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Economics of Young Female Management

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INTRODUCTION

What is the value of a heifer calf, a bred heifer, or a re-bred 2nd calf cow? How does that value compare to the current market price? What is your cost of raising a heifer calf, bred heifer, or re-bred 2nd calf cow? How many pencils have been worn dull or how many spreadsheets have been created to answer these questions? The unrealistic objective of this paper is to answer these questions. Perhaps a more realistic objective is to answer some of these questions and to provide you the framework to answer some of the questions for your own operation.

One approach to determine value is to simply consider the market price for the heifer. However, this is only the true value if you actually sell the heifer. If you keep the heifer, then her true value is based on her future production, your annual costs to keep her, and the future market prices for calves and for a cull cow when the heifer is ultimately sold. When one considers these factors and how variable they are from year-to-year, from ranch-to-ranch and from heifer-to-heifer there is no single value that will be correct. However, there are some correct principles to determine these values for individual operations.

Replacement heifer management from weaning of the heifer calf, to breeding, to calving and to re-breeding can greatly impact the future productivity of a heifer and therefore impact the value of the heifer. There may also be significant differences in costs associated with alternative heifer management programs. Four alternative heifer management programs will be briefly considered, primarily to illustrate a method of determining costs. A method of determining expected value will also be presented. The last section of the paper will present a historical comparison of the cost, value, and market price of a replacement heifer.

HEIFER MANAGEMENT OPTIONS

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 (Fox, Sniffen and O'Connor). 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 1. 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.

Table 1. 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).

Date	Description	Program			
		I	II	III	IV
01-Nov	Initial weight	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 1 st 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 ^a	84%	91%	93%	89%
	ADG 2 nd 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 2 nd calf cow weight	1013	1041	1069	1098
	Percent pregnant ^a	86%	92%	94%	92%

^a Conception rates based on data from Fleck et.al., Lemenager et.al., and Paterson et.al.

It is apparent from the data in Table 1 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 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 2 contains 1997-2001 average 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 3.

Table 2. Livestock Weights and Prices and Feed Costs Used to Evaluate the Alternative Replacement Heifer Management Strategies (1997-2001 Nebraska Average).

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 1. Summer range was valued at

Table 3. The Total Direct and Indirect Costs of Raising Replacement Heifers Under Four Different Management Practices (Weaned Heifer Through 31 Months).

Description	Program			
	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	<u>15</u>	<u>15</u>	<u>15</u>	<u>15</u>
Total 1 st year's costs	735	746	759	774
Less: value of cull heifers	<u>113</u>	<u>72</u>	<u>63</u>	<u>89</u>
Net 1 st year's costs	622	674	696	685
Net cost for 1 bred yearling heifer adjusted for death loss and culls ^a	\$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	<u>26</u>	<u>26</u>	<u>26</u>	<u>26</u>
Total 1 st & 2 nd year's costs	1190	1192	1206	1229
Less: value of cull 2 year old cows	89	57	46	59
value of weaned calf	<u>359</u>	<u>380</u>	<u>396</u>	<u>409</u>
Net 1 st & 2 nd year's costs	742	755	764	761
Net cost for 1 bred two-year old cow adjusted for death loss and culls ^b	\$888	\$846	\$838	\$852

^aNet 1st year's costs divided by (conception rate minus 4% culled for other reasons).

^bNet 1st & 2nd year's costs divided by (conception rate minus 2.7% culled for other reasons)

\$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 3).

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 year's costs include the value of the bred replacement heifer at the start of the second year. The next section of Table 3 is very critical to accurately valuing the replacement heifer. Sales of cull 2 year old heifers are considerably larger under programs I and II 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 fed 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). 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.

THE VALUE OF A REPLACEMENT HEIFER

Several factors must be considered to arrive at the value of a replacement heifer. Perhaps the first and most important is how long will the heifer remain in the herd and how many calves will she produce. While all ranchers can name that favorite cow that produced 15 calves, the reality in most herds is that less than 20 percent of the cows will have ten calves. A typical cow disappearance chart is presented in Figure 1. This is based on a 90 percent calf crop and the assumption is made that all open cows are culled and sold. The culled bar represents cows that are culled for other reasons than being open. Based on this disappearance distribution, the probability of a replacement heifer having 1, 2, ..., 11 calves is displayed in Figure 2. Just over 50 percent would be expected to have more than seven calves and less than 20 percent would have ten or more calves.

