

Culling Rate on Dairy Farms and Its Effect on Income Over Feed Costs and Forage Inventory Requirements

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Summary

Traditionally, we have considered the cost of feeding replacement heifers as a cost to be absorbed by the lactating cows. Hence, the cost of feeding heifers has often been included in the calculation of income-over-feed costs (**IOFC**), leading to the conclusion that culling rate, through its impact on the size of the replacement herd has a substantial effect on herd profitability. A modern view separates the farm business into separate enterprises where the heifer replacement enterprise is in fact a ‘meat’ enterprise. The ‘milk’ enterprise made of lactating and dry cows is in essence leasing animals from the ‘meat’ enterprise. When the lease expires, the animal is returned to the ‘meat’ enterprise to be slaughtered and its reduced value must be paid as a redemption fee by the ‘milk’ enterprise. Using current market prices, the traditional view would result in a reduction in IOFC of \$1.00/cwt when culling rate increases from 35 to 45%. Under the modern and correct view, profitability would be affected by less than \$0.10/cwt, which is a relatively small and arguably a negligible value. Of course, culling rate affects the size of the replacement herd required to maintain the size of the milking herd, and thus, impacts the total amount of resources required. In a herd of 100 lactating cows, a culling rate of 45% requires an additional 230 tons of silage/year compared to a culling rate of 35%. Therefore, when conditions make the supply of feeds - especially forage – very tight, reducing culling rate can meaningfully decrease the demand for the scarce resource.

Introduction

Tight margins in dairy production compounded with a severe drought in the central States of the United States in 2012 have raised questions regarding optimal culling rates, profitability, cash flows, and forage needs. Traditionally, the dairy farm is viewed as an integrated enterprise where the cost of feeding all animals, productive or not, is entirely supported by those animals producing cash: the lactating cows. In a more modern and business-like approach, the farm business is separated into its distinct enterprises, each with their own profitability and cash flow requirements. The objective of this short paper is to provide a uniform set of current production and financial numbers to compare the 2 approaches, to argue about the fallacy of the traditional view from a profitability standpoint, and to examine the consequences of different culling rates on forage demand and inventory requirements

The Traditional View: Aggregate Cash Flow

In the traditional view, lactating cows are the income generating entities that must support the non-productive dry cows and replacement heifers. I have used this approach in the past and characterized the lactating cows as the equivalent of working taxpayers, while the dry cows and heifer replacements became the welfare recipients. With this approach, income and costs are looked at from a cash flow standpoint, with the exception that farm-grown feeds are also considered as being consumed

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on a cash basis. Being welfare recipients (i.e., consuming feeds without generating any cash revenues), replacement heifers are cash-flow reducers. By mistakenly equating cash-flow with profitability, one concludes of a strong negative relationship between the size of the replacement herd and profitability expressed by its proxy, income-over-feed costs (**IOFC**). Because of the direct relationship between culling rate and the minimum replacement herd size required to maintain the lactating herd size (i.e., the greater the culling rate, the greater must the replacement herd be as a proportion of the lactating herd), many farm advisors (including myself) have recommended the minimization of culling rate as an approach to profit enhancement.

Tables 1 and 2 report the cash-flow revenues and feed costs for 2 herds with identical structure (each with 100 lactating cows) and except for their culling rates: one herd has a 35% culling rate, hence requiring 80 heifers per 100 lactating cows, whereas the second herd has a culling rate of 45%, thus requiring 110 heifers per 100 lactating cows. Feed prices are representative of market feed prices that were in effect in the Mideast region of the United States in early March 2013. In short, increasing culling rate from 35 to 45% decreases IOFC by \$67/day or \$24,638/year per 100 lactating cows. At an average production of 75 lb/cow/day, this equates to a reduction of \$0.90/cwt in IOFC. This is a large number when one considers that the net farm income in the Mideast averages \$1.00 to 1.50/cwt.

The Modern View: Enterprise Profitability

As is generally done in business management, the farm can be partitioned into its various enterprises. Even under this framework, the heifer replacement enterprise is generally viewed as a supplier of dairy animals to the milking herd. But with cull cows selling for \$1,200+/head, the whole business structure can be thought in a very

different framework, as pictured in Figure 1. Here, calves are born as future meat animals. The genetic of dairy calves might not be very good for producing high quality meat, but the reduced quality compared to that of an animal selected for meat quality ends up being reflected in the price. In fact, the quality of the meat harvested from U.S. culled dairy cows would be considered excellent in many parts of the world.

