

NEW TOOLS FOR DECIDING WHEN TO REPLACE USED DAIRY COWS

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Introduction

Traditionally, culling of dairy cows has been viewed from a historical viewpoint. Many dairy farmers and their consultants calculate their annual culling rate, and focus on the percentage of cows culled for a variety of reasons. Dairy advisors recommend “optimal” culling rates, and studies and simulation models attempt to determine the culling rate that will maximize the profit from genetic gain while minimizing the costs of turnover. High cull rates have been considered a sign of management failure, and recently, semen companies have even been marketing “longevity”. These generalizations may have value in the abstract as descriptions of desirable average performance across the industry, but they do not provide a practical framework for on-going culling decisions on a specific dairy.

A more prospective approach is needed. To effectively implement a practical culling strategy on a dairy, certain fundamentals must be understood.

Every dairy has an optimum inventory of cows that makes the most profitable use of its facilities. That optimum inventory defines a number of “slots” that can be occupied by cows on the dairy. In some cases the number of slots is easily determined, e.g. the number of stanchions in a barn. In most cases, however, the optimum number of slots is not defined by facilities alone. Freestalls and dry lots are often over filled and some farms switch milk cows in stanchions. The optimum number of slots depends at least on management, parlor and labor capacity, feeding system, and probably on season. Every dairy should first work to determine its unique capacity and fill each slot with a productive cow.

Leaving an available milking cow slot empty on a dairy is very expensive. In the U.S., even in the face of very high prices for replacement animals it is still profitable to purchase additional cows and fill the barn. Spreadsheets can model the decision (see Spreadsheet 1). The decision might be quite different in situations where the added milk from an additional cow would be in excess of the dairy’s production quota limit. The spreadsheet could be used to model such a decision at the reduced milk price or model the capital investment in additional quota.

Once all productive slots are filled, the goal of a culling decision is to fill each slot on a dairy with the cow that will make the dairy as profitable as possible. The profitability of a particular cow in a slot depends on many factors. These factors include not only the cow and her current status, but also her future potential, the probability that she will remain in the slot and not be culled at a particular point in the future, and, very important, the profit potential of the heifer that will replace her in the slot and all of the string of heifers that will occupy the slot out into the future. Again, the goal of culling is not to maximize the profit earned by a particular cow, but rather the profit earned by a slot on the dairy.

In the ideal on any given day, each slot on the dairy should be considered and the question asked: Is the value this slot brings to the dairy greater if I leave the current cow in the slot, or would the value of the slot be greater if she were replaced today with a new heifer? {Throughout this paper the replacement is referred to being a first lactation heifer. In fact the principle is the same if another mature cow replaces the current cow, providing the comparison is based on the mature cow's attributes.}

The number the dairy manager needs is the value of the slot to the dairy with the current cow filling it, compared to the value of the slot if were immediately filled with a new milking heifer. In financial terms, one wants to know the difference in the net present value of all future profits from the slot from the current cow, minus the net present value of the profit streams into the future of an immediate replacement. Present value concepts are needed because of the time delay in receiving those profits and the unequal quantities in any given year/lactation. Profits are difficult to calculate. As a practical alternative, net income after feed cost and replacement costs can be calculated more easily by modeling the costs of replacement (purchase price minus salvage value), milk production (and therefore revenue) and the cost of feeding for that production in a particular time period. If one accepts the assertion that other costs of having a cow in the slot are independent of which particular cow is in the slot, then the difference in the net present values of income over feed and replacement costs is the same as the difference in profits.

Ultimately, every cow is replaced. The best, healthiest, most productive cow on any dairy will someday reach a point where the value of keeping her on the dairy wanes and a replacement heifer provides more future value in economic terms. Many things in addition to simple aging can shorten the time a cow should profitably remain on the dairy, e.g. mastitis, lameness, failure to conceive or delayed conception, faulty feeding, injury, etc. The best managers minimize those factors that contribute to the premature decline of a cow's economic value by meticulous attention to feeding, careful milking, excellent cow comfort and on-going disease control.