Estimating the price for calves and cull cows over the next 11 years is not an exact science. Anyone who tells you they can predict prices that far in the future is a dreamer or an agricultural economist with an unrealistic view of the power of their mathematical model. However, we know cattle prices are cyclical and it is possible to make some educated price forecast. Regardless of price level, relationships between steer and heifer prices, calf and

yearling prices and calf and cull cow prices remain relatively constant. Actual and projected prices for calves and cull cows from 1990-2011 are contained in Figure 3.

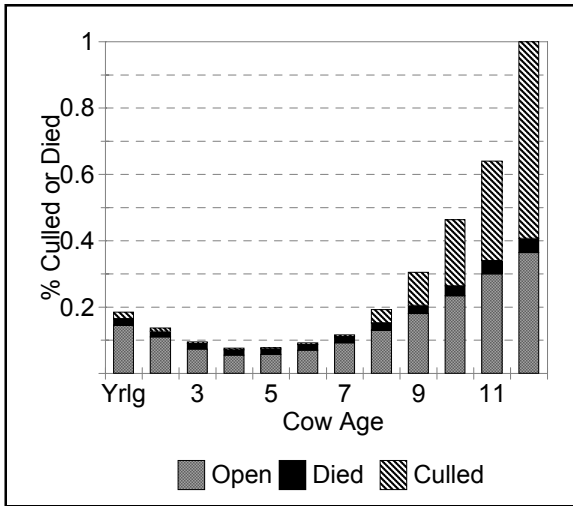


Figure 1. Percent of Cows that are Culled or Die, by Age, Based on 90% Calf Crop.

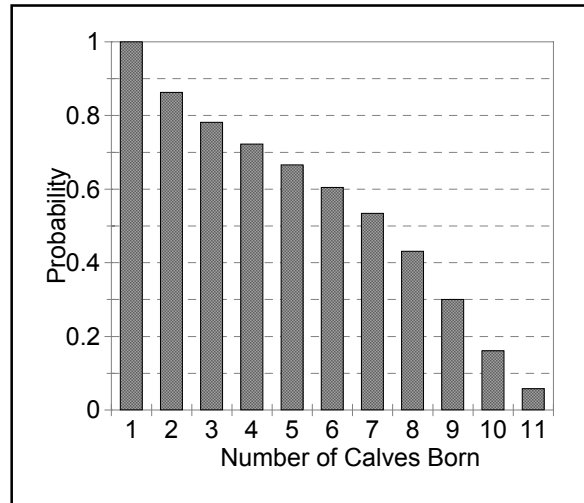
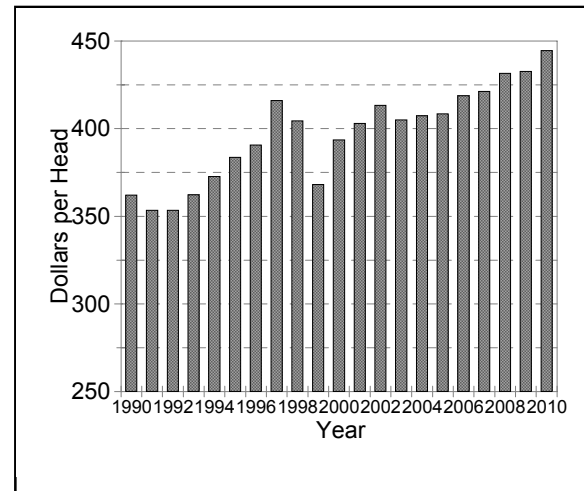
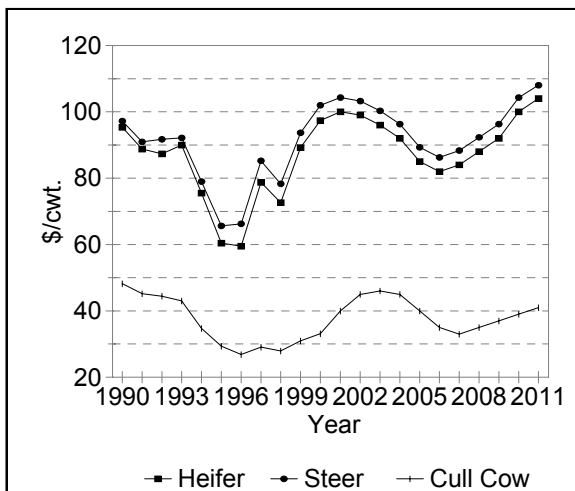


Figure 2. Probability of Having X Number of Calves.

