Managing for Today's Cattle Market and Beyond

Managing Cow-Calf Production Costs:

What To Do Before The Money Runs Out

By
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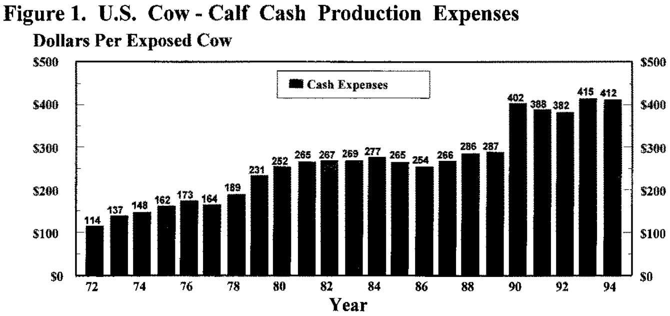
Cow-calf producers are a lot like jet pilots. That is, cow-calf producers and jet pilots have to think far in advance of where they are at the present time in order to react to the problems they may be confronted with in the future. Therefore, if you're a cow-calf producer looking to improve future cow-calf profitability, you must begin **today** managing your cow-calf **production costs**.

Figure 1 illustrates the average cash production expenses incurred by U.S. cow-calf producers from 1972 to 1994. During this 23-year period, cow-calf cash production expenses have nearly quadrupled. In 1994, U.S. cow-calf cash production expenses averaged about $412 per exposed cow. In order to cover cash production expenses per exposed cow of this level with average calf weaning weights of 550 pounds, the average cow-calf producer would need to receive average calf market prices of about $75 per hundredweight. When adjustments for weaning percent and allocations for depreciation, unpaid family labor and management, and the use of equity capital are included, the cow-calf producer would need to receive average calf market prices that are **substantially** greater than $75 per hundredweight. Therefore, when calf prices are well below $75 per hundredweight, it is absolutely essential that cow-calf producers know their production costs and seek ways to control, manage, and/or reduce them.

Figure 1. U.S. Cow - Calf Cash Production Expenses



USDA, ERS. Note: 1990-94 estimates were based on a revised methodology.

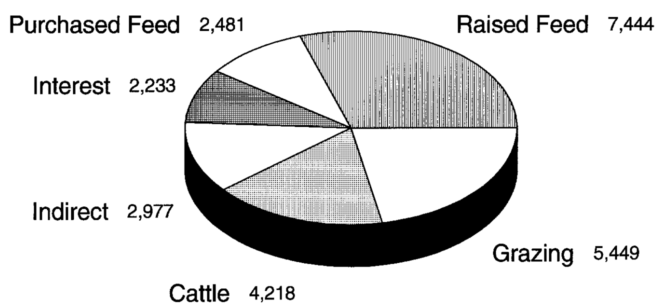
Where Do I Start?

First, collect your production costs and separate them into categories. Common categories may include purchased feed, raised feed, grazing, cattle, indirect, and interest costs. Sorting your production costs into categories will allow you to group common types of costs together. Too many categories will result in chaos and too few categories will not provide you with sufficient information to manage production costs. Separating production costs into these categories for your financial records may be done by hand or with a computer program.

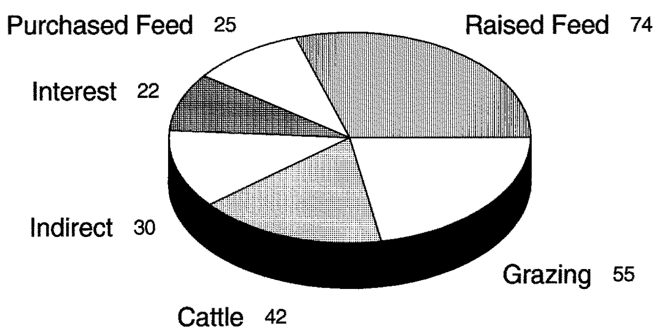
Once you have defined production cost categories, you can easily determine where you are spending money and the amount in each category. The use of categories will offer you a closer look at the types of inputs you are using and what they cost. Now you can begin to evaluate opportunities to lower input use or costs, select substitute inputs, and/or eliminate these inputs if they are unnecessary.

In addition, production cost information may be

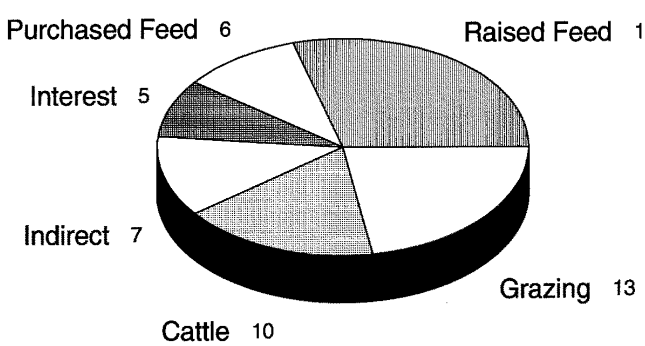
Total Dollars Per 100 Cows $24,812



Dollars Per Breeding Cow $248



Dollars Per Cwt. $58



used to view the cow-calf operation based on total dollars (e.g. $24,812), dollars per breeding cow (e.g. $248), and dollars per hundredweight (e.g. $58) of calf production. These measurements are useful for evaluating net income, identifying high-cost areas, and for comparing input and management alternatives.

You are now equipped with the necessary information to begin investigating opportunities to improve the net income of your cow-calf operation. During years of low calf market prices, your objective should be to lower your unit cost of production. You can lower your unit cost of production by one of four different actions. They include 1) maintaining the same pounds of calf production while lowering production costs, 2) maintaining the same production costs and increasing pounds of calf production, 3) lowering production costs by more than you lower pounds of calf production, and 4) increasing pounds of calf production by more than you increase production costs.

The key to lowering your unit cost of production is being able to estimate the effect that a change in production costs will have on the pounds of calf production. The selection decision about which option to use requires management expertise. Do not hesitate to consult with others (ranchers, Extension agents, lenders, accountants, veterinarians, IRM-SPA team, etc.) when making this difficult decision.

Factors to Consider to Lower Cow-Calf Production Costs

Dramatic production cost differences exist among U.S. cow-calf producers. Current annual financial cow cost data from the cow-calf IRM-SPA program ranges from $156 to $969 per breeding cow. These differences are due to the enormous variety of inputs, resources, production practices, and management used by cow-calf producers. The following is an itemized list of factors to consider as opportunities to lower your production costs or unit cost of production.

Purchased Feed Costs

- Develop a purchasing plan for feed (amount to spend, type of feedstuffs, quantity, quality, etc.).
- Minimize the need for the use of purchased feeds.
- Have feed analyzed for nutrient composition.
- Use purchased feeds based on nutritional needs of cow-herd and replacements (lactating, gestating, dry, growing, etc.).
- Buy purchased feeds in volume and at seasonal low prices when storage is feasible.
- Identify alternative feeds and by-product feedstuffs.
- Compare alternative feed prices and nutrient costs.
- Develop feed rations based on feed and forage analyses.

- Minimize feed losses during storage and feeding.
- Compare alternative feed, storage, and feeding costs.
- Buy feedstuffs by weight and quality (%DM, %TDN, %DP, etc.) instead of bulk measure ments (bale, roll, trailer load, etc.).
- Use limit feeding techniques (fat, salt, rolling out hay, etc.) when practical.
- Consider incorporating cool- and warm-season forages (grasses/legumes) in your grazing plan to reduce dependence on purchased feeds and nitrogen fertilizer.
- Consider whether forage species or forage variety selection can lengthen the grazing season and thus lower purchased feed needs.

Raised Feed Costs

- Develop a plan that describes your anticipated raised feed needs (best and worse case scenarios).
- Minimize the use of raised feeds when growing forages is economically advantageous.
- Compare the costs of raising, harvesting, and storing alternative raised feeds.
- Compare your cost of harvesting raised feed with custom harvesting rates.
- Compare your cost of raised feeds with alternative purchased feeds (buy feed if it is cheaper than self raising and harvesting feed).
- Minimize harvest, storage, and feeding losses.
- Consider weather, labor availability, and machinery readiness to minimize harvested feed losses.
- Consider feed storage facilities to minimize feed losses.
- Consider the use of feed panels/rings to minimize feeding losses.
- Borrow, share, and/or rent machinery and labor with neighbors.
- Use limit feeding techniques (rolling out hay, etc.) when practical.