Evaluating a culling program by the "causes" of culling is retrospective at best and is a poor measure of whether the culling decision for a particular cow was made properly. First, culling categories are notoriously arbitrary and inaccurate. Even if a cull is correctly identified as being "caused" by mastitis, for example, the category alone does not provide the information needed to evaluate the correctness of the cull decision. Categorization by "causes" may be useful when the dairy is trying reduce the management faults that lead to damaging the value of cows. It is not correct, however, to assert that a particular dairy in a particular year culled "too many" cows due to mastitis because the percentage is higher than "desired". The culling decisions may have been entirely correct, i.e. the culled, mastitic cows may have lost their value in their slot. What was wrong on the dairy, however, was that the dairy's mastitis control program failed. Using culling as a monitor for health control programs is too little, too late. There are much better monitors for mastitis control, reproduction, youngstock rearing, lameness control, and feeding programs.

There are two types of costs involved in culling a cow: cash costs and economic costs. Cash costs are simple to calculate: price of the replacement heifer minus the salvage value for the culled cow. Cash costs do not accurately reflect the economic impact of a cull, however. At the extreme, consider a decision to cull a ten year old cow making 10 pounds of milk, open, high somatic cell count, and lame. The cash cost is still \$1,100 (e.g. \$1,500 for the replacement minus \$400 for beef). In this case, the economic value

of the culling decision is very large and positive. If the economic benefit of the cull were not positive (including factoring in the cash cost), then the dairy should not cull the cow.

Replacing a cow too soon loses money. Most notably, these culls incur the cost of replacement (purchase minus salvage) sooner than desired. {This paper consistently refers to the cost of bringing in a new heifer as a “purchase”. If heifers are raised on farm, then the “purchase price” can be valued as either the cost of rearing or the value the reared heifer would bring if sold. Of the two, the latter is a better estimate of the heifer’s value. The difference between the two measures of a heifer’s value is a measure of the dairy’s efficiency of heifer rearing. }

There are two types of premature culling:

- a.) Culling a cow before her exit is justified in economic terms. If the future productive potential of a cow is not correctly identified, she may be culled before her value to the dairy declines below the value of replacing her with a heifer. These are true errors in culling.

Culling a cow before the dairy would ideally have liked to cull her. These are usually not errors in culling. Instead they are signals that other management areas need attention so that the potential of cows is not damaged and their value lost prematurely.

Both of these types of premature culling are expensive. The first can be avoided by more careful and more frequent calculation of the value of a given cow in her slot. Improved cow / dairy management avoids the second.

Replacing a cow too late can also lose money. Retaining a cow in a slot beyond the point when the value of the slot is enhanced by a replacement is a decision to retain a comparatively non-productive asset. Keeping a cow because she is “paying her way” (presumably recouping her daily variable expenses for feed and care) is not the same as retaining a cow because she brings more value to a slot than a replacement. In general, cows slated to be culled (open cows, poor producers, etc.) are milked longer than they should be on many dairies. Perhaps the most costly type of mistake in delaying culling is the error of letting a poor first lactation animal stay for a second lactation to “see if she does better”.

It is rarely a good economic decision to cull a cow before her replacement has calved. An empty slot is very expensive; under generally prevailing conditions on American dairies, the lost profit is 2 to 3 dollars per day.

A prospective model for culling

Current culling practices often rely on hunches, or maybe guidelines. The following describes a financial model that can help fine-tune the optimum time of replacement. The model has been built into the dairy management software “DairyCOMP 305” distributed by Valley Agricultural Software, Tulare, California. The results of the model’s calculations are not meant to replace good judgment when making culling decisions, but rather to augment the information available for decision making.

The Model

The model calculates the “productivity net present value” of each cow (Figure 1). Basically, it estimates each cow’s future income (milk production) and expenses (replacement costs and feed costs), then discounts difference in these the cash flows to today. By necessity, the model makes numerous assumptions. Three important ones are:

1. Slots are full – the dairy is at capacity. If not, fill empty slots first.
2. All cows are replaced with the herd’s average heifer – either raised or purchased.
3. Dairy farms will make replacement decisions based on maximum future profit.

Management Questions

There are many herd level (policy) decisions made on a dairy –what is the ration, should young sires be used, what is the BST policy, etc., but there is still much profit involved in decisions on each individual cow each day. Three fundamental questions can be addressed using information from the model.

1. Should this cow be replaced today with a new heifer?
2. If this cow is sick, should she be treated or culled?
3. If this cow is in heat, should she be bred, or should we stop inseminating her?