At 2 years of age, the animal is 'leased' by the 'milk' enterprise. During the lease, which extends for a period of approximately 2 years, the animal produces milk sold by the dairy enterprise and gains additional weight. At the end of the lease, the animal is returned to the 'meat' enterprise, carrying a lower market value than it had at the beginning of the lease. For those of you who ever leased a car, the process should look very natural. One leases a new car, pays for its reduction in value as it is being used to produce transportation, and eventually returns it to the 'car' enterprise with some residual value. The car is never owned by leasing the car. Likewise, the animal is never owned by the 'milk' enterprise, but it is leased for a variable period of time. The only difference between the car and the cow lease is that a car lease requires monthly payment. The cow lease sends in-kind payments in the form of calves to the 'meat' enterprise.

Now, we can look at the economics of this lease. The 'milk' enterprise must bear the interest on the value of the animal at the initiation of the lease. If we use a value of \$1500/heifer and an interest rate of 5% per year, the interest to be paid on each leased animal by the 'milk' enterprise amounts to \$75/year, or \$6.25/month. At the end of the lease (averaging 2 years), the 'milk' enterprise must pay an additional redemption value equivalent to the lost value of the animal during the lease. With a culled cow worth \$1,200 and a replacement heifer at \$1,500, this \$300 additional cost per animal equates to \$150/year, or \$12.50/animal/month.

During the lease, the animal is not constantly producing: the 75 lbs/day for the lactating cows equates to 62.7 lbs/day of milk production while the animal is leased, or 1,880 lb/month. Therefore, the lease cost for the 'milk' enterprise equates to $\$6.25 + \$12.50 = \$18.75$ per 1,880 lb of milk, or just about \$1.00/cwt of milk produced.

Of course, the average terms of the lease would change depending on the culling rate. The numbers calculated above are about right for a 45% culling rate (about a 2-year lease). On an average, the lease would be longer for a lower culling rate. For example, a 3-year lease (culling rate of ~25%) would result in a reduction in the redemption cost per unit of milk produced from \$0.66 to \$0.44/cwt; whereas, the interest cost would remain at \$0.34/cwt, for a total lease cost of \$0.78/cwt of milk produced. The difference in the lease cost between a culling rate of 45% and a culling rate of 35% amounts to approximately \$0.09/cwt, a figure substantially smaller than the \$1.00/cwt calculated with the traditional aggregate 'cash-flow' approach. One can even build a scenario where the lease cost becomes negative when heifers are selling for \$1,500/head and culled cows are selling for \$1,550/head.

Of course, the exact cost figures are very situation dependent. The point, however, is that as heifers grow, they accumulate weight and this weight has a value that is not reflected in the cash-flow but would be reflected in the balance sheet of the farm as a whole. Thus, it is grossly incorrect to fully charge the cost of feeding heifers to the lactating-cow enterprise as is done in the traditional approach. Under current price conditions, the profitability of a dairy farm has little to do with culling rate as long as cows do not die on the farm.

Forage Requirements

The conclusion reached in the previous section does not mean that culling rate doesn't

impact the amounts of resources required by the aggregated enterprises. For many Mideast farms, the drought of summer 2012 resulted in a severe forage shortage. Culling rate impacts the size of the replacement herd, and thus, the farm demand for forages. In Tables 3 and 4, I calculated the amount of forage required for the 2 herds described in the previous section. Raising the culling rate from 35 to 45% results in an increase demand of 230 tons/year of silage for the whole herd, which equates to a 9.5% increase in the amount of forage required. Thus, although farm profitability is highly insensitive to culling rate under current price conditions, the demand for forage is significantly influenced by culling rate.

Conclusions

The traditional view regarding culling rate has incorrectly substituted cash-flow for profitability. Hence, culling rate has traditionally been perceived as having a significant impact on profitability. Because the price of a replacement heifer is much closer to the price of a cull cow than what we have been accustomed historically, the traditional view is incorrect. Currently, culling rate by itself has an insignificant effect on farm profitability (every thing else being the same).