Grazing Costs

- Develop a grazing plan to better utilize your inputs, resources, and forages.
- Soil test to determine fertilizer nutrients and/or lime needs.
- Evaluate alternative fertilizer formulation prices and spreading costs to reduce the cost of fertilization.
- Where possible, incorporate legumes into perennial pastures to lower nitrogen fertilizer inputs and improve forage quality.

- Split fertilizer applications if it will minimize fertilizer losses.
- Use non-commercial fertilizer inputs (animal wastes, sludge, light industry and mining materials, etc.) when prices and availability permit.
- Consider leasing additional land when lease rates are cheaper than fertilization costs (compare dollars per AUM or dollars per unit of dry matter forage production).
- Perform weed control practices (chemical or mechanical) only when it is economically advantageous.
- Where feasible, improve forage utilization with improved grazing methods (creep, limit, rotational, intensive, etc.).
- Adjust fertilization and stocking rate levels based on calf and fertilizer prices (i.e. higher fertilizer costs imply lower fertilization levels which result in lower stocking rates, less cows per acre).
- Utilize crop aftermath and woodland browse when possible.
- Consider stockpiling certain forages for use as standing hay if this is possible in your area.
- Consider drilling/overseeding cool-season forages (grasses and legumes) to lengthen the grazing season and reduce purchased and/or raised feed needs.
- Provide animals having the highest nutritional requirements access to the highest quality pasture.

Cattle Costs

- Develop a cattle management plan (produc tion, reproduction, nutrition, herd-health, feeds, forages, marketing, etc.).
- Adopt a controlled breeding season to improve/reduce management and labor costs.
- Consider adjusting cow-herd inventory and stocking rate due to lower beef prices and/or higher input costs (i.e. lower calf prices imply lower fertilization levels which result in lower stocking rates, less cows per acre).
- Review cow-herd records and cull open, defective, low producing cows and especially older cows to lower production costs.
- Retain only the essential number of replace ment animals to achieve the desired herd

inventory. Developing replacement animals is expensive.

- Evaluate buying versus raising replacement animals.
- Try to keep cows productive over a longer time period.
- Consider leasing high quality bulls, cows, and replacement heifers.
- Perform preventative herd-health practices to reduce "emergency" costs and losses.
- Compare prices of herd-health animal prod-ucts.
- Reduce cow frame size over time if needed to lower total feed requirements.
- Sort cows into groups based on nutritional needs to improve/reduce management and feed costs.
- Use caution when selecting inputs to increase weaning percent or weights during low beef market price years. The cost of some inputs will exceed the revenue generated by their use.

Indirect Costs

- Identify overhead items that are not essential to maintain production and eliminate them.
- Monitor utility costs and manage their use.
- Maintain only essential inventory items of farm supplies.
- Compare insurance coverage and rates.
- Plan vehicle, machinery, and equipment use to reduce labor and operating costs.
- Control and monitor family living withdraw als.
- Be selective about educational, travel and entertainment opportunities.

Interest Costs

- Develop a financing plan and review financial records to identify time periods that loans will be needed and when they may be repaid.
- Minimize the use of borrowed money during low beef market price years. Delay purchasing machinery, equipment, pasture renovation, facility improvements, etc. until market condi tions justify these capital expenditures.
- Thoroughly evaluate all capital purchases that require financing to ensure they result in profitable investments and have a reasonable payback period.
- Compare interest rates and financing charges among financial institutions (negotiate when possible).
- Consider consolidating debt when necessary to reduce debt servicing requirements.
- Consider reducing borrowed funds by liqui dating non-essential or non-productive assets.

- Consider liquidating assets (land, cattle, timber, machinery, etc.) in advance to avoid making delinquent payments or defaulting on loans.

Summary

In the beef cattle industry, production costs are constantly changing due to weather conditions, fluctuating feedstuff and input prices, animal performance, domestic and export markets, technol-ogy, and agricultural policies. Consequently, cow-calf producers need to continually measure and manage the production costs of their operations.

By collecting and organizing production cost data, cow-calf producers will be able to determine their total production costs, costs per breeding cow and cost per hundredweight of calf production. The process is simple, but it requires a lot of discipline to continuously record and tabulate production cost data.

Without production cost data, cow-calf produc-ers will not know if they are a high or low cost operation. They cannot determine what is an acceptable bid price for their calves. They cannot evaluate profitability, nor can they make informed decisions about what pays and what does not. The chances of making correct management decisions is extremely limited if cow-calf producers do not know their cost of production. However, by knowing their production costs and being able to estimate the effect that a change in production costs will have on the pounds of calf production, cow-calf producers will improve their chances of making profitable manage-ment decisions.

Cow-calf producers, just like jet pilots, need to be knowledgeable of current and future conditions. Current and projected cow-calf production costs will provide cow-calf producers with the knowledge and time to make adjustments in their operations in advance of adverse beef market price conditions. Therefore, if producers are looking to improve future cow-calf profitability, they must begin **today** managing their cow-calf **production costs**.

Managing Your Herd's Composition

By
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Management decisions related to the composition of cattle on your rangeland probably impact the long-term profitability of your operation more than any other management decision. This article briefly addresses herd composition issues surrounding 1) the age cows should be culled at and whether they should be replaced or not replaced, 2) merits of fall calving, and 3) the impact of different sale weights and dates on profits.

Determining Optimal Culling Decisions

Range cow culling and replacement decisions are driven by future cow productivity, feed costs, and the current and future market value for replacements, calves, and slaughter cows. As the spread between market prices changes through time optimal culling decisions change. This article looks at how selected culling decisions would have changed from 1971 through 1995 using the culling Decision Support System (DSS) developed by Tronstad and Gum. The DSS calculates whether cows of a given age and pregnancy status should be kept or culled depending on cattle prices. Culling rules generated from this DSS are available for free to everyone with access to the World Wide Web at the address of *http://ag.arizona.edu/AREC/cull/culling.html* (note that the address is case sensitive). Click and point input into the DSS yields a graphic solution on culling recommendations that can aide ranchers making culling decisions. Culling decisions are an important part of managing your herd's composition. These decisions not only determine the age of cows on your ranch but they also have implications for managing herd size.

Management decisions considered in the culling model for each cow of a given age are: 1) Pregnancy test and replace open cows with a bred heifer now. 2) Pregnancy test and cull open cows but don't replace open cows with a bred heifer at this time. 3) Cull and don't replace now. 4) Keep and allow for breeding in six months. 5) Replace with a bred heifer immediately. 6) Keep and allow for breeding immediately. Pregnancy testing at $2/head has value in the first two management decisions but has insufficient economic merit in the last four. If pregnancy testing has value for cows of a given age then it follows that cows which test pregnant (open) should be kept (culled). A decision to cull and not replace (#3) indicates that a cow is getting old (decreased production expected) and market conditions are not conducive to maintaining or building herd size. The decision for cows to be kept and bred immediately or in six months indicates that these cows are most probably pregnant. These decisions just indicate that cows of this age should have the opportunity to be bred now or in six months in case they are open. If calving is feasible in the spring or fall, cows that are open can be productive six months earlier than with only a spring or fall calving season. Allowing for biannual calving is important to the economic viability of keeping open cows. Because the viability of biannual calving is greatly impacted by the cost differential between spring and fall calving, this cost differential is varied when deriving optimal culling recommendations.

The herd will diminish in size whenever a decision to cull and not replace is generated from the DSS. Conversely, the herd can increase in size using the DSS by bringing additional replacements into the herd when cows 13 years of age (maximum age is 13.5 years) are recommended for "replace with a bred heifer" rather than "do not replace at this time." Increasing herd size in this manner is sound provided that production costs are still $100/head per six month feeding period, as assumed in the model. The DSS does not directly evaluate land purchase decisions for expanding herd.

