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Using the Replacement Model for Open Breeding Stock

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Introduction

Beef cattle producers are faced with the Retain / Replace decision for open breeding stock each year. In the past, extension personnel have encouraged farmers to replace any cow that did not produce a live calf. This recommendation has been based on the assumption that costs of keeping the open cow in inventory, coupled with the risk of her being open again the next year, would outweigh the benefit of the calf that she would potentially produce. In most situations, replacing the open cow is the best option. However, there are additional components to this decision that should be considered.

When an open cow is sold and replaced with a young replacement heifer, we replace an animal that may be at the height of her productivity. Cows in their 4rd through 8th productive years are the most productive cows in our herds. Conversely, a two-year old replacement heifer is the most questionable animal in our herd. She is the most likely to be open, have calving trouble, and will usually produce a smaller calf.

Secondly, this decision is seldom evaluated on equal time frames. When we replace an open cow with a replacement heifer, the heifer has ten or more productive years ahead of her. Conversely, the open cow has fewer productive years left. Thus, a 10-year asset is being compared against a shorter life asset without adjusting for this time difference. Not surprisingly, these evaluation criteria have tended to favor purchasing a replacement heifer. In order to truly evaluate this decision it is necessary to set the two options on equal time frames.

The Model

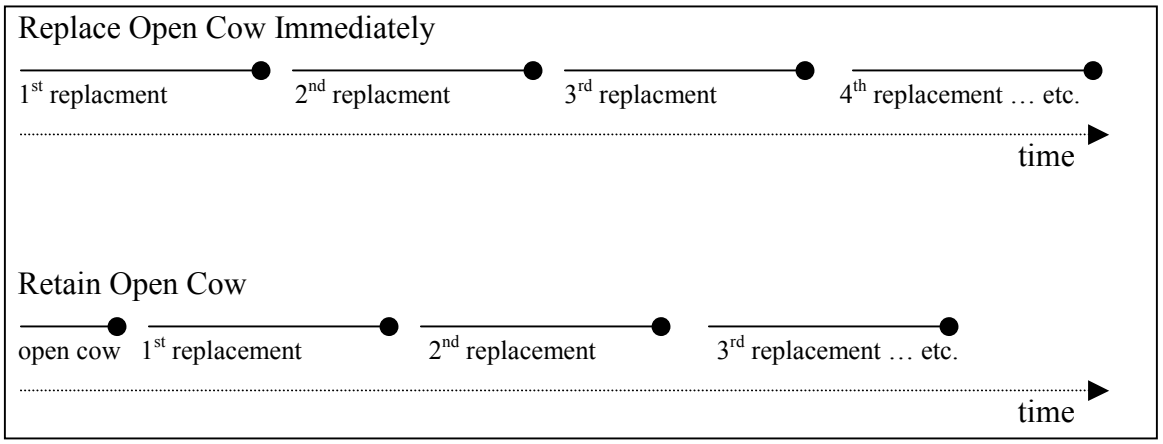
Our objective in creating this model was to provide farmers and extension personnel with a spreadsheet based decision tool that would allow the cow-calf producer to consider all factors when making culling decisions. Although the spreadsheet contains reasonable default values, all values should be changed to reflect current market conditions and existing production parameters for a given operation. By doing this, the user is able to receive a recommendation specific to his or her operation based on current production and marketing conditions.

The method used to evaluate this decision is to assign a long run Net Present Value to the cash flows generated by each alternative. If we choose to replace the open cow, we immediately receive her salvage value as a cull cow, which is put towards the purchase of a two-year old bred

replacement heifer. From the heifer, we receive a calf in that same year, while also realizing all expenses associated with keeping her in inventory. Each productive year, we receive returns from her offspring, and pay expenses associated with her. After a selected number of productive years, the cow is replaced with another two year old, bred replacement heifer, and the process is repeated. This process continues for an infinite number years until the time value of money becomes nearly zero. Due to the discounting process, each additional replacement becomes less valuable than the one before. The sum of all these net present values becomes the present value of the replacement decision to sell the open cow immediately.