Table 1. Estimated cash costs per animal and per hundredweight of milk for a herd of 100 lactating cows with an annual culling rate of 35%.¹

	\$/herd/day	\$/herd/year	\$/animal/day	\$/cwt milk	%
Income					
Milk	1,500	547,500	15.00	20.00	
Feed Costs					
Lactating cows	790	288,350	7.90	10.53	77.8
Dry cows	45	16,425	0.45	0.60	4.4
Heifers	180	65,700	1.80	2.40	17.8
TOTAL	1015	370,475	10.15	13.53	100.0
Income Over Feed Costs					
Lactating cows	710	259,150	7.10	9.47	146.4
Dry cows	-45	-16,425	-0.45	-0.60	-9.3
Heifers	-180	-65,700	-1.80	-2.40	-37.1
TOTAL	485	177,025	4.85	6.47	100.0
Income Over Total Costs					
TOTAL	16.25	5,931	0.16	0.22	

¹Herd consists of 100 lactating cows, 15 dry cows, and 80 replacement heifers. Lactating cows are fed 52.5 lb/day of DM at a unit cost of \$0.15/lb. Dry cows are fed 25 lb/day of DM at a unit cost of \$0.12/lb. Heifers less than 1 year old are fed 12 lb/day of DM at a unit cost of \$0.14/lb. Yearling heifers are fed 24 lb/day of DM at a unit cost of \$0.12/lb. Lactating cows are producing 75 lb/day of milk at 3.8% fat, 3.1% protein, and 5.7% other solids, resulting in a mailbox price of \$20.00/cwt. Non-Feed costs are set at \$6.25/cwt. A 35% culling rate requires a replacement herd of 80 heifers per 100 lactating cows to keep the number of animals constant, assuming a calving interval of 13.5 months, an average age at first calving of 24 months, 10% death rate pre-weaning, and 6% culling between weaning and first calving.

Table 2. Estimated cash costs per animal and per hundredweight of milk for a herd of 100 lactating cows with an annual culling rate of 45%.¹

	\$/herd/day	\$/herd/year	\$/animal/day	\$/cwt milk	%
Income					
Milk	1,500	547,500	15.00	20.00	
Feed Costs					
Lactating cows	790	288,350	7.90	10.53	73.0
Dry cows	45	16,425	0.45	0.60	4.2
Heifers	225	90,338	2.48	3.30	22.8
TOTAL	1083	395,113	10.83	14.13	100.0
Income Over Feed Costs					
Lactating cows	710	259,150	7.10	9.47	170.1
Dry cows	-45	-16,425	-0.45	-0.60	-10.8
Heifers	-248	-90,338	-2.48	-3.30	-59.3
TOTAL	418	152,388	4.18	5.57	100.0
Income Over Total Costs					
TOTAL	-51.25	-18,706	-0.51	-0.68	

¹Herd consists of 100 lactating cows, 15 dry cows, and **110** replacement heifers. Lactating cows are fed 52.5 lb/day of DM at a unit cost of \$0.15/lb. Dry cows are fed 25 lb/day of DM at a unit cost of \$0.12/lb. Heifers less than 1 year old are fed 12 lb/day of DM at a unit cost of \$0.14/lb. Yearling heifers are fed 24 lbs/day of DM at a unit cost of \$0.12/lb. Lactating cows are producing 75 lb/day of milk at 3.8% fat, 3.1% protein, and 5.7% other solids, resulting in a mailbox price of \$20.00/cwt. Non-Feed costs are set at \$6.25/cwt. A 45% culling rate requires a replacement herd of 110 heifers per 100 lactating cows to keep the number of animals constant, assuming a calving interval of 13.5 months, an average age at first calving of 24 months, 10% death rate pre-weaning, and 6% culling between weaning and first calving.

Table 3. Feed dry matter (DM) and forage required for a herd of 100 lactating cows with an annual culling rate of 35%.¹

	Number of animals	DM (lb/day)	Silage (lb/day, as-fed)	Silage (tons/year)
Lactating cows	100	5,250	9,000	1,645
Dry cows	15	360	925	170
Young heifers	41	490	915	170
Yearlings	39	935	2,410	440
Total	195	7,035	13,250	2,425

¹Lactating cows are fed 52.5 lb/day of DM with 60% of the DM from forages. Dry cows are fed 25 lb/day of DM with 90% of the DM from forages. Young heifers (< 1 year of age) are fed 12 lb/day of DM with 65% of the DM from forages. Yearlings (heifers) are fed 24 lb/day of DM with 90% of the DM from forages. All forage quantities are expressed as silage equivalent at 35% DM.