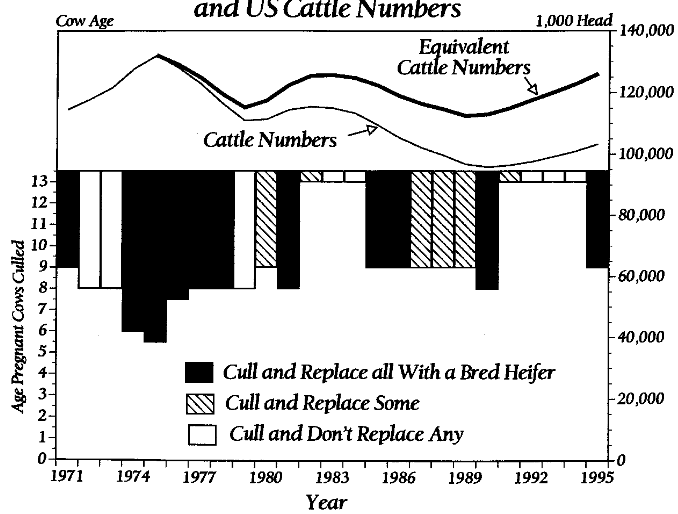
Biological factors included in the DSS model center around cow age and recent fertility. Biological productivity estimates were made from the San Carlos Apache Experimental Research Registered Hereford herd, located about 60 miles east of Globe, AZ. Range conditions are semi-arid with an elevation of approximately 5,000 feet. Estimates of cow and calf weights, plus fertility were made from individual cow records for the years from 1982 to 1989. Fertility encompasses the three basic stages of 1) conception, 2) calving, and 3) survival of calves until weaning. See the article of Range Cow Culling: Herd Performance, at *http://ag.arizona.edu/AREC/cull/culling.html* — biological factors for a more detailed description of the data. Market price relationships and the dynamic programming algorithm are also described in more detail at this web address.

Market prices for replacements, slaughter values and sale calves were considered in the analysis. Uncertainties surrounding future cattle prices complicates the culling decision. Price uncertainties were accounted for in the model by estimating historical price relationships. The model is highly dependent on current price levels, since current prices are a better predictor of where prices will be six months from now than a long-term average price. That is, the model calculates an expected value of returns six months from now utilizing current price levels and historical price movements. The model evaluates culling decisions for the months of May and November. Historical prices show sale calf prices to be lower for November than May, and this is incorporated into the analysis. Current prices and returns are weighted more heavily than distant prices and returns, due to discounting.

Recommended Culling Rules from the DSS

Figure 1 gives a sample of what the recommended culling rules from the DSS would have been from 1971 through 1995. The figure illustrates the recommended culling age and subsequent replace, replace some, or do not replace culled pregnant cows in the fall considering only a spring season calving operation. Decision rules are not directly impacted by an estimated cattle cycle length. But the rules are influenced by the relative values of slaughter cows, bred replacements, and calf prices which fluctuate as the composition and total number of cattle vary.

Figure 1. Culling Age of Pregnant Cows and US Cattle Numbers



Note: Culling Decision Rules for "Spring Only" Calving. Cattle Inventory Numbers from USDA and Cattle-Fax.

Cattle numbers are also given to illustrate how the DSS coincides with a historical build-up or drop off in herd numbers. Equivalent cattle numbers (*Cattle-Fax*) are meant to adjust for heavier carcass weights, a faster "turn over" rate, increased feeder cattle imports, and the movement of dairy steer calves into the fed beef mix. From 1985 to 1995 total cow numbers dropped by 1.44 million head or 3.11 percent. But 93 percent of this decline was from a reduction in the number of dairy cows. Overall, US beef production has increased by 6.3 percent from 1985 to 1995. Average slaughter weights have increased from 656 to 711 lbs. per carcass, an 8.4 percent increase. A faster turnover in fed cattle has also pulled more cattle forward to increase beef supplies. These factors account for the much higher equivalent cattle number for 1995 than actual numbers suggest.

Starting in 1971, the DSS recommends that pregnant cows greater than 9 years of age be culled and replaced with a bred heifer. Then as cattle numbers increase more severe culling is recommended. The DSS indicates that pregnant cows 8 years of age and older should be culled and not replaced. Open cows and cows culled due to physical calamities are also not recommended for replacement when “don’t replace any” occurs. In the fall of 1974, the real value of an 1,100 lb. slaughter cow was only $30 to $35 per head less than bred replacement prices. By the fall of 1975, cattle numbers had increased further and slaughter cow prices were higher than the price for bred replacements. Thus, the DSS recommended that pregnant cows 5.5 years of age and above should be culled. Because prices were relatively low in 1975, even 6 year old cows had a poor chance of fetching a good price for their calves in two to three years or before their productivity would start to decline (conception rate, weaning weight, odds of being culled from physical calamities or dying). A bred heifer brought into the herd at this time will have a better chance at attaining a high price for her calf when she is in her prime.

Cattle numbers were increasing in 1981 and the model indicated that pregnant cows greater than 8 years of age should be culled and replaced with a bred heifer. The rule to replace was driven by the fact that the price of slaughter cows were near or exceeded the cost of a 2.5 year old bred heifer. The following three years were followed by keeping virtually all pregnant cows and not replacing any cows culled. Although cattle numbers were relatively high and prices were generally low, the price of replacements relative to slaughter values were not conducive for replacing pregnant cows with bred heifers. The DSS rarely recommends to replace cows culled when the cost of a replacement is $100/head (1991 dollars) more than their salvage value as a slaughter cow. From 1991 through 1994 the DSS indicates that pregnant cows should not be culled until they are 13 years of age, the maximum age allowed for in the model. During this period replacement prices exceeded the salvage value of most cull cows by at least $120/head.

The DSS is limited in that only the “average” biological performance for an age group is considered. Clearly, some cows raise a superior calf consistently year after year. In order to help identify whether an above or below average performing cow should be culled or maintained in the herd, “cost of mistake” values are available from the DSS. For example, if the DSS indicates that pregnant cows 9 years of age and older should be culled and replaced with a bred heifer, consider the calculated one-period “cost of mistake” for keeping this cow. If the “cost of mistake” is only $5 to $10 per head then it would only make sense to keep an above average performing cow. However, if the “cost of mistake” value is over $50/head, it is very doubtful that even a superior cow will be able to raise a calf that is worth $50 more than an average cow for a given age group. The easiest way to see how simple it is to use the DSS and whether this tool can aide you in making culling decisions is to go to the web address of *http://ag.arizona.edu/AREC/cull/culling.html* (case sensitive address).

Merits of Fall Calving

As previously mentioned, open cows can be made productive six months earlier with biannual calving seasons than only a one season calving period. Thus, fall calving has economic merit for keeping open cows, provided that the cost of fall calving does not greatly exceed that for spring calving. Calving in two different seasons may also improve the demand for peak labor requirements. Income variability will be less selling calves in two different seasons and markets. But the primary reason for considering fall calving is that calf prices are historically higher in the spring than fall. Calf prices in May have exceeded November calf prices in all but 4 out of the last 25 calendar years. From 1971 through 1991, May calf prices averaged $6.96/cwt. more than November prices in 1991 dollars. These are advantages to fall calving but what is the tradeoff between higher production costs in the form of increased feed costs and/or decreased weaning weights?

Figure 2 shows what the long-term composition of a herd would be expected to look like in the fall using culling rules from the DSS and varying the cost fall calving exceeds spring calving (i.e., cost differential) anywhere from $0 to $205 per year. When the cost of fall and spring calving are equal, fall calving makes up almost 80 percent of all cows in order to take advantage of higher spring calf prices. Spring calving still exists to take advantage of biological and market opportunities. Cows that are open and culled due to physical calamities can be productive 6 months earlier and market conditions which favor buying replacements in the fall can be taken advantage of. Although most ranchers raise their own replacements, the economic cost of bringing a replacement into the herd is the foregone market value of what a replacement heifer can be sold for rather than the feed and associated costs of raising a replacement. For this reason, the DSS keys off of the market value of replacements.