If we choose to retain the open cow and breed her in the following year, we realize the full costs associated with her that year, and receive no income. We do receive revenue from her calves for the remainder of her productive life, along with typical maintenance costs. At the end of her productive life, she is replaced with a two-year old bred replacement heifer. As in the previous scenario, we continue this process of adding replacement heifers for an infinite number of years. The sum of these net present values becomes the value of the retain decision. A graphic of these two possibilities can see seen on the following page.

Figure 1. Pictorial Comparison of Replacement versus Retainment of Open Cow



One of many concerns associated with this question is the likelihood of the open cow being open in the following year. Generally, a cow that comes open once is not very likely to be open again. It is more likely to be a non-genetic issue than something that would result in future losses. However, there is a slightly higher risk of that open cow being open in the following year as well (Tronstad, Gumm). For this reason, we have discounted calf values by the probability that the cow could be open in the following year. Replacement heifers also have considerable risk of not re-breeding, which is captured by the calf value.

Using the Replacement Model

We have tried to make the replacement model as easy to use as possible. When the model is opened, the user is prompted to answer a series of questions including: the productive year of the open cow, the annual costs of keeping a cow in inventory, cost of a bred replacement

heifer, value of open cow if sold, required rate of return on investment, value of calf at cow's peak performance, salvage value of cow at the end of her productive life, a cow's expected productive life in years, and a calf discount value. Each of these variables are described below.

Open Cow's Productive Year – This is not the same as her age. For the most part, a five year old cow will be in her fourth productive year, a seven year old will be in her sixth productive year, and so on. One can think of productive years as being potential calf bearing years.

Annual Variable Cost of a Cow in Inventory – This number should come from past production records. It should include the cost of feed, variable labor, health treatments, and other costs that are realized if a cow remains in the herd.

Cost of a Bred Replacement Heifer – This variable represents the cost that would be realized if the producer had to purchase a bred replacement heifer on the open market. The user is strongly encouraged to put considerable thought into this number. Cheap replacement heifers may be available through local stockyards, but little is known about the background of those heifers.

Value of Open Cow – This number should be considered the current market value of the open cow in question; most likely, this will be the price of a cull cow at the local auction barn.

Required Rate of Return – Required Rate of Return is the rate of return that the producer would expect to receive on this investment. For some users, this number may be difficult to derive. It is recommended that this number be at least the rate of current risk free investments such as certificates of deposit and government bonds.

Value of Calf at Cow's Peak Performance – It was mentioned earlier that cows in their 4^{th} production year and older are the most productive cows in our herds. The value of a calf at the cow's performance refers to the value of calves at this stage in the cow's life; this variable should also come from past production records. In the replacement model, this value is not reached until year four. Another variable will be used to account for the higher risks and smaller calf sizes for younger and older cows.

Value of Cow at the End of Her Productive Life – This is the salvage value of breeding stock, or the value of a cull cow. Note that this variable refers to a cow at the end of her productive life and may be different that the value of an open cow. The open cow in question may bring the same price per pound at auction, but could be heavier, thus more valuable.

Cow's Expected Productive Life – This variable is very straightforward and should come from past production records. The user is being asked how many productive years are expected from a cow in their herd.

Calf Discount – The calf discount factor is used to account for the fact that cows in their first three productive years have smaller calves and are expected to have more problems than mature cows. The calf discount factor is used to discount calf values in years one, two, and three. In year one, the discount factor is multiplied by three and then used to discount the value of a calf. In a cow's second productive year, this discount factor is multiplied by two, and then used to

discount calf value. In year three, the discount factor itself is used to discount the value of the calf. This factor is also used to discount calf values as cows become very old. After a cow's eleventh productive year, the calf discount itself is used to discount calf value.

Using the data that is input on this screen, cash flows are estimated for both scenarios. Calf values are discounted by the probability that the cow would be open, and then discounted for the time value of money. Then we subtract expenses from this value to determine net cash flows for each year. The sum of these discounted cash flows is the net present value of the decision. The financial calculations are built into this spreadsheet model. Directly below this data entry section, the user would be shown a net present value for both options and the higher NPV is recommended to the user. Default values for the model are shown below in Table 1.