Cow Value

Cow Value is the expected net present value of income over feed cost (IOFC) and replacement costs compared to similar cash flows of an average replacement heifer in the herd. For each cow currently in the herd, a projection of the income over feed costs (IOFC) for the remainder of the current lactation is calculated. If the cow is not pregnant, the probability of the cow becoming pregnant is calculated, based on the herd’s estrus detection and conception rates. Beyond the current lactation, the probability that a cow will be culled during any given lactation in the future is derived from the inputs to the model, ideally based on the herd’s own culling experience and judgment about the herd’s likely future performance.

As the cow is projected into future lactations, there is a growing chance she will have been culled and replaced by a new heifer. Thus the “cow” in future modeled lactations is not an actual cow, but rather a “mixture” of the cow and a replacement, in proportion to the probability of each actually occupying the slot (see Figure 1). Over time, the cow will fade out of the herd, be replaced, and the replacement too will be proportionately replaced over time. The various productions, IOFC’s and replacement costs of the slot are discounted to their present value for both retaining the current cow and for a heifer replacing her. The difference between the two present values is the value the current cow brings to the slot in comparison to replacing her today.

Over a long enough period, the slot will be filled with a statistical proportion of cows in various lactations, mirroring the herd’s general demographics. This is also true if the current cow is replaced today. When both “futures” in the slot are filled with the same “mixture” of cows, then there is no further difference in the future of the slot. Only the events before that point contribute to the difference between the current cow’s value in the slot versus replacing her. In addition, the impact of cash flow projections for future lactations is diminished because their actual values are discounted to today’s dollars. For both of these reasons, the first several years from today have the greatest impact on the final net present value of the slot.

Cow Factors

For each cow, the model estimates the future IOFC until she is replaced. Thus the model must estimate her future milk production, both for this lactation, and for future lactations. The following factors are used to help estimate the remaining life of this cow (Table 1 shows a typical set of input parameters, Table 2 shows part of the output report for a herd of 500 Holstein cows, showing the cows in the herd with the worst cow values):

- Current milk production
- Current days in milk
- Age (older cows are less likely to have future lactations)
- Reproductive status
- Days carried calf
- Days since last heat, if not confirmed pregnant

Adding health factors to the model would likely have only small effects. Health factors are very important to dairy profitability, but most, if not all, health factors of importance result in decreased production or reduced probability of survival into the next lactation and these are accounted for in the model. From a financial point of view, diseases that have no effect on milk production or longevity are of minor impact. There are exceptions to this generalization, particularly when dealing with the control of contagious diseases, but the approximation is valid for most culling decisions. Cow Value is not a static value for a cow over time. Because production can decline with age and disease, and because the reproductive status of a cow can change (she may or may not be seen in estrus, be bred, be diagnosed pregnant or open) her CowValue can change. In general, CowValue should be recalculated on a frequent (at least monthly) basis.

A cow's CowValue can also be viewed in another way. It is an estimate of the financial loss if the cow is prematurely forced from the herd, e.g. broken leg or incurably lame, never bred, agalactia from severe coliform mastitis, etc.

Herd Factors

Because each cow is always compared to a replacement heifer modeled using herd specific parameters, the model also must be able to predict the performance of the average heifer. This entails estimating her production by lactation, how quickly she will become pregnant, and her chance of being replaced. The following factors must be set for each herd.

- Expected milk production by lactation
- Expected future cull rate by lactation
- Heat detection, conception rate, voluntary wait period
- Heifer cost, cull value
- Feed cost, both for maintenance and for milk production
- Milk price
- Discount rate

A fresh heifer will have a CowValue of approximately \$1,100, (assuming the current replacement cost is \$1,500, and the cull value is \$400). The average CowValue on most dairies is somewhat less than the fresh heifer. This is consistent with most dairymen's implicit understanding that replacement heifers have a higher value (once paid for and calved into the herd) than most currently milking cows. If a cow has a negative CowValue, replacing her would likely be more profitable than keeping her. A potential cull list typically contains cows sorted by CowValue, with the most negative on top (see Table 2). Thus, CowValue can help answer the question: Should this cow be replaced today?

Dairies can use CowValue as an additional tool to determine whether to treat a diseased cow. A cow that is diagnosed with a displaced abomasum that has a CowValue of \$1150 may be more profitable treated than shipped. On the other hand, a cow with a repeat mastitis case that has a CowValue of \$-200 may be an excellent opportunity for replacement.