Figure 2. Herd Composition in the Fall

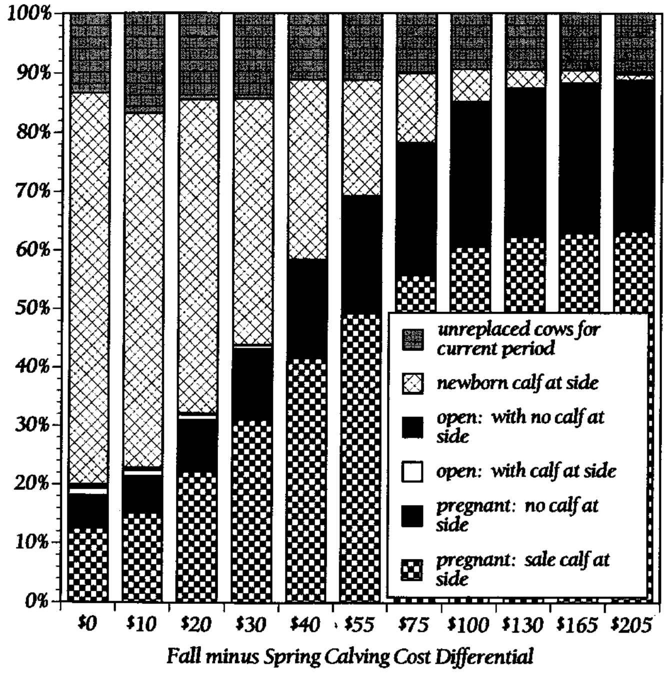
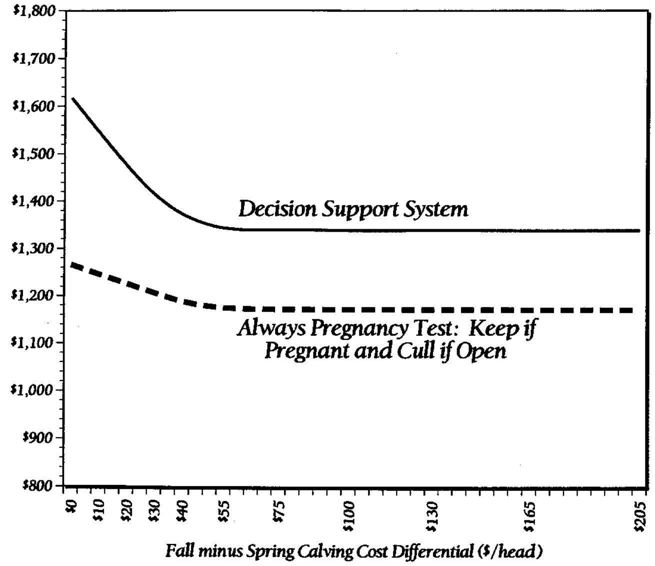


Figure 3. Present Value of Culling Strategies



The DSS indicates that on average about 10 percent of the herd will not be replaced with a bred heifer in the fall. For "cost differentials" that are below $55, many of these "vacancies in the herd" will be replaced with a bred heifer in the spring. But for the calving cost differential of $205, bringing a bred replacement into the herd in the spring is not an economically viable option. If a ranch could support 100 cows, the 10 percent average herd vacancy indicates that a ranch might have 95, 75, 90, 100, and 90 cows in a 5 year period. But it is very important to note that the DSS calculates a reduction in feed and production costs of $100/six months for not carrying these cows. If all feed and associated production costs are fixed then the above ranch would run nearly 100 cows year after year. Keep in mind that production costs are not entirely fixed if forage or future fertility can be carried over from one year to the next.

Figure 3 gives the discounted present value of returns for an average slot in the herd after 20 years. Values portray current and future returns of existing cows plus the future returns of the cows they are replaced by. These present value numbers could be used to evaluate how much one could afford to pay for a ranch (per animal unit) with the cows included, assuming the above production costs of around $100/six months. The strategy of following the DSS is compared in figure 3 to a more traditional strategy of pregnancy testing all cows and culling only those that are open. The later strategy has a fixed annual herd size. Results indicate that the DSS would increase returns by $351 or 28% when fall and spring calving costs are equal. If the cost of fall calving exceeds spring calving by $205 (i.e., spring only calving), the DSS would increase returns by 14% or $168. The DSS generates about twice the percentage increase in returns when biannual calving is viable because more "buy low" and "sell high" opportunities can be capitalized on.

Sale Weight versus Calf Numbers

The tradeoff between sale weight and calf numbers is complicated by the fact that the price spread between light and heavy calves can vary dramatically from year to year. Variability in rainfall and subsequent forage from year to year also complicates the tradeoff between sale weight and calf numbers. To gain some insight into this tradeoff, the profitability of different sale weights and calf numbers from 1980 through 1993 were compared using prices and representative range conditions from Arizona. Target steer calf sale weights of 350, 450, 550, 650, and 750 pounds were compared. For the number of days it took calves to go from 450 to 550, 550 to 650, and 650 to 750 pounds, .5, .6, and .7 AUMs of forage, respectively, were charged for these heavier weaning weights. The charge was made by reducing total cow numbers, which reduces the number of calves available for sale.

Spring and fall calving operations were also compared in the analysis. All sales were either made in mid-May or mid-November. Birth dates for November sales were calculated by using daily gain rates of 1.5 lbs./day for weights from birth to 450 lbs. and 1.75 lbs./day for weights from 450 to 750 lbs. Daily rates of gain were reduced by 10% for May sale dates. Depending on when the calf was born and sold, supplementation varied from 0 lbs. (350 and 450 lb. sales in

November) to 400 lbs. (750 lb. sale weight for May) in order to attain the above rates of daily gain. These average annual supplement costs varied from $0 to $51.28, respectively. The retail cost of a 50% corn meal and 50% cottonseed meal mixture was charged for supplement. Another expense item that varied with different sale date and weight options was the opportunity cost of money. That is, calves sold at 750 lbs. could have been sold at an earlier weight. If a calf had been sold at say 450 lbs., interest could have been earned on this money by placing it in the bank or against an operating loan. Expenses for all other items were the same for all sale weights since cow numbers were reduced appropriately (AUM rate above) to account for heavier calf weights. Details of the analysis are given in Gao.

Figure 4. Relative Return of Strategies

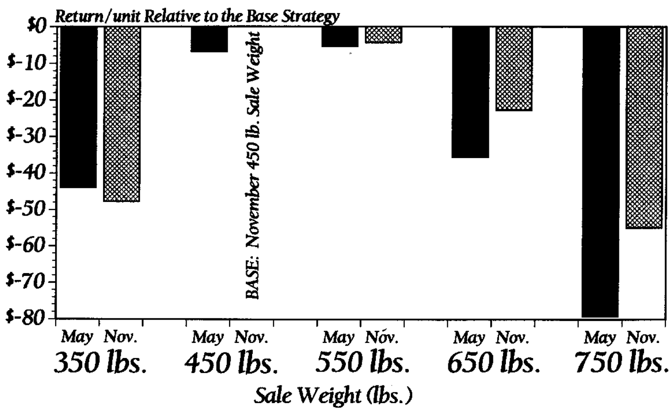


Figure 4 gives the relative average annual return from following the different sale date and weight combinations. November sales of 450 lb. calves generated the highest return under the assumptions outlined above so all other returns are compared to this strategy. Sale weights of 450 and 550 pounds for both May and November sales were at the top and differed by less than $7 per unit. Although the highest average calf price was for light 350 lb. calves, this higher price did not offset the lighter sale weight. As sale weights exceeded 550 lbs., the benefit of higher sale weights was more than offset by a decrease in price and decline in the number of calves and cull cows sold. The difference in return from May sales was anywhere from $1 to $24 per unit less than November sales for the same weight. Under the assumptions made, seasonal differences appear to have less of an impact on profits than sale weights. These results also indicate that heavier sale weights alone are most likely not your answer to increasing ranch profitability or minimizing red ink.

In summary it is important to note that a flexible sale date and weight combination could have easily generated more net return than the "fixed strategies" above. A strategy that would take advantage of market opportunities for buying replacements when they are cheap or feeding calves to a heavier weight when corn prices are high and forage is available would outperform the best "fixed strategy" of always selling 450 lb. calves in November. Staying in tune with market conditions and available resources is key for becoming or maintaining your status as a low cost producer. The days of maintaining the same fixed herd composition year after year and surviving as a cow-calf operation may be gone.

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Managing for
Today's Cattle Market
and Beyond

March 2002

The Costs of Raising Replacement Heifers and the Value of a Purchased Versus Raised Replacement

By
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Numerous sheets of notebook paper have been trashed, considerable barnyard door space has been used, and many brain cells have been drained by ranchers, bankers and agricultural economists in an attempt to determine the cost (or value) of a replacement heifer. On the surface, it appears rather straight forward to determine this value: assign a dollar value to a weaned heifer calf; calculate the winter feeding costs and the summer grazing and breeding costs; add these together and the total is the cost of the replacement heifer. However, this is only the beginning; a very basic starting point. Adjustments must be made to the cost of the replacement heifer when one realizes that varying the replacement rate changes the number of calves and cull cows available to sell. Production from a replacement heifer (calf weaning weights and percent calf crop weaned) is typically less than that of a mature cow and the management of the replacement heifer will effect her level of production. Is it possible to adjust the value of the heifer to account for these issues? What about the type of bull used on the heifer, the amount of calving problems, and the subsequent reproduction of the second calf heifer?