Table 1. Defalt Production and Marketing Values

1) Open Cow's Productive Year?	4
2) Annual variable cost of cow in inventory?	($300.00)
3) Cost of a bred replacement heifer?	($950.00)
4) What can the open cow be sold for?	$400.00
5) What rate of return would you require on this investment?	10%
6) What is the value of a calf at cow's peak performance?	$400.00
7) Value of cow at end of productive life?	$400.00
8) Cow's expected productive life? (8-14 years)	10
9) Calf discount	4.00%

Implications

The results of the calculations are highly dependent on the nine fields that are entered by the user. The table below describes the impact that each of the variables has on the decision, and the likelihood of retaining the cow.

Table 2. Impact of Input Varibles on the Replacment Decision

Holding all other things constant, as the following parameter increases:	**The likelihood of retaining the cow being optimal ...**
Age of the open cow	Decreases
Annual maintenance costs	Decreases
Price of bread replacement heifers	Increases
Value of open cow if sold	Decreases
Required rate of return	Increases
Value of weaned calves	Decreases
Salvage value of a cow	Increases
Expected productive life	Increases
Calf discount	Increases

The variables that seem to have the biggest impact on the retain / replace decision are the cost of a bred replacement heifer, the age of the open cow, and the annual maintenance costs associated with keeping a cow in inventory. The following tables show the sensitivity of the retain / replace decision to these three variables holding all other variables in the model constant; refer to Table 1 for default values. Negative (shaded values) depict times when the retaining the open animal is optimal.

Table 3. Sensitivity Analysis of Variable Costs and Cow's Productive Age

		Open Cow's Productive Year					
	($68.15)	2	3	4	5	6	7
Variable	-240	($167)	($142)	($102)	($58)	($9)	$45
Costs	-270	($153)	($127)	($85)	($39)	$12	$68
per	-300	($139)	($111)	($68)	($21)	$32	$91
Year	-330	($125)	($96)	($51)	($2)	$53	$113
	-360	($111)	($80)	($34)	$17	$73	$136
	-390	($97)	($65)	($17)	$35	$94	$158

Table 4. Sensitivity Analysis of Bred Replacement Heifer Cost and Cow's Productive Year

		Open Cow's Productive Year					
	($68.15)	2	3	4	5	6	7
Cost of	-700	$78	$87	$109	$134	$161	$192
Bred	-750	$35	$47	$74	$103	$135	$171
Heifer	-800	($9)	$8	$38	$72	$110	$151
	-850	($52)	($32)	$3	$41	$84	$131
	-900	($95)	($71)	($33)	$10	$58	$111
	-950	($139)	($111)	($68)	($21)	$32	$91

It is valuable to identify times when retaining open cows is most likely to be an optimal strategy; these times are characterized by specific production and market conditions. The cost of bred replacement heifers is the primary indicator. Anytime replacement heifers are expensive, one should carefully evaluate other market conditions before replacing open heifers. This was the case in fall 1999; bred replacement heifers were selling for over $1000 and 500 pound calves were selling in the upper seventies and low eighties. Cull cows were selling in the mid-thirties, making them worth less than weaned calves. Under market conditions such as this, a producer with cow maintence costs of $300 per year, would have been best served to keep open cows in their sixth productive year (seven year olds) or younger.

The fall of 1995 was much the opposite. Calves were very cheap with prices in the low to mid-fifties. Cull cow prices were in the low thirties making cull cows worth $50 to $100 more than weaned calves. Replacement heifer prices seemed to hit rock bottom as quality bred replacement heifers could be purchased for $600 to $650. In the fall of 1995, it would not have been optimal for a cow-calf producer to retain open cows under any reasonable circumstances.

The decision aid described above should serve as a guide to producers as they make the retain/ replace decision for open breeding stock. It is not intended as a substitute for good herd

management and common sense. Producers are encouraged to use the model as such, accompanied with their own experienced judgment. Only the individual producer knows the complete history of his or her breeding stock and financial situation of his or her operation.

Get the "Replacement Model for Open Breeding Stock"

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