Productive Life Of Dairy Cows In Florida

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Introduction

Productive life refers to how long cows stay in the herd. Other terms that express the same idea are longevity, lifespan, and herd life. Productive life is determined by when cows enter the herd, typically as freshening heifers, and when they leave, typically because they are culled.

Because the cost of raising or purchasing a heifer is much higher than her cull value, it is generally considered economically beneficial when cows can stay longer in the herd. A cow's ability to avoid culling is also called survivability, stayability, or durability.

This paper looks at some reasons why cows are culled, factors that affect productive life (with new results for Florida), and the economic value of a longer productive life.

Culling Reasons

Reasons for cows leaving the herd are typically divided into involuntary culling and voluntary culling reasons. Involuntary culling reasons are considered those that reduce or prohibit a dairy cow's main function, which is to produce milk. Cows that left the herd because they did not become pregnant in time, were sick, injured, had mastitis, or problems with feed and legs are therefore considered involuntary culls. Death can be considered an involuntary culling reason too. Cows that left the herd for primarily low milk production are considered voluntary culls. Cows leaving the herd for dairy purposes might also be considered voluntary culls.

The distinction between voluntary and involuntary reasons is not always clear or useful, because many cows leave the herd for more than one reason. More importantly, considering that most dairy producers foremost keep cows for profit, both voluntary and involuntary culling are essentially motivated by economic considerations. Either a cow's future profit (milk sales minus variable cost) is negative, or bringing in a replacement animal is more profitable than keeping the present cow. Later in this paper we'll go through an example of how these two different reasons lead to different economic values for extending productive life.

Table 1 contains reasons for cows leaving the herd and their frequencies. The percent of cows that left the herd in that year was 35.1% (North), 34.5% (South) and 35% (Florida). About 80% of cows in the South leave their herds for involuntary

reasons. A list of reasons of why cows left the herd in the last 365 days can be an important tool for identifying problems. It has been estimated that saving one cow in a 100 cow herd from involuntary culling improves net revenue by about $750 to $900 per year (Rogers et al. 1988).

Table 1. Reasons for cows leaving the herd by region.

Cull Reason	North (1998)*	South (1998)*	Florida (2002)**
Dairy	3%	5%	8%
Low production	12%	16%	12%
Reproduction	18%	22%	19%
Disease + injury	31%	19%	18%
Died	16%	21%	22%
Mastitis + udder	13%	11%	14%
Feed, legs	6%	6%	8%

* North: Midwest + Northeast states, South: Southeast states + LA + TX. Source: Smith, et al. 2000.
** Florida Herd Summary DHI-202 (12-2002 state average).

Genetics

Genetics plays a smaller role in keeping cows longer in the herd. Involuntary culling through poor management and environment cannot be overcome enough by breeding with bulls that have daughters that stay longer in herds. Nevertheless, productive life and its economic value have been primarily studied by geneticists. Bulls can be chosen which produce daughters that are expected to stay longer in the herd.

USDA calculates a Predicted Transmitting Ability (PTA) for productive life (PL). USDA's measure of productive life is the total months in milk at 84 months of age. However, not more than 10 months in milk are counted per lactation. The value of a bull's PTA-PL is only partially decided by the actual productive life of his daughters that have been culled. Information from daughters that are not yet culled is also used by projecting how long they are expected to remain in their herds. Furthermore, information on a bull's daughters' type traits is weighted in the PTA-PL.

PTA-PL is expressed in months difference from the genetic base. For example, the average PTA-PL of the 325 Holstein sires in the March 10, 2003, Hoard's Dairyman Bull List was 1.2 months longer than the base. The range of PTA-PL for all bulls in the list was 2 months shorter to 5.5 months longer than the base. PTA-PL counts for 14% in the Lifetime Net Merit (NM$) PTA and 11% in the Fluid Merit (FM$) PTA.

USDA's measure of productive life is a true measure of how long cows are in milk in their lives (up to seven years of age). On average, daughters that produce more milk are also going to stay longer in their herds. This is called true stayability. By contrast, the Canadian measure Herd Life is an expression of extra productive life of daughters for reasons other than a higher milk production. This is often called functional stayability. Figure 1 shows that the true genetic component of stayability (?) has improved over the years. However, because culling standards have been raised,

the actual stayability (¦) has decreased over the years (productive life has become shorter). The functional genetic component of stayability (?) shows that the genetic makeup of cows to avoid culling for reasons other than milk production has also declined. If it was not for a higher milk production, cows are more prone to culling now than in the past.