As one begins to account for the above mentioned factors, the cost of the raised replacement heifer generally increases. In addition one finds many different opinions as to what that cost actually is. This adds fuel to the age old debate of rather it is better to raise your own replacement heifers or buy bred replacements from others.

There probably isn't one best answer for all producers all of the time. The correct decision for each individual rancher will depend upon their own costs, management practices, and the current and expected market prices for calves, replacement heifers and cows. Cattle type should also be considered as some types of cattle are well suited for the slaughter market but have poor maternal traits.

The intent of this paper is to evaluate the economics of various heifer management practices by accounting for the biological production realities associated with the cow herd, and particularly the replacement heifer. Once the appropriate costs of a replacement heifer are established, the raising versus purchasing decision can be analyzed.

Realities of Herd Replacements

The first issue that needs to be addressed is the actual replacement rate needed to maintain the cow herd. It is not uncommon to hear of replacement rates varying from 10% to 30%. Many individuals probably underestimate the actual number of replacements required when they are preparing budgets. Over the long term, an average replacement rate of 15% to 25% is probably required for most herds.

The size of the cow herd, the resources available, and the degree of management will all affect the required replacement rate. Table 1 contains a sensitivity analysis when the expected death loss and conception percentages are changed. For example, with only an 84% conception rate and a 3% annual death loss, a 28.3% replacement rate is required. A replacement level that high would require more than 50% of the heifer calves to be kept as replacements. However, with improved management (94% conception rate and 1% death loss) only a 15.5% replacement rate is required. Clearly, management aimed at increasing the overall herd conception rate, could have some positive effects on ranch returns. The first place to start improving herd conception rates is with replacement heifers.

Table 1. Sensitivity Analysis -- Weaned Replacement Heifers Needed as a Percent of the Number of Cows to Calve.

Death Loss	Conception Rate Percentage					
	84%	86%	88%	90%	92%	94%
1.0%	25.9	23.5	21.2	19.1	17.2	15.5
2.0%	27.1	24.5	22.2	20.0	18.1	16.3
3.0%	28.3	25.7	23.3	21.0	19.0	17.1

Heifer Management Options

Having determined the number of replacements required, one can begin to look at alternative strategies for raising replacement heifers. A very crucial factor in determining the average cow herd conception rate is the management of the replacement heifer. Research consistently has shown that management of the replacement heifer as a yearling not only effects reproductive performance as a 1st calf heifer, but also has an effect on subsequent reproductive performance as a 3 and 4 year old cow. A heifer that has adequate size, is bred early in the season, and doesn't have major calving problems is likely to breed back earlier and consistently wean a heavier than average calf. On the other hand, a heifer that has not had adequate growth likely will conceive later, experience greater calving difficulty, and have a greater tendency to be late re-breeding or be open.

At what age or at what size will a heifer reach puberty and be ready to breed? Research has shown that size is more important than age, and that size needs to be a relative measure. English breeds will reach puberty at lighter weights than will larger continental breeds. Animal scientists generally recommend that a heifer be at 65% of mature cow weight prior to the breeding season. To reach this objective the heifer probably will need to be fed to gain at least one pound per day through the winter. Lower rates of gain can decrease substantially the reproductive potential of the heifer.

Four different heifer management programs were analyzed by varying the average daily gain through the first winter to arrive at various prebreeding target weights. The daily gains and the performance of these heifers are contained in Table 2. The beginning weight of the heifers is assumed to be 500 pounds and the normal mature cow weight is 1175 pounds. A six month winter feeding period also is assumed and allowance is made for compensatory gains in the summer for animals gaining less through the winter.

It is apparent from the data in Table 2 that both the conception rate of yearling heifers and their subsequent conception rate after their first calf are effected by the prebreeding target weight. The weight of the first weaned calf also is effected by the size of the heifer. One can also notice

Table 2. Four Different Replacement Heifer Management Programs and the Subsequent Productivity of the Replacement Heifers (Based on an 1175 Lb Mature Cow Weight and a 180 Day Winter Feeding Period).

		Program			
Date	Description	I	II	III	IV
01-Nov	Initial wight	500	500	500	500
	ADG winter feeding period	0.55	0.90	1.25	1.63
01-May	Weight going onto grass	600	663	726	795
	ADG 1st month on grass	1.50	1.35	1.20	0.90
01-Jun	Weight prior to first breeding	646	705	763	823
	Percent of mature weight	55%	60%	65%	70%
	ADG summer and fall grazing	1.30	1.10	0.90	0.70
01-Nov	Bred replacement heifer weight	845	873	901	930
	Percent pregnant	84%	91%	93%	89%
	ADG 2nd winter	0.95	0.95	0.95	0.95
01-Mar	Pre-calving weight	959	987	1015	1044
	Post-calving weight	829	857	885	914
	ADG Mar1 - Nov 1	0.75	0.75	0.75	0.75
01-Nov	Weight of first weaned calf	445	460	475	485
	Bred 2nd calf cow weight	1013	1041	1069	1098
	Percent pregnant	86%	92%	94%	92%

that the advantages, in terms of productivity, are quite small or negative in going from program III to IV. This suggests that there may not be much advantage to feeding heifers to reach prebreeding weights in excess of 65% of the mature weight.

Cost of Raising Replacements Heifers

By looking at the economics of these four different programs, i.e. the costs and the returns, one can gain additional insight into the overall replacement heifer enterprise. Table 3 contains 1999 level prices for cattle and feed used in evaluating the economics of the various heifer management programs.

A 63 day breeding season is assumed and yearling heifers are bred one month earlier than mature cows. All open heifers and cows are assumed to be sold. Based on these assumptions, replacement heifer budgets were developed for each of the four different management programs. The results are displayed in Table 4.

Table 3. Livestock Weights and Prices and Feed Costs Used to Evaluate the Alternative Replacement Heifer Management Strategies.

Item		Price/Cost
Steer calf	540 lbs	$ 92.00 per cwt.
Heifer calf	500 lbs	87.50 per cwt.
Yearling heifer	845-930 lbs	75.00 per cwt.
Cull two yr. cow	1013-1098 lbs	47.00 per cwt.
Cull cow	1100 lbs	33.00 per cwt.
Grass hay	11.0% CP	50.00 per ton
Alfalfa-grass hay	15.0% CP	60.00 per ton
Alfalfa hay	17.0% CP	70.00 per ton
Corn grain		$2.00 per bu.
Soybean meal		160.00 per ton
Summer pasture		16.00 per AUM
Fall pasture		10.00 per AUM

Least-cost winter feed rations were developed that satisfied the nutritional requirements for the various rates of gain presented in Table 2. Summer range was valued at $16 per animal-unit-month (AUM) and the weight of the yearling heifers were considered when accounting for the required number of AUM's. Other variable expenses included such items as: veterinary, supplies, breeding, machinery costs, etc.. Interest was charged on the value of the animal and half the value of the variable expenses and feed costs. The fixed costs include insurance and depreciation on livestock buildings and equipment. The value of the heifers culled and sold is subtracted from the total costs to arrive at the net cost value. Since it takes more than one heifer calf to end up with one bred heifer (due to death loss and culls) the net cost figure is adjusted to show the total cost of getting one bred yearling heifer (Table 4)[1]. This number represents what one could afford to pay to obtain one bred heifer and just break-even with the cost of raising the bred heifer. Also, selling surplus bred heifers for more than this amount would be net profit.

Table 4. The Total Direct and Indirect Costs of Raising Replacement Heifers Under Four Different Management Practices (Weaned Heifer Through 31 Months).

	Program			
Description	I	II	III	IV
Opportunity cost of the heifer	$438	$438	$438	$438
Feed costs: Winter	80	87	96	107
Summer	77	80	84	87
Aftermath	10	10	10	10
Other variable expenses	60	60	60	60
Interest @ 10%	55	56	56	57
Fixed expenses	15	15	15	15
Total 1st year's costs	735	746	759	774
Less: value of cull heifers	113	72	63	89
Net 1st year's costs	622	674	696	685
Net cost for 1 bred yearling heifer adjusted for death loss and culls	$776	$775	$785	$804
Cost of a bred heifer	$776	$775	$785	$804
Feed costs: Winter	120	123	125	127
Summer	96	96	96	96
Aftermath	10	10	10	10
Other variable expenses	70	70	70	70
Interest @ 10%	92	92	94	96
Fixed expenses	26	26	26	26
Total 1st & 2nd year's costs	1190	1192	1206	1229
Less: value of cull 2 year old cows	89	57	46	59
value of weaned calf	359	380	396	409
Net 1st & 2nd year's costs	742	755	764	761
Net cost for 1 bred 2 year old cow adjusted for death loss and culls	$888	$846	$838	$852

It should be noted that through this stage of the analysis the cheapest program is to feed the heifers to reach only 60 percent of mature weight at breeding. Unfortunately, many analyses of replacement heifers stop here and recommend program I or II. But, the next year of the replacement heifers life is very important in determining her true value to the cow herd.