Table 4. Feed dry matter (DM) and forage required for a herd of 100 lactating cows with an annual culling rate of 45%.¹

	Number of animals	DM (lb/day)	Silage (lb/day, as-fed)	Silage (tons/year)
Lactating cows	100	5,250	9,000	1,645
Dry cows	15	360	925	170
Young heifers	56	670	1,250	230
Yearlings	54	1,295	3,335	610
Total	225	7,575	14,510	2,655

¹Lactating cows are fed 52.5 lb/day of DM with 60% of the DM from forages. Dry cows are fed 25 lb/day of DM with 90% of the DM from forages. Young heifers (< 1 year of age) are fed 12 lb/day of DM with 65% of the DM from forages. Yearlings (heifers) are fed 24 lb/day of DM with 90% of the DM from forages. All forage quantities are expressed as silage equivalent at 35% DM.



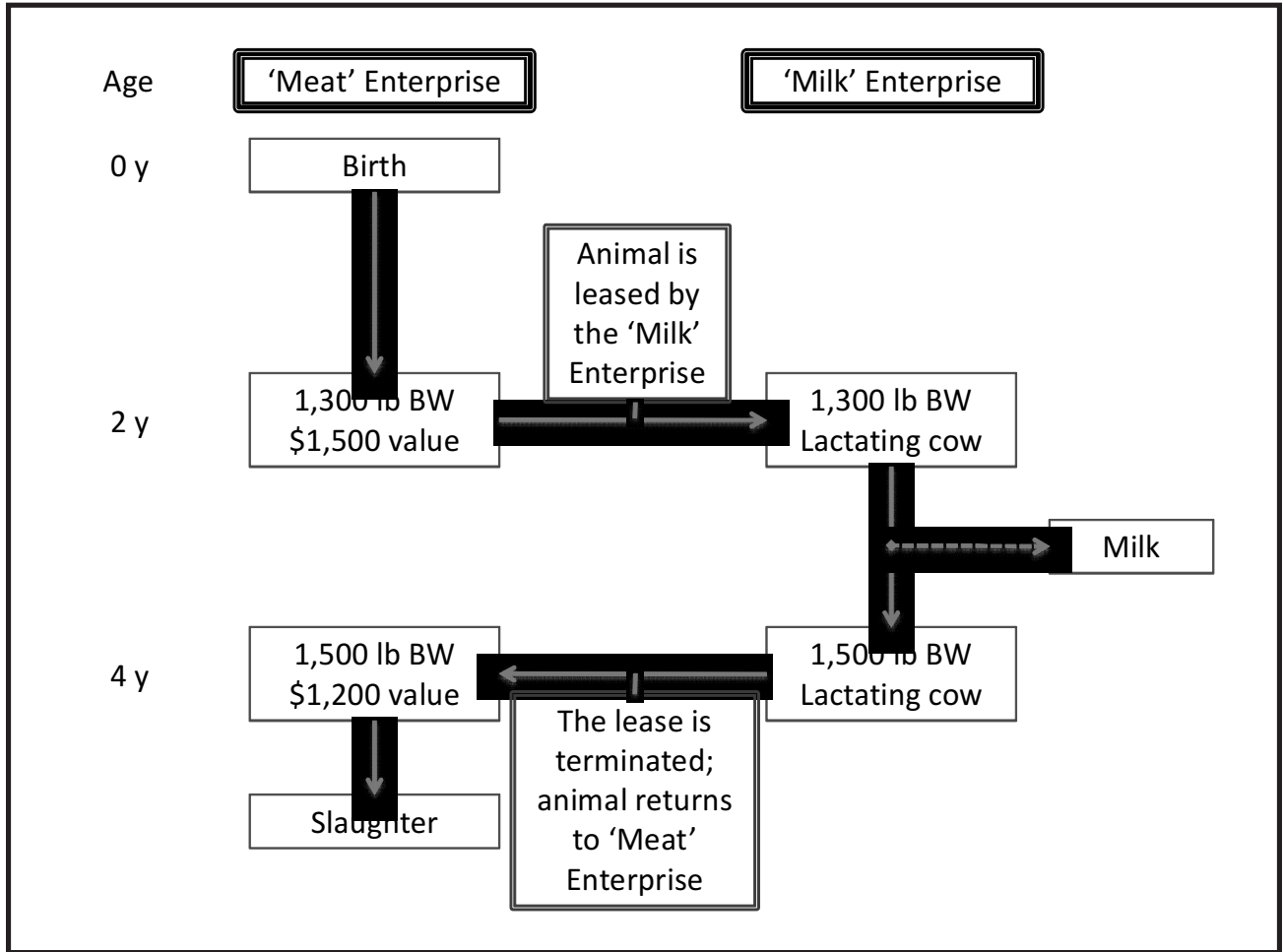


Figure 1. Schematic view of the modern replacement/culling function in a dairy herd.