after shrink and marketing costs. The weight, price and marketing costs are critical in determining net payweight and payweight price.

**Yardage cost** is used as an expression indirect cost including ownership (depreciation, housing, insurance and interest costs) and operating cost of facilities, repair and maintenance of machinery and equipment, fuel, labor, management, utilities, property tax and general and administrative costs. These costs are and charged head days and grazed. The sum of direct costs and yardage combined with financing cost is **total unit cost**. The “yardage concept” is used for grazing cattle as feedyards use for custom fed cattle.

### **Key Standardized Performance Analysis (SPA) Reproduction Definitions:**

1. **A total female exposed at the beginning of the breeding season** is the number of females in the beginning inventory that are exposed either to bulls or in an artificial insemination (AI) program. The number should correspond to the number on the **beginning date** of the breeding season.
2. **Adjusted exposed females including sales, transfers, purchases of pairs and exposed and pregnant females** -- is an inventory of exposed females that results from the beginning inventory plus all the adjustments. This is the most critical number that must be generated by the inventory in the reproduction and production performance measures of the cow-calf enterprise. The accuracy of this value will determine the overall accuracy of the productivity analysis. The key is to carefully monitor monthly inventory maintenance and consistency between operating cycles. This number begins with the beginning inventory on day one of the breeding season, subtracts culls not intended to be bred, as well as sales or transfers out of the breeding herd and adds purchases or transfers in. The net result is used to determine the weaned calf percentage and other production measures of performance.
3. **Number of exposed females that are pregnancy tested** will be the base number used to calculate the pregnancy rate after adjustments. Include females, which were pregnancy tested and sold or transferred out after the breeding season.
4. **Number of females diagnosed as pregnant** is the actual number of the exposed females diagnosed as pregnant. The accuracy of the pregnancy rate improves when all females that are exposed are pregnancy tested. Include females, which were diagnosed as pregnant, but sold or transferred out of the breeding herd after the breeding season.
5. **Pregnancy percentage** -- expresses the number of females diagnosed as pregnant as a percentage of the number of exposed females that are pregnancy tested.
6. **Number of females diagnosed as open** is the number of females diagnosed as not being pregnant or the total number pregnancy tested minus those diagnosed as being pregnant. Includes females, which were diagnosed as open but sold or transferred out of the breeding herd after the breeding season.
7. **Pregnancy percent based on exposed females is the key SPA measure** and is the number of pregnant females divided by the adjusted number of exposed females.
8. **A pound weaned per exposed female** is a very important measure of performance for producers selling weaned calves. It is calculated by multiplying weaning percent by average weight. Combining weaning weight and reproduction truly measures production.

### **Reference: Other beef cattle decision aids including SPA**

Texas A&M University - Department of Agricultural Economics – Agri-Life Extension

Beef Cattle Decision Aids: <http://agecoext.tamu.edu/resources/decisionaids/beef/>