The feed cost, variable expenses, interest, and fixed expenses are almost identical under each of the four management alternatives through the second year of the replacement heifers life. The total 2nd years costs include the value of the bred replacement heifer at the start of the second year. The next section of Table 5 is very critical to accurately valuing the replacement heifer. Sales of cull 2 year old heifers are considerably larger under programs I, due to a greater number of heifers being open after a 63 day breeding season. However, due to lower calf weights, the value of calves sold from heifers kept under programs I and II is less. The net costs still appear to favor program I. However, the net cost must be adjusted to obtain the cost of having one bred 2 year old cow (accounting for death loss and cull 2 year old sales)[2]. Then, the bottom line value shows it is optimal to feed the replacement heifers under program III, to reach 65 percent of mature weight prior to breeding.

Purchasing versus Raising

Once the cost of raising a replacement heifer from a weaned calf to a bred yearling heifer and to a bred 2 year old cow has been determined, one can begin to evaluate the decision of raising versus purchasing replacements. The decision to raise replacements or buy bred yearling heifers would appear to be relatively straight forward to evaluate. One simply compares the cost of buying bred yearling heifers with the adjusted cost of raising one bred yearling heifer in Table 4. If feed costs and other marketable resources were valued at their market value, and if the same number of cows are being run, then one could pay the same amount as the adjusted raised cost and just break-even. However, purchases of bred yearlings do not need to occur in November. Based on the variable costs in Table 4, each additional month should be worth about $30 more per head.

There is another possibility also to consider: if the replacements were purchased, rather than raised, additional resources would be available on the ranch. This is apparent by looking at animal units (AU) compared to cow units. If one doesn't include horses and bulls in the calculation, then raising replacement heifers requires about 1.15 AU's for each cow expected to calve. So if a ranch had the resources to calve out 100 cows plus raise the replacements, it would be able to calve out 115 cows if the replacements were purchased. These additional resources could be used to retain calves and sell them as yearlings or run additional cows on the ranch. The amount of profit from the retained calves or additional cows would then increase the value of a purchased bred heifer compared to the cost of raising the bred heifer.

The general level of livestock prices and feed costs were varied to determine what effect these variables would have on the cost of raising replacement heifers. Varying cattle prices and feed costs also effects the profitability of running beef cows, which changes the value of the additional resources available when replacements are purchased. The cost of raising replacement heifers under program III and the break-even purchase price for bred yearling heifers are displayed in Table 5. The top number in each cell is the cost of raising a bred yearling heifer and the bottom number is the break-even value for a purchased bred heifer in November.

Table 5. The Cost of Raising Bred Yearling Heifers and the Break-even Value for Purchased Bred Heifers Under Various Cattle Prices and Feed Costs.

General Level of Feed Costs	General Level of Cattle Prices		
	10% Lower	Expected	10% Higher
10% Lower	$715[a/] $787[b/]	$762 $828	$810 $870
Expected	$737* $820*	$785 $862	$832 $903
10% Higher	$760* $853*	$807 $895	$855 $937

[a/] The cost of raising a bred yearling heifer.
[b/] The break-even value for a purchased bred heifer in November.
* At these prices, the replacement heifer is not profitable.

As one would expect, the cost of raising a bred yearling heifer increases with increasing feed costs and increasing cattle prices. Changing feed costs and cattle prices also effect the purchase break-even price. Depending upon the price scenario, the break-even purchase value for a bred heifer is about $50 to $100 higher than the cost of raising the heifer. This assumes that the additional resources are used to run 15% more cows.

There are also a couple of other considerations in this decision. What is the breeding of the raised heifers versus the purchased heifers? How will this breeding effect their subsequent performance in the cow herd? Another vary important question is knowing the management program of the purchased heifers, because, as this analysis has shown, that will greatly effect their subsequent performance and their value. The numbers contained in Table 5 assume the purchased heifers are bred and raised similar to the raised heifers and that the additional resources are used to run additional cows.

Summary

Selection and development of cow herd replacements is extremely important to the overall management of the cow herd. A decision on replacements this fall will have an impact on the profitability of the cow herd for at least the next 10 years. When one considers keeping offspring of current replacements for future replacements, then herd profitability will be altered further into the future.

The first step in evaluating replacement strategies is to first identify the level of replacements required to maintain desired herd size. The replacement rate may vary from 15% to 25% depending upon herd management. The next step is to carefully evaluate the heifer management plan and attempt to identify all direct and indirect costs associated with that plan. To correctly evaluate all costs and returns associated with raising replacement heifers analysis must be done beyond first conception. Calving, re-breeding, and size of the first weaned calf are all important considerations. Adequate feed and management must be provided to reach higher production goals. This research, along with the recommendations of many animal scientists, suggests that a replacement heifer needs to be at 65% of mature weight prior to first breeding. Only after all costs of raising replacements have been accounted for can one analyze the current market conditions and look at purchasing versus raising replacements.

If replacements are purchased rather than raised fewer resources will be required to calve the same number of cows. The assumption regarding the use or sale of the additional resources effects the break-even value for purchased replacements. Time of purchase, level of calf and cull cow prices, and feed costs all effect the break-even value for purchased replacements.

The livestock prices and feed costs presented in this analysis are used only for example purpose. They may not be very representative of your particular operation and market area. However, by following a similar budgeting approach, you should be able to identify your costs of raising bred heifers and bred two year old cows. In general, you could probably pay $50 - $100 more for a bred heifer, than your cost of raising the heifer.

Genetic quality differences will be important in determining the price, but were not analyzed in this paper. Producers wanting to change the type of cattle in their herd, can do this more rapidly through purchasing replacements. However, this may also add more variability into their herd, and increase the incidence of sickness or disease.

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[1] Net cost = Net 1st year's cost ÷ (1 - percentage culled and died)

[2] Net Cost = Net 1st & 2nd year's cost ÷ (1 - percentage culled and died)

Managing for Today's Cattle Market and Beyond

March 2002

Leasing Arrangements for Cattle

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Introduction

Agriculturalists have long used leasing arrangements as a means of farming or ranching with more than owned resources. Most commonly, land has been leased, but other resources can be acquired in a similar manner. Beef cows are leased between parties on either a cash or share of calf crop basis, but share leases seem to be predominant. Bulls, when not part of a cow share agreement, are primarily leased for cash.

Leasing arrangements may be considered in several situations. Producers can use leases, calf share in particular, to transfer ownership of cows to others over time with possibly less income tax consequences compared to an outright sale. Individuals who are forced to liquidate cowherds may use leases as a means for re-establishing a herd without needing to borrow money for capital purchase. Producers who wish to establish new or expand existing cowherds could examine leasing as an alternative to raising or purchasing cows.

Lease or Own Cows and Bulls?

The decision whether to own or lease cows and bulls involves several factors in addition to cost comparison. Cost comparisons for an operator deciding whether to own (by purchasing or raising) or to lease, can usually ignore all costs for the cows except ownership and lease costs, provided that the cows to be leased are of similar size and quality to those to be raised or purchased. Comparing costs of raising cattle to leasing requires estimating the cost to raise a replacement heifer/bull to breeding, calving or other age depending on when she/he would enter the herd. Depending on feed costs and replacement purchase prices, raised replacements may cost more or less than purchased replacements.

Cost Comparison

To compare the costs of owning or leasing a cow, complete these three steps: 1) estimate ownership costs per year for purchased or raised cattle, 2) estimate bull ownership cost per year on a per cow basis, and 3) compare the ownership costs of the cow (including bull if appropriate) with the lease cost. Detail for each of these steps follows.