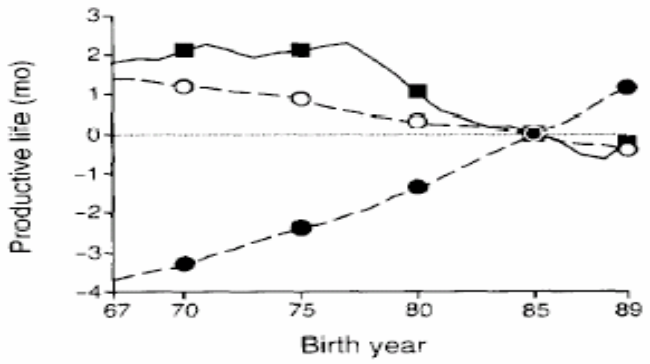

Figure 1. Phenotypic (■) and genetic (●) trends in productive life and productive life adjusted for milk yield (○) relative to a 1985 base of 25 mo by birth year (1967 to 1987).

Figure 1. Phenotypic (actual) and genetic trends in productive life. Source: VanRaden and Wiggans (1995).

Breed and Crossbred Differences

Holsteins born in 1990 had an average productive life (USDA's measure) of 23.8 months. Jerseys, Holstein x Jerseys crossbreds, and Brow Swiss x Holstein crossbreds had a slightly longer productive life (less than 1 month longer) than purebred Holsteins (VanRaden, 1995). A longer productive life for crossbreds and breeds other than Holstein was also found by researchers from Wisconsin using a recent survey. They asked dairy producers in the U.S. to evaluate their breeds and crossbreds for their ability to avoid culling (stayability) among herd mates. Producers evaluated a pure Holstein the lowest with a score of 2.6 (1 = poor stayability, 5 = excellent stayability). Other scores were Brown Swiss x Holstein (score 3.1), pure Jersey (score 3.3), Jersey x Holstein (score 3.6), and Jersey x (Jersey x Holstein) (score 4.2). The study did not say how much longer these breeds and crossbreds stayed in their herds (Weigel and Barlass, 2003).

Management and Environment

More than 90% of the differences among cows for productive life are due to management and environment (Faust, 1993). The key to reducing involuntary culling is to keep cows comfortable and healthy. Some important factors are controlling mastitis, a good dry cow program to minimize metabolic problems in fresh cows, and a good reproductive program. Other papers in these proceedings discuss some of these factors much more in dept. In addition, some new results using Florida and Georgia

data are shown below. These results were calculated from DHI records that were collected from 41,369 cows that calved on 100 Florida herds in 1995 and 1996 and 52,622 cows that were culled from 344 herds in Georgia and Florida in 2000 and 2001. Productive life in these herds was calculated as the time between first calving and culling.

About 20% of these cows were culled within 365 days after first calving. Fifty percent was culled after 827 days (the median productive life). Ten percent of the cows were still in the herd after 1580 days. Figure 2 shows that on average the chances of a cow being culled on a certain day increases with her productive life after an initial dip. This dip can also be seen in Figure 3; most cows leave early in lactation. About 25% of all culls happen the first 75 days after calving.

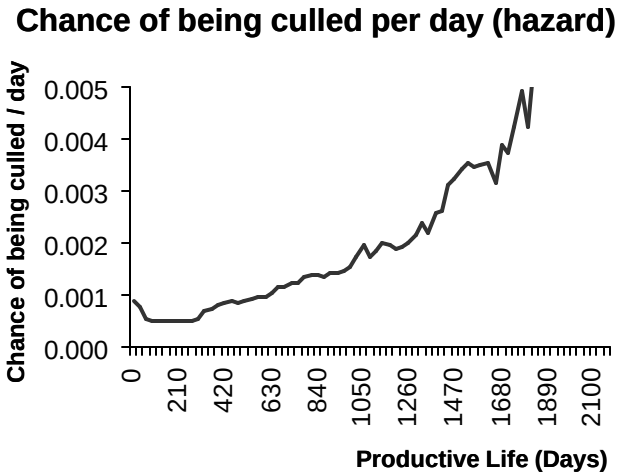

Figure 2. Chance that a cow is being culled at a certain day if she is still in the herd.

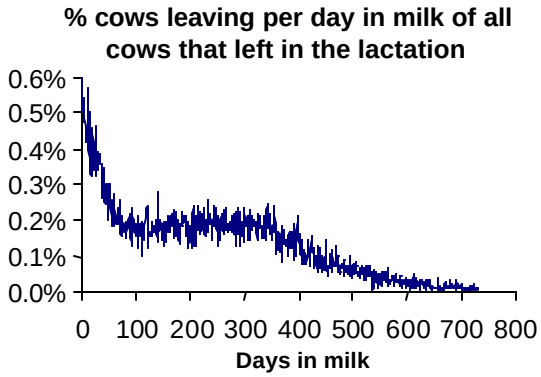

Figure 3. Percent of cows leaving per day of all cows that left in the lactation.