The last main item needed to estimate a replacement heifers value is to know your annual cow costs. The same replacement heifer may be more or less valuable to your operation compared to your neighbor's operation depending upon your costs being lower than or greater than your neighbors. By knowing your annual cow costs you can more correctly value a replacement heifer for your operation. Average annual cow costs are shown in Figure 4.



To summarize, a replacement heifers true value is the sum of all the sales of her weaned calves, plus her own sale as a cull cow, minus the annual cost to carry her. A set of these values for replacement heifers placed in a herd from 1990-2000 and remaining in the herd for 1, 2, ..., 11 years is displayed in Table 4. In general, the heifer becomes more valuable the longer remains in the herd and is weaning another calf. However, there are times in the cattle cycle, when cow-calf producers are losing money on each calf sold, and when the cull cow market is also low, that a heifer actually loses money by remaining in the herd for a longer time period. For example, a replacement heifer placed in the herd in 1990 and culled after three calves would have been more valuable than one that weaned four through nine calves. This was because the cow-calf enterprise was not profitable during the middle of the 1990's. Only if the heifer actually had 10 or 11 calves was there sufficient profit at the end of the 1990's and 2000 to offset the losses through the mid 1990's.

So what was the actual value of the replacement heifer placed in the herd in 1990? Was it \$597 or \$1,130? It all depends on how long the heifer remained in the herd. However, we can get an expected value for the heifer placed in the herd in 1990 by considering the probability of having 1 to 11 calves depicted in Figure 2. The expected value for the heifer placed into the herd in 1990 was \$701.

HISTORICAL COMPARISON OF COST, VALUE, & PRICE

An historical analysis was completed comparing the cost of raising bred replacement heifers to their expected value and to the market price for bred heifers from 1990 through 2000. The costs of the bred heifers were based on raising them under program III, Table 1. Feed and pasture costs are Nebraska averages over the time period, interest rate was set at prime, and other variable and fixed costs increased over time with the general level of inflation.

Nebraska average cattle prices were used for the appropriate steer, heifer, and cull cow market to determine value over time. Actual prices were used from 1990-2001, and estimated prices were used for 2002-2011, see Figure 3. Annual cow costs varied over time based on actual Nebraska pasture and hay cost from 1990-2000 and these costs were increased slightly over time from 2001-2011.

Replacement heifer market prices were obtained from Cattle-Fax for the 1990-2000 time period.

The historical cost, value and price are displayed in Figure 5. Several observation can be made:

- \$ The cattle cycle impacts the cost, value and price of replacement heifers
- \$ The value of a replacement heifer is less than the cost and price as calf prices peak and start lower
- \$ The value of a replacement heifer is greater than the cost and price as calf prices hit bottom and start higher
- \$ Over the course of the cattle cycle the cost, value and price of replacement heifers are about equal

§ Lastly, the lowest calf prices in over 20 years that occurred in 1996 as a result of the stage of the cattle cycle and record high corn prices had a very negative effect on the value of replacement heifers placed in the herd from 1991-95.

Table 4. Estimated Value of a Bred Replacement Heifer Based on Calving 1, 2, ..., 11 Times and being Culled and Sold after Last Calf. (Values are in Dollars per Head)

# of Calves	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	606	604	596	426	284	245	359	288	415	518	580
2	713	712	549	328	205	308	328	396	592	733	761
3	821	665	451	249	269	277	436	573	808	914	872
4	773	567	373	313	238	385	613	789	988	1025	949
5	675	488	436	282	346	562	829	970	1099	1102	943
6	597	552	405	390	523	778	1009	1081	1176	1096	921
7	660	521	513	567	738	958	1120	1157	1171	1074	932
8	629	629	690	782	919	1069	1197	1152	1149	1085	1005
9	738	806	906	963	1030	1146	1192	1130	1160	1158	1088
10	914	1021	1086	1074	1107	1141	1170	1141	1233	1241	1211
11	1130	1202	1197	1151	1101	1119	1181	1214	1316	1364	1343

SUMMARY

Selection and development of replacement heifers is extremely important to the overall profitability 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.