Step 1. Estimate ownership costs per year for purchased or raised cows or bulls.

a. **Economic depreciation (D)** is an expense claimed by the owner of a capital asset to compensate for the asset wearing out over some limited useful life. Economic depreciation may differ from depreciation taken for tax purposes, as depreciation allowed by the Internal Revenue Service may differ from values used for management purposes. Any discussion of depreciation in the remainder of this article refers to economic depreciation. Depreciation estimated as part of cattle ownership costs is the difference between beginning value (BV) and ending (may be cull) value (CV) divided by expected years in herd (YH) or (BV-CV)/YH. For example, an $800 heifer with an expected cull value of $400 at the end of 8 years would have annual depreciation of $50 [($800 - $400) /8]. A $2000 bull with an $800 cull value and 4 years in the herd would have annual depreciation cost of $300. This method of calculating depreciation uses the standard economic approach, straight-line depreciation.

b. **Interest on investment (I)** is usually an opportunity cost on funds tied up in cow or bull ownership. Interest on investment in a cow or bull is the interest rate times the average value of the animal i.e. r x ((BV + CV)/2). In our example suppose we use 8 percent interest rate then I = r x ((BV + CV)/2 or 0.08 x $600 = $48.00/year for the cow and 0.08 x $1400 = $112/year for the bull.

c. **Death loss (DL)** is another cost of cow ownership. Death loss should be calculated on average value. If we estimate a 1 percent death loss then the cost for our example is $6/year for the cow [($800 + $400)/2 x 0.01] and $14/year for the bull [($2000 + $800)/2 x 0.01].

d. **Property tax (PT)** may be assessed against cow and bull values in some states. In such cases these taxes should be added to the ownership cost. For our example assume PT = 0.

e. **Total ownership costs (TO) = D + I + DL + PT** or in the example, $50 + $48 + $6 + 0 = $104/year for the cow. The annual ownership cost for the bull would be $300 + $112+ $14 + 0 = $426. Higher cow or bull values or interest rates or a shorter depreciation period will increase the cow and bull ownership costs.

Step 2. Estimate bull ownership costs per year per cow.

This is estimated by dividing the bull TO by female-to-bull ratio (number of heifers and cows per bull) for example $426/30 = $14.20/cow.

Step 3. Compare the cost of owning the cow with the cost of leasing a cow.

In situations where the bull is provided as part of the lease, add the bull ownership cost per cow to the ownership cost of the cow for comparison.

a. **Cash leases** for cows or bulls (discussed later) are the easiest to compare to owning. In our example, we would compare the cash lease to $104/cow without bulls or $118.20/cow ($104 + $14.20) if bulls were provided. If the cash lease exceeds the $118.20 then we would be ahead to purchase the cows and appropriate number of bulls. However, our cash flow may not permit purchase and our lender may not be willing to loan us the amount to buy cows or bulls. In such a case, the lender may not approve a cash lease either because it would require a cash payment for use of the cows and bulls.

The conditions of the cash lease are important to the comparison. If the cow owner stands death loss and is willing to replace infirm and open cows for reasonable reasons, then the comparison can be made straight forward and as described above. If, however, the cow owner expects payment for any death loss, then the amount of rental payment should be reduced by estimated death loss. If replacing open or infirm cows is the responsibility of the lessee, then those replacement costs will be borne by the lessee. The cash lease cost should be negotiated down depending on what is a reasonable expectation for replacement of open or infirm animals. Remember, the straight cash lease does not change during the year if prices go up or down. If calf prices go up the lessee is the primary beneficiary and the cow owner will not gain. On the other hand, if prices fall the cow owner is protected and the lessee will carry the burden of all reduced gross value of sales. In other words, production and price risk usually fall solely to the lessee with a cash lease.

b. **Share leases** may be a way to obtain the use of capital in the form of cows and/or bulls in situations where cash or credit is limited. These leases also permit the sharing of risk between the lessee and lessor. Just which risks are shared depends on how the lease is written. Comparing ownership to share leasing is more difficult than comparing to cash leasing. In most share lease arrangements the cows and bulls are furnished for a share of the calf crop. While all leases depend on negotiation between both parties, equitable lease arrangements usually share revenues in the same proportion as each party contributes to costs. For example, if the cow owner costs, as calculated above, were 30 percent of the total cost of production, she/he would receive 30 percent of shared revenue. A remaining issue is to determine what revenue is shared. Livestock leases will typically contain revenue from production (calf crop) and revenue from capital asset sales (cull cows and bulls). Both parties, as per the lease agreement, share revenue from production. As a general rule, the income from cull cows and bulls is not shared, however, there are exceptions to this rule. These difficulties are discussed in a later section on Cow-Share Leases which follows.

Unlike cash leases, the cost of a share lease (value of the calves shared with cow owner) will change if the market goes up or down and if productivity of the cowherd changes. After determining cow ownership cost, the producer wishing to lease cows on a share basis must estimate the cost of leasing in terms that can be compared to costs of owning. To make this comparison for share leased cattle, requires estimation of calf weaning weights, weaned price, and number of weaned calves for the cows leased. Suppose weaned calves (males and females) are expected to average 450 pounds and bring $90/cwt. Due to open cows and calf losses the producer expects to wean 88 calves per 100 cows leased. The expected cost per cow leased is the share payment to the cow owner (assume 30 percent of calf crop for the example) times the net per cow leased. In the example, the net revenue per cow is 4.5 cwt. x $90/cwt. x 0.88 = $356.40. The cost per cow leased is $356.40 x 0.30 = $106.92 which is to be compared to the cost of owning the cow of $104 without a bull and $118.20 with bulls. The cow owner is sharing production and price risk with the lessee. That is, if production or calf price is below expectations, the rent goes down and if higher the rent goes up. In our example, it would cost more to lease the cows and bulls on this 30 percent to the cow-owner share lease than to own them based on comparing economic costs. If risk sharing is important and dollars to pay for purchasing or raising the cows are limited, then the producer still might decide on the share-lease.

Other considerations

Relative costs are important, but they are not the only consideration. Productivity and quality of the leased versus owned cattle should also be considered. Producers who have improved the genetic base of their herd may be reluctant to bring in leased cattle unless they can be assured the quality is similar. It is important to know as much as possible about the quality of leased cattle. One way of helping control quality is for the lessee to continue to provide his or her own bulls or AI service.

Income tax impacts (and in some states property taxes) may also be important. There may be income tax advantages to leasing or owning cattle depending on the producer’s particular situation. We recommend that before entering into either a cash or share lease for cattle that producers discuss the tax implications with their tax advisers.

If property tax is charged on the cattle, that expense should be added to the ownership costs discussed above. If the producer chooses to own the cattle, then she/he will pay the property tax whereas if leased, the cow-owner will pay the tax.

If the share lease arrangement compares favorably to ownership costs it is probably equitable; however, testing a lease arrangement for equity will help both parties be more comfortable with the arrangement. A lease that strongly favors one party over the other is not likely to last in the long run. In the long run all parties should have the opportunity to profit from the lease; otherwise, it will lead to dissolution of the agreement.

Cow-Share Lease

Even if the cow-share lease turns out to compete economically with owning cows, producers should consider other points. Those who enter such agreements must realize that they are giving up some degree of control plus management now might be shared.

What is equitable or fair?

Fairness is in the eyes of the "beholder." What may appear fair to one may not to another. The agreement must be fair in the eyes of **all** those agreeing to its terms if they are going to continue to do business together. While we may not be able to determine fairness, we can estimate the equity of an arrangement. If an agreement is equitable, it may be considered fair to the parties involved.

The common arrangement in an area is one way of judging equity. A survey of Nebraska Sandhills ranchers (Clark and Coady) found that the typical cow owner received between 30 to 40 percent of the calf crop. The cow owner usually furnished the bulls and replacement females. The rancher (lessee) provided the feed, labor, most management, and veterinary expenses.

Common, however, does not necessarily mean equitable. As indicated earlier, an equitable share arrangement from an economic standpoint, is one in which returns are shared proportionally to the cost contributions of each party. In other words, if one party provides 35 percent of the cost of production, then that party should get 35 percent of the output. This method works reasonably well if risks associated with the agreement are ignored. Production and price risks of calves are usually shared; however, the cow owner usually bears price and death loss risks for cows unless the share agreement is updated when major changes in cattle values occur.

Determining relative cost contributions

The procedure for determining relative contributions of the contracting parties seems quite simple, but that can be misleading. The costs contributed by each party are added and then divided by the **total** costs. Determining the appropriate cost for various inputs is the more difficult part. For example, what is the value of a cow? The cow owner and lessee may or may not agree, but it is an important number for determining the cow owner's contribution. The rate of return the cow owner should receive is also an important determinant of the owner's costs and could be a point for discussion. The evaluation of the contributions by the lessee is also critical. Some resources, especially labor, can easily be double counted. Inputs such as hay and grazing should be valued at their opportunity cost. When this is done the contribution of labor and land is already valued so labor for hay harvesting, for example, should not be counted again.