Figure 4 shows at what stage of lactation cullings for four common reasons occur most. Culling for reproductive problems peaks around day 350 when most still open cows are culled. Deaths and mastitis happen mostly early in lactation. Low production culls occur evenly the first 300 days in milk. The percentages are lower after 400 days in milk because most cows that are culled in the lactation have already been culled by then.

A lot of research has been focused on developing culling guidelines. Not much attention has been paid on when cows could best enter the herd. Figure 5 shows the impact of the month of first calving on average productive life and average lifetime milk yield per day. The difference between the month with the longest (calving in March) and shortest (calving in July) productive life is 163 days (5.3 months). Heifers calving in January produce on average 7.1 lbs more milk per day during their entire productive life than heifers calving in July. About 29% of the heifers calving in October through May are culled in their first lactation. But up to 40% of heifers calving in June and July do not make it to their second lactation.

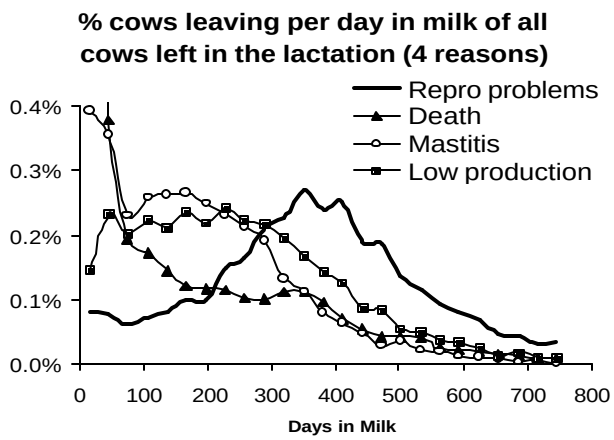

Figure 4. Percent of cows leaving per day of all cows that left in the lactation by four culling reasons.

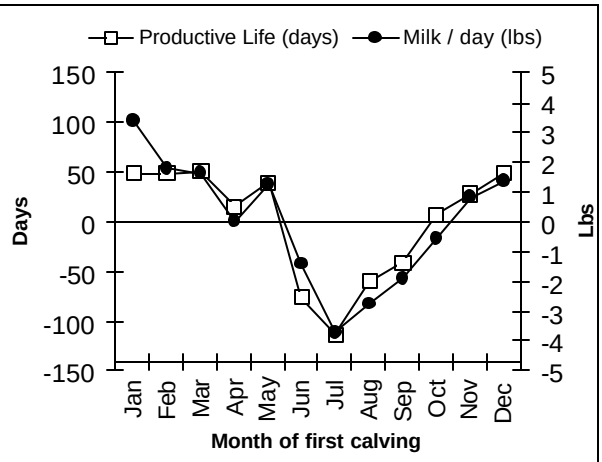

Figure 5. Difference in average productive life and average lifetime milk / day by month of first calving.

These differences are quite significant and show the dramatic effect of seasonality on production it the Southeast. The results depend of course on the type of facilities and the cooling provided, but not enough data is available to look at these effects. Nevertheless, dairy producers should consider these differences when planning the timing of first calving through heifer purchases or young stock programs.

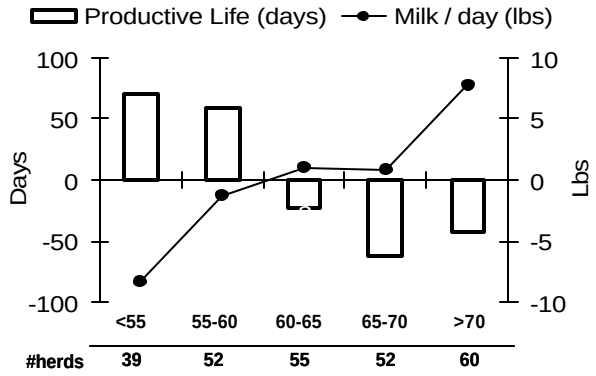

Figure 6. Difference in productive life and lifetime milk yield per day by standardized 150 day milk.

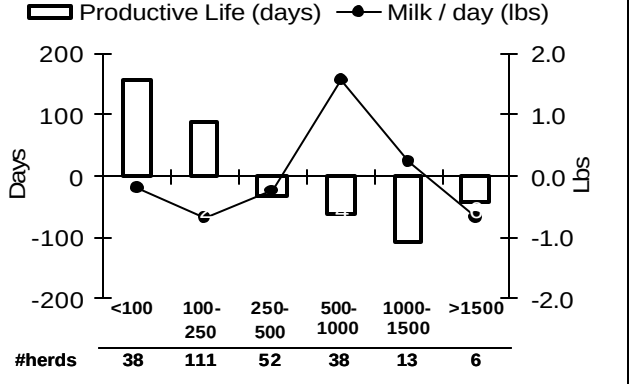

Figure 7. Difference in productive life and lifetime milk yield per day by average herd size.