Pregnancy Value

In addition to calculating a CowValue, a second value is calculated for each cow. If the cow is not pregnant, the model assumes she becomes pregnant today and recalculates her CowValue. PregValue is the change in her CowValue if she were successfully bred today. Typically, PregValue is about \$200 for open cows. That means getting the average cow pregnant is worth \$200. If she is already pregnant, the program models the effect of an abortion today. The average PregValue for a pregnant cow is much higher, typically about \$600 - \$800; the projected loss if the cow aborts.

Regarding the question of whether a cow should be bred, if an open cow has a negative PregValue, it means she would be worth less pregnant than if she remains open. She should not be bred. This derives from the assumption in the model that all pregnant cows are retained for a subsequent lactation. For some cows, pregnancy and retention have a negative value, compared to replacing her with a new heifer. Her current CowValue would increase once she is flagged as a "Do Not Breed" (DNB) cow in the program. This makes sense - it is sometimes a profitable decision to flag a cow as a DNB cow. Note that a cow flagged as DNB may still have a positive CowValue until her milk production decreases below that cull/cutoff value.

Practical Application of the Model

For the model to be useful, the dairy must first have accurate, up to date records of production, reproductive status, and current culling rates. Using these as a baseline, the parameters can be edited for the model. Users must be careful not to simply mimic the herd's current numbers in the parameters. The parameters should be a thoughtful prediction of what the future of the herd will be. In particular, the user should be careful not to over estimate the productivity of replacement heifers, milk price, or longevity in the herd. Once the model calculates CowValue for each cow, a list can be prepared of all cows with a negative cow value, ranked from worst to best. The list is not a verdict; it is only an indictment. The manager must then consider each cow as an individual case and make a judgment about her value in the herd. For example, a newly calved heifer recovering from LDA surgery may currently have a low CowValue based on limited production data. Certainly the manager should not cull her immediately. Instead, he should wait to determine her productive status in a few months and then evaluate her again. At the other end of the scale, a high CowValue cow that has just been diagnosed with clinical Johnes

disease should be culled. In practical application, cows in the first 60 days of lactation are typically not listed on the report of potential culls. The reliability of milk production projections at that early stage of lactation are unreliable enough that they are a risky basis for a culling decision.

Finally, the model is just that, it is a model. The parameters used are subject to change, the probabilities are estimates, and the projection of economic conditions is fraught with uncertainty. No one should cull based on the results with a slavish devotion to the last decimal place. There is probably no certainty that the difference between a cow with a CowValue of \$600 and one with \$700 is exactly \$100, but both cows are likely to be more valuable than a cow with a CowValue of \$400.

Practical Conclusions

A dairy farm should always be operated at capacity.

This capacity may be obvious, as in a stanchion barn, or may be less clear, in a free-stall or dry lot. This optimum capacity may even vary with different environment/season and prices. The lost profit from having one empty stall is very large (typically \$600 to \$900 per slot per year). The major incremental (marginal) costs of an additional cow are purchase price, some “cow care costs”, feed costs, and perhaps additional marginal labor. For practical purposes, most of the overhead costs (labor, mortgage, utilities, etc) are the same whether the slot is occupied or not. The incremental income is essentially the milk production. Under current prices, a new heifer has usually returned her investment well before the end of her first lactation.

Not running the dairy at capacity due to financial constraints means lost profit. It usually means that a lender has erred, as the incremental profit from the additional cow will help the dairy pay back their other loans. There are very few investments on a dairy that have that payback potential.

It is certainly possible to overcrowd a dairy to the detriment of profit. There are extreme examples where selling a significant number of cows caused more total milk production! Each dairy should estimate their optimum capacity on a semi-annual basis.

Maximizing the profit at each slot maximizes the profit on the dairy.

Once each slot is full, the next goal is to maximize the profit from each space. This approach requires comparing the feed costs and milk income between the current cow and her potential replacement. For practical purposes, the maintenance costs of these two cows are similar (accepting some minor effects of growth and weight loss/gain). It then becomes necessary to estimate marginal feed cost. This is the average incremental cost to feed a group of cows that produce an additional 100 pounds of milk. It does not include the maintenance feed which she consumes regardless of her milk production.

Diseases cost dairies money.

Diseases incur costs in a number of different categories: decreased milk production, decreased milk sold, treatment costs, labor, drugs, decreased reproductive performance, and premature replacement. As

a general rule most reasonable investments in disease control are justified. The cost of disease for a dairy's average cow is small in comparison with the cost of an empty slot.