The terms of the lease affect how cost contributions are to be calculated. A full discussion of all possible factors that can affect a lease is beyond the scope of this paper. Leasing arrangements vary widely and one method for estimating some of these costs cannot be used across all possible lease arrangements. Two important issues are how economic depreciation (rather than tax depreciation) and interest (opportunity cost) are estimated and allocated between lessee and lessor. The lessee and lessor should carefully consider the conditions of their lease and make sure both parties use appropriate costs. General procedures that can be used to help estimate the more important and difficult costs are outlined below.

Breeding livestock are capital assets. However, while an individual cow wears out over its useful life, a **breeding herd** that is maintained through annual culling and replacements does not, assuming constant valuation of the same quantity/quality of breeding animals. At the end of the lease, the cow owner may get the capital asset (breeding herd) back in the same condition as at the beginning of the lease. Whether or not depreciation should be allowed as a cost of the cow owner in lease negotiations and for determining lease equity depends on the terms of the lease. The lease arrangement also affects the calculation of interest on investment and death loss when evaluating the equity of a share lease. We previously described calculating investment return and death loss for comparing ownership to a lease. Interest on investment for estimating equitable share leases may be calculated differently in some situations. To illustrate, three lease scenarios and their implications for depreciation and interest on investment, are discussed below. The mechanics of calculating depreciation are the same as already discussed.

Scenario 1. The quantity and quality of the cattle herd is maintained over time through timely insertions of replacements. The lease arrangement specifies that the cattle owner is financially responsible for providing those replacement cattle. All calves are sold or divided between the parties each year at weaning. Since the lease requires the cow owner to maintain herd quantity/quality, economic depreciation can be used to estimate that cost. Because the quantity/quality of the herd is being maintained, interest on investment and death loss should be calculated using the beginning value, not the average value (see Table 1). Replacements can either be raised (calves and development costs need to be provided by lessor) or purchased from outside the herd. This is one of the more common lease arrangements.

Scenario 2. The quantity and quality of the **leased** cattle herd is **not** maintained over time. The lease specifies that no replacement heifers are kept from the calf crop or provided by the cow owner. The number of cattle covered by the lease will thus decline over time as animals are culled from the herd. This type of lease may be suitable for a relatively short-term lease with predominately young breeding animals. It also may be used to transfer ownership of the herd over some specific amount of time to the lessee who does supply the replacements. The lessee's supplied replacements then fall outside the lease agreement and are no longer relevant to the calculations for determining appropriate shares for the remaining cattle covered by the lease. The cow owner in this arrangement incurs an expense for the asset wearing out over the period of the lease. In this instance, the cattle owner is credited with depreciation as an expense on the cattle covered by the lease. Interest on investment and death loss are based on the average value of the herd since it is declining in quality (Table 1).

Table 1. Cattle-share lease scenarios and treatment of depreciation, return on investment and death loss.

Scenario ==>	**1**	**2**	**3**
Cowherd size, quality maintenance	Maintained over time through replacements added to herd [a]	Not maintained over time (number of cows and herd size decreases as aged cows are culled) [b]	Maintained over time through raised replacements from herd
Income from calves	Income from all calves is shared [c]	Income from all calves is shared	Income from all calves sold is shared (i.e., excludes replacement heifers)
Income from cull cattle to:	Cow owner	Cow owner	Shared
Cow replacement allowance (depreciation)	$\frac{(BV-CV)}{YH}$	$\frac{(BV-CV)}{YH}$	Not applicable
Credit depreciation to:	Cow owner	Cow owner	Neither party
Interest on investment	BV x r	[(BV+CV)/2] x r	BV x r
Death losses to cow owner	BV x DL	[(BV+CV)/2] x DL	BV x DL
Property tax	If appropriate	If appropriate	If appropriate

[a] Replacements can either be raised or purchased from outside of the herd, however, in both cases they are the financial responsibility of the cow owner.
[b] This type of lease is typically used when the ownership of the cowherd is being transferred from one party to another. Replacements that are added to the herd are the responsibility of the lessee and thus are not included in the lease.
[c] If replacements are held back from raised heifers, the cow owner needs to purchase the lessee's "share" of any heifers retained.

Scenario 3. The quantity and quality of the cattle herd is maintained by retaining replacements from the annual calf crop. Ownership of the entire breeding herd remains with the cow owner who will receive the herd back at the end of the lease in the same condition as the beginning. The owner may not incur any annual expense for developing the replacements. If the lessee pays all heifer development costs then the lessee's share of the total costs will be increased compared to the other two scenarios and the lessee would receive a larger share of calves or revenue. There will, however, be fewer calves shared since replacements are retained. Because herd quality and quantity are being maintained from within the herd, depreciation should not be used as a cost to either party. Cull income, however, should be shared to help compensate both parties for the reduction in total calves available for sale. Interest on investment and death loss should be estimated from the beginning herd value since it is being maintained (Table1). This type of lease is cumbersome to set up and to evaluate for equity. We recommend that it not be used if possible.

This brief discussion is only to alert readers that cost calculations for a lease will vary a great deal. Table 1 summarizes the key points of these three scenarios. See references at the end of this article for a more detailed discussion of the process of valuing inputs and testing the equity of the agreement.

Cash Leases for Bulls

Cost comparisons

Bulls may be leased separately from cows and, when this occurs, they are usually leased on a cash basis. A producer should compare the bull ownership costs as described above with the cash rental rate for the bulls. In addition, quality and health factors should be considered.

One major difference between bulls leased as part of a cow or calf share arrangement and bulls leased outright for cash pertains to the length of time for which a bull must be cared. Bulls leased for cash are usually on the lessee's premises for only the length of the breeding season. This arrangement reduces the feed and care costs of the bull compared to owning the bull. The reduced feed and care costs should be estimated and used to reduce the lease cost when comparing to ownership. For example, if the bull is not around during the winter in the northern parts of the U.S., no hay or protein supplement will be needed so costs could be reduced easily by $100 per bull per year just through reduced feed.

The bull owner often replaces cash leased bulls if a bull is injured, dies or becomes unacceptable for some other reason. If the lessor has adequate bulls of the needed breed and quality, this type of replacement guarantee can be an important advantage. There may be tax advantages to leasing bulls so producers should consult their tax adviser.

Other considerations

Adding only virgin bulls to the bull battery for the cowherd is the safest from a health standpoint. When leasing bulls, this may not always be an option. Virgin bulls minimize the risk of introducing venereal diseases into the herd. The two common venereal diseases (spread by breeding) are vibriosis (campylobacteriosis) and trichomoniasis (trich). These diseases can reduce pregnancy rates by 20-30 percent and result in many late bred and open cows. Bulls four years old and older can become chronically infected with trich but it can also be found in younger bulls. Detecting trich is expensive and requires up to three tests of bulls per year to be assured they are not carriers. Vibriosis and other diseases can be controlled with a good vaccination program for both cows and bulls. Breeding soundness is another consideration. A bull breeding soundness examination should be done yearly, 1 to 2 months prior to the breeding season. The bull owner or leasing firm should provide this exam. The best advice is to discuss bull leasing with your veterinarian. He or she can contact the veterinarian in charge of the herd health of the bull owner or leasing firm to evaluate the herd health program and help you consider the pros and cons of bull leasing for your cowherd.

While health and economic issues are keys to the lease decision, other important questions should be considered. Are EPDs available for the leased bulls? Can you pick the bulls? Are appropriate breeds available year after year to match your breeding program?

Summary

The decision as to whether to own or lease cattle requires estimating ownership and lease costs. Determining cash lease costs is reasonably straightforward. While cash leases are appealing because of their simplicity, they may involve considerable risk for the lessee. This is because rental payments are fixed regardless of production and price levels. Cash leases are not common for beef cowherds; however, they are the most common type of lease for bulls. Comparing ownership costs to share lease costs also is not extremely difficult if the terms of the share lease are known. Determining whether or not the share lease is equitable, however, is much more difficult and requires attention to lease conditions. While estimating the equitable terms for share leases is more complicated than cash leases, share leases provide a means for the cow owner and the producer to share production and price risks. Share leases have generally been the most common type of arrangement for beef cowherds.

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