Figure 6 shows that productive life is longer in herds with lower standardized 150 day milk, but that the lifetime milk yield per day is less in these herds. Figure 7 shows that productive life is longer in smaller herds, but there is not much difference in lifetime milk per day. Herds milking 2x had on average a 63 day longer productive life than 3x herds. Average lifetime milk per day was 3.3 lbs higher in the 3x herds.

Economic Value of Productive Life

The economic value of a longer productive life has much to do with whether a replacement animal is immediately available or not. If no replacement animal is available, then culling a cow will leave a temporarily empty "spot" in the herd. In such cases the cow should be kept as long as her future revenue is greater than her future variable cost. In other words, when a replacement animal is not immediately available, a longer productive life is profitable as long as the cow keeps paying for herself.

On the other hand, when a replacement animal is available, there is an opportunity cost to keeping a cow in herd because she delays another more profitable cow (typically a heifer) from coming into the herd. In this case the value of a longer productive life is typically less. A simplified example aims to make this principle clear:

Consider a purchase price of a heifer of $1500 and her salvage value as a cow of $350. The replacement heifer is exactly the same quality as the present cow in the herd at the same stage of their lives. Furthermore, let's say that the returns minus variable cost (milk sales – feed cost etc.) during the first lactation is $420, $480 during the second lactation, $460 during the third lactation etc:

Lactation	1	2	3	4	5	6	7	8
Returns–variable cost	$420	$480	$460	$400	$290	$170	$-10	$-90

If such a cow is kept one lactation, then her total profit is $-1500 + $420 + $350 = $-730, a loss. If this cow was to remain in the herd for two lactations, her total profit would be $-1500 + $420 + $480 + $350 = $-250, a loss again, but smaller than when she was kept only one lactation. The average loss per lactation would be $-250 / 2 = $-125. Similarly, if this cow was kept for three lactations, her total profit would be $210, and the average profit per lactation $210 / 3 = $70. Table 2 shows these calculations for eight lactations.

Clearly, this cow should not be kept after the sixth lactation because her returns minus variable cost start to be negative (she does not pay for herself anymore). But should she be kept the sixth lactation? That sixth lactation adds $170 to her total lifetime profit. If she was culled earlier, that $170 would not be made. On the other hand, her average profit per lactation reduces from $180 to $178 per lactation. It is more profitable to cull this cow at the end of the fifth lactation and bring a replacement heifer in for $1500. Keeping such a cow and her identical replacements for five lactations is the most profitable.

So if no replacement heifer is available, then the value of that sixth lactation (one lactation extra productive life) is $170 because there is no opportunity cost. But if a replacement animal is available, then the value of keeping her that sixth lactation is actually a loss of $2 ($178 - $180) because the opportunity cost of delaying to bring in the heifer must be considered.

Table 2. Example of the value of a longer productive life depending on the opportunity cost.

Lactation	Returns – variable cost in lactation	Total lifetime profit	Average profit / lactation
1	-1500 + 420 + 350 =	-730	-730
2	-1500 + 420 + 480 + 350 =	-250	-125
3	-1500 + 420 + 480 + 460 + 350 =	210	70
4	-1500 + 420 + … + 400 + 350 =	610	153
5	-1500 + 420 + … + 290 + 350 =	900	**180**
6	-1500 + 420 + … + 170 + 350 =	**1070**	178
7	-1500 + 420 + … - 10 + 350 =	1060	151
8	-1500 + 420 + … - 90 + 350 =	970	121

This simple example shows that the economic value of a longer productive life depends on whether a replacement animal is available or not. Furthermore, the economic value depends on what lactation the cow is in. A refinement of this example would show that the value of a longer productive life depends also on the cow's level of milk production, her stage of lactation, whether she is pregnant or not, and the quality of the replacement heifer.

USDA uses a profit of $28 per extra month of productive life in the PTA-PL calculation. Other researchers found a value of $29 per month when opportunity cost was considered, and $70 when no opportunity cost was considered (Jagannatha et al. 1998). Research in underway to calculate estimates for cows under conditions in Florida.

Summary

Productive life, or longevity, is generally the time between first calving and culling. About 80% of cows in Florida leave their herds for involuntary culling reasons. The genetic component of productive life is small, but USDA calculates a PTA for productive life for bulls. Productive life estimates for Florida show that the season of first calving has a large effect on the length of productive life and the average lifetime milk yield per day. An economic example showed that the economic value of a longer productive life is less when a replacement heifer is available. USDA uses an average of $28 per extra month of productive life, which includes this opportunity cost.

Acknowledgments

These results are part of a study that aims to give guidelines on when to purchase replacement animals, how many, and what dairy producers can afford to pay for them. This study is sponsored by a 2002 Milk Check-off grant. In addition, Dairy Records Management Systems, Raleigh, NC, is thanked for kindly providing the data of the Florida study.

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