Last year's culling is a poor method of monitoring herd performance.

It is already established that diseases cost dairies money. Premature culling is only a portion of that loss. Appropriate surveillance systems should warn the dairy of problems long before the cows actually leave the herd. The situation is similar for reproduction. A dairy (or consultant) that needs to wait until cows actually leave the herd to recognize reproductive failure is not utilizing appropriate monitoring techniques. But most important, the culling records from last year should never be used to make a decision about the culling of an individual cow. No dairy should ever say, "Since I culled too many cows for mastitis last year, I guess I will start keeping more of these low-producing, high-SCC, chronic-mastitis cows."

Longevity can decrease replacement costs, but profit is more important.

Replacement costs in the U.S. are currently very high – more than \$1000 above cull prices. If the average cow is productive for 3 years, it costs the dairy \$1.65 per day to pay the replacement costs; if she is kept two years, it costs \$2.40 per day. At current feed and milk prices, paying this replacement cost requires slightly more than 12 pounds of production per day. In simplistic terms, if a replacement would average more than 12 pounds per day over the next three years compared to retaining the current cow, she will pay off the cost of replacement. It appears many dairies keep cows in an attempt to reduce culling and increase longevity when replacing them would be more profitable.

A nearly 40% "cull" rate is likely with excellent reproductive, heifer, and health management.

With good reproductive performance (13 month calving interval), and an excellent heifer program (little death loss, 23 month age at freshening), approximately 40% of the herd will have female offspring that survive to calve. Those replacements will be entering the herd two years later. This means that about 40% of the herd will need to be sold each year. The dairy has the choice between the next springing heifer, or the least profitable cow. Some dairies will elect to sell the worst cow; others will sell these "excess" heifers. Carefully considering the financial implications of the choices will help dairy farms make the correct decision. Remember, some cows that should be culled on excellent dairies should still be sold for use as dairy animals on poorer dairies. Not every cow leaving a dairy needs to go to slaughter.

The culling rate for a dairy will depend on the current and projected future economic climate

Looking out over the next year or so, if milk prices are projected high (slaughter prices are high, feed prices are low, heifer prices are low) the dairy should cull more aggressively. Conversely, when milk prices are low, fewer cows have poor enough financial value to warrant the cost of replacement. Working with the model in many herds shows that production and milk price are the most powerful drivers of the finances of culling. Reproductive performance also matters, because it contributes significantly to the risk that the cow will leave the herd earlier than desired. The cash cost of replacement (purchase of a heifer minus salvage value of the culled cow) has an impact, but it is not as important. As an example, if the

average new heifer costs an additional \$200 in cash costs and survives in the herd for three years, it only takes about 2 additional pounds of milk production per day to cover the added costs.

Cows that are known culls (e.g. open late in lactation or poor udder conformation) should leave at higher milk production levels (typically around 20 pounds below herd average production) than cows that will be retained should be dried off.

The model calculates a cull milk production level, below which the cow should be replaced. Keep in mind that the exiting cow should not be replaced until the replacement animal has calved and is ready to fill her slot. Empty slots are expensive. In contrast, cows that will be retained for another lactation in the herd should probably be milked to lower levels of production, as long as they are not displacing a new animal from entering the milking string.

The profitability of replacing a current cow is independent of the dairy's desire to add cows. Culling and expansion are different issues.

The decision to expand herd size (either by constructing new facilities or by filling existing empty slots) does not affect the profitability of replacing current cows whose value to the dairy has diminished below the value of a replacement. This is a very common confusion in the dairy industry, with dairies often retaining poor cows with the justification that they are expanding herd size and prefer to keep any animal that is milking. In fact, there are two different issues involved. The first issue is the question of filling all available slots on the dairy. As noted above, this is a priority for any dairy, whether they are building new facilities or simply optimizing the use of existing ones. The second issue is the value of cows within those slots. In financial terms, a cow with a poor value should be culled and replaced. On some dairies, limits on financial resources or the speed with which new animals can be introduced may constrain the manager to choose between adding an additional cow and replacing a poor one. Given that there is a limitation on available cash for purchasing new animals, adding the extra cow is generally the better choice. Even better would be for the manager and lender to re-evaluate the constraint on capital for replacements. Making more money available to the dairy for replacements may increase farm profits and enhance the dairy's ability to service its entire existing debt.