This paper presented procedures for determining replacement heifer costs and replacement heifer values. While not specifically shown in this paper, management decisions that will increase the productivity of a replacement heifer will likely increase the value of that replacement heifer far more than the added cost.

The stage of the cattle cycle has a large impact on the cost, value and market price of replacement heifers. However, over the course of a cycle, these values are approximately equal.

Further research is needed to document the value differences between heifers with differing levels of productivity into the future. Perhaps, this author will have that answer in two more years.

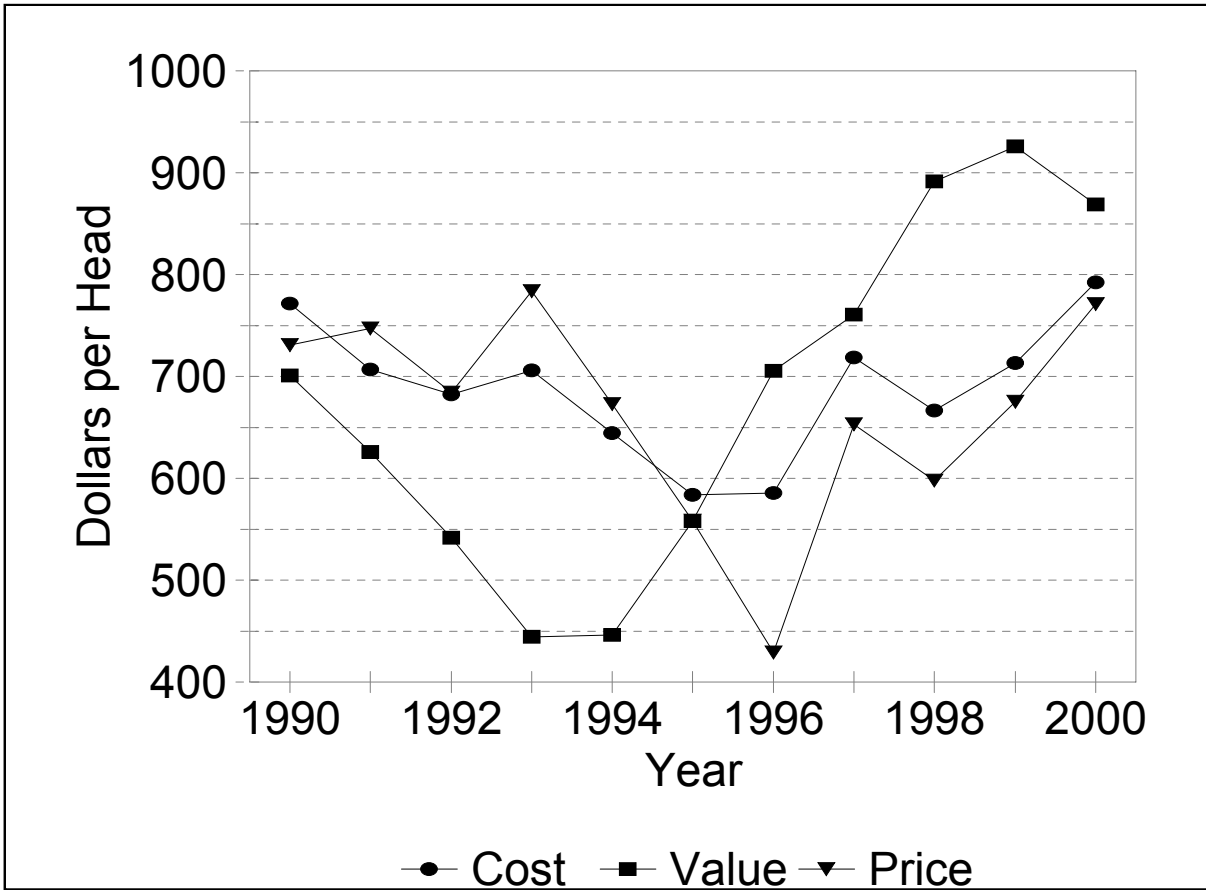


Figure 5. Replacement Heifer Cost, Value and Price from 1990-2000.

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