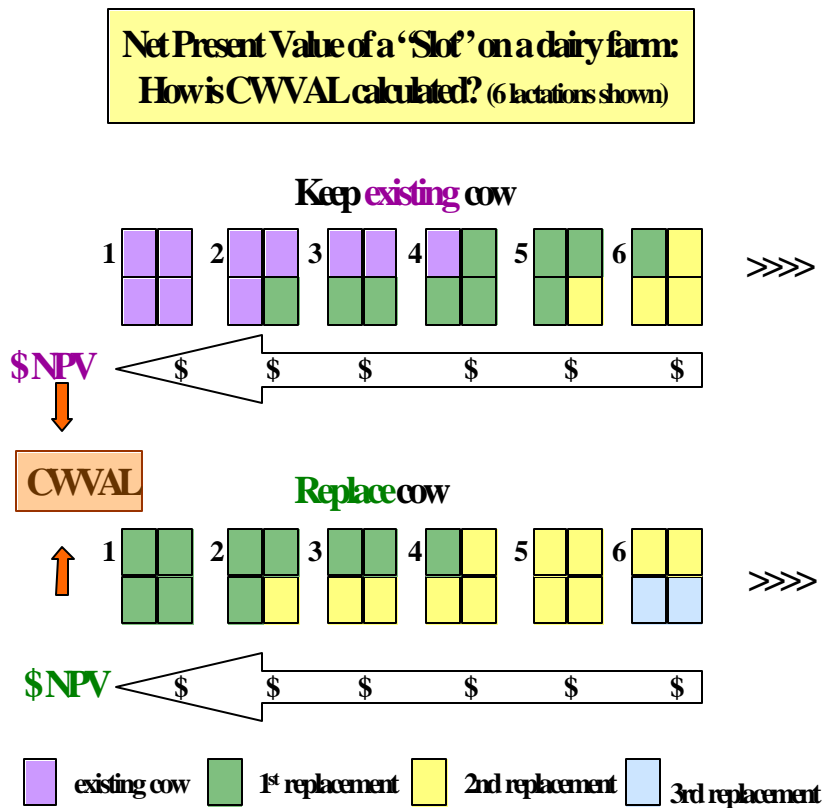
Conclusion

Culling and the associated costs on a dairy are a major component of operating costs. These decisions (as well as decisions about treatment and breeding) should be driven by the economic value that the individual cow brings to her place on the dairy. Newer models can help calculation those values and provide practical information for dairy managers.

Table 1: Typical herd input parameters for the CowValue model in DairyCOMP 305

Pregnancy Rate	0.20	Lact 1 305 Milk	22000
Conception Rate	0.40	Lact 2 305 Milk	24000
Heat Detection	0.50	Lact 3 305 Milk	26000
VWP	60	Lact 1 CullRate	0.33
Average Days open	130	Lact 2 CullRate	0.33
		Lact 3 CullRate	0.50
Heifer Cost	1600	Lact 4 CullRate	0.50
Cull Value	400	Lact 5 CullRate	0.99
		Lact 6 CullRate	0.99
Milk Price/cwt	13.00	Lact 7 CullRate	0.99
Marginal Feed	3.00	Lact 8 CullRate	0.99
Maint. Feed/day	1.50	Lact 9 CullRate	0.99
Discount Rate	0.10		

Figure 1: Schematic model for calculating CowValue



What is it worth to add cows?

22-Mar-02

Example Dairy

\$
814 **total additional profit per year**

1 number of cows added (cows that survive well into their first lactation)

\$ **profit per year from one added**
814 **cow** **\$** **3.70 profit margin per cwt**

\$3.70 profit per hundredweight of added production from added cows

\$
3,142 **revenue per living cow per year**

\$ milk
3,080 revenue

22,000 average annual milk production
\$ 14.00 milk price net of hauling and marketing (mailbox price)

\$ 62 income from value of the average liveborn calf

\$ 75 average price of living calf

10.0% stillbirth rate

13 average calving interval (months)

\$ **per cow total marginal operating costs per year, cow cost, and capital**
2,328 **additions**

\$ **breakeven milk price to support additional**
10.30 **cows**

marginal operating costs per living cow per
1,724 year

5% percent feed wastage
\$ 460 maintenance feed costs per year

\$ 1.20 maintenance feed cost per day
average dry days per
60 year

305 average milking days per year
\$ 647 feed cost for milk production per year

22,000 pounds of milk per year
\$ 0.028 price of feed per pound of marginal milk

\$ 618 annual variable non-feed costs per **marginal** cow

	\$	
	100	BST
	\$	
	60	veterinary and medical
	\$	
	25	DHIA
	\$	
	30	breeding
	\$	- manure management costs per cow
	\$	- utilities, fuel
	\$	
	40	bedding
	\$	
	50	supplies
	\$	- other
	\$	
	313	labor: based on marginal cost for labor per cow
	\$	25,000 labor costs per employee
		80 cows per employee

\$ 604 economic cost of purchasing the cow and facilities (per year) cost per day

annualized payment to purchase	
604 cow	\$ 1.65

1,902	total investment in added cows
9.0%	cost of cow loans (interest rate per year)

1,902	effective purchase cost of a productive heifer
\$ 1,700	purchase price of the new heifer
\$ 100	pre-fresh carrying costs of a new heifer
5%	% heifers that don't enter milking string
1	months before culling those heifers

\$ 360	effective salvage value
\$ 400	cull price when sold
10.0%	probability of the cow dying on the dairy
3.0	average life span of a cow (years)
33%	average annual cull rate

cost per day

\$ - annual cost per cow for facilities \$	
	1 number of cows
	10% interest rate
	10 years on mortgage
	- total non-cow capital additions
	- freestall building (structure, electric, plumbing, etc.)
	- freestall equipment (dividers, waterers, etc.)
	- manure system and permitting walkway / alley / etc.
	- special needs barn
	- renovations / alterations
	- land (is this really needed??)
	- farm equipment (scrapers, tractors, loaders, etc.)
	- parlor modifications
	- other

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Table 2:

DairyCOMP Report

LIST ID LACT DIM MILK ME305 RPRO CWVAL PGVAL FOR CWVAL<-200
DIM>60 BY CWVAL

ID: cow identification #

Lact: cow's lactation number

DIM: days in milk (days since calving)

MILK: milk production at the last test day (pounds)

ME305: mature equivalent milk production (a standardized measure of production)

RPRO: reproductive status

CWVAL: cow value (compared to an average replacement heifer)

PGVAL: change in the cow's CWVAL if her known pregnancy status changes

ID	Lact	DIM	Milk	ME305	RPRO	CWVAL	PGVAL
1667	1	84	8	6130	BRED	-973	-336
1701	1	67	11	6690	OK/OPEN	-903	-202
1703	1	75	32	11370	BRED	-903	-107
1716	1	92	57	17050	BRED	-883	-64
559	4	104	24	7480	BRED	-863	-223
609	3	143	8	4160	BRED	-837	-485
1243	2	115	16	7160	BRED	-834	-411
1066	2	79	73	18190	BRED	-796	350
1082	2	74	24	10930	BRED	-796	-10
1305	2	109	57	14610	BRED	-770	423
1665	1	125	35	11550	BRED	-769	264
348	7	145	11	7980	BRED	-741	-258
1213	2	110	59	16190	BRED	-705	450
923	2	207	32	13190	PREG	-696	-367
2	6	106	73	19530	BRED	-682	467
1249	2	125	24	11610	BRED	-644	493
919	2	138	62	18290	PREG	-596	17
583	4	206	14	9660	BRED	-580	-534
779	3	170	19	7630	BRED	-569	-434
973	2	170	49	14110	BRED	-546	361
673	6	248	22	14170	BRED	-531	-430
627	4	208	38	15450	BRED	-518	-399
1405	1	334	3	15490	BRED	-507	-170
218	5	286	38	13250	PREG	-464	-135
1079	2	147	38	11980	OK/OPEN	-461	-446
1514	1	242	27	15160	BRED	-441	467
839	3	129	35	14400	BRED	-437	770
1614	1	167	54	20300	BRED	-437	701
1058	2	168	49	13930	BRED	-435	102
960	2	131	124	32120	BRED	-431	750
1219	2	70	76	19580	FRESH	-422	684
874	2	325	54	19330	BRED	-376	376
660	4	122	95	20760	BRED	-331	335
191	6	226	19	12560	PREG	-331	-2
488	4	421	27	17380	BRED	-329	292
628	3	279	49	19840	OK/OPEN	-329	135
629	3	318	35	15810	BRED	-329	-76
672	6	269	32	19860	OK/OPEN	-329	-288
833	2	409	19	28000	BRED	-329	1090