WHAT IS THE VALUE OF GETTING A COW PREGNANT?

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Summary

The value of getting a cow pregnant is the same as the economic loss if the cow fails to get pregnant at a breeding opportunity compared to if she does get pregnant. This economic loss is the difference between the expected economic return if the cow gets pregnant and the expected economic return if she fails to get pregnant. Many factors affect the expected economic return. Important are milk production, pregnancy rates, and prices.

I created a computer program to put the effects of all these factors together to calculate the economic loss from failure to get pregnant. This computer program was used for a typical situation in Florida with seasonality in milk production and pregnancy rates. The results show that the economic loss from failure to get pregnant is the highest in the winter and spring. This is so because milk production and pregnancy rates are the highest in this time of the year. Higher pregnancy rates reduce the economic loss because the open cow is expected to get pregnant sooner. Also, the economic loss is higher for cows that are later in lactation. However, entering the summer and fall months reduces this loss. Finally, how long we keep breeding open cows has a significant effect on the economic loss. We need more study to find the most profitable culling policy for open cows.

Introduction

In general, dairy cows need to get pregnant at the best time in their lactation to maximize their economic return. At every breeding opportunity, the cow either gets pregnant or fails to get pregnant. Typically, failure to get pregnant has been associated with economic loss. The question then is what the difference is in economic return between getting a cow pregnant at a breeding opportunity versus failure to get her pregnant at that time. The difference is the value you can spend to make sure the cow gets pregnant at that breeding opportunity instead of later.

Many attempts have been made in the past to estimate the economic loss from failure to get pregnant. Typically, this economic loss has been expressed as the cost per extra day open.

There is a large variation in the estimated cost of an extra day open. In the literature these cost range from almost nothing to at least $5 per day. The large variation in the estimates of the cost of an extra day open is primarily the result of differences in prices, pregnancy rates, culling policies, milk production, seasonality, feed intake, days open, and calculation method. Sometimes rather simplistic calculations are made that do not consider the important factors far enough into the future.

The economic loss from failure to get pregnant is also determined by the time it takes to get the cow pregnant in the future after a failure. For example, if the cost of a day open is $2, and a cow that fails to get pregnant is expected to get pregnant 60 days later, then the economic loss from failure to get pregnant is 60 * $2 = $120. However, if it takes on average 90 days to get the cow pregnant, then the economic loss is 90 * $2 = $180. The time it takes to get pregnant in the future depends on the pregnancy rate.

Breeding a cow to get her pregnant is an investment in her. The economic loss from failure to get pregnant can, and probably should, be analyzed using proper methods for analyzing investments. The best-known method compares the net present value of the estimated future cash flows for both the case that the cow gets pregnant and fails to get pregnant. This method will now be explained.

Comparing Future Cash Flows

A simple example

There are three basic steps to find the economic loss of failure to get pregnant:

1) Calculate two series of future cash flows: one for if the cow gets pregnant at the breeding opportunity and one for if she does not.
2) Calculate the net present values of both series of cash flows. This is the sum of the present values of the cash flows per period.
3) The difference in net present value is the economic loss from failure to get pregnant.

First, let's go through a simple example of these steps. The data used in this example are shown in table 1 and are made up. Let's assume that if the cow gets pregnant, the expected cash flow in year 1 is $500, in year 2 is $510, in year 3 is $450 and in year 4 is $680. These cash flows are the difference between estimated yearly receipts and expenses. Receipts are for example milk sales and calf sales, and a one-time cull sale at the end of the cow's stay in the herd. Expenses are for example feed cost, labor cost, and breeding cost. Only receipts and expenses that are different at some point in the future because the cow gets pregnant or not need to be included.

The estimated cash flow for if the cow fails to get pregnant is $510 in year 1, $470 in year 2, $430 in year 3, and $680 in year 4. These cash flows depend on if and when she is expected to get pregnant in the future.

Table 1. Simple example to calculate the economic loss from failure to get pregnant at a breeding opportunity.

	Year 1	Year 2	Year 3	Year 4	Sum
Cow gets pregnant at breeding opportunity					
Estimated cash flow	$ 500	$ 510	$ 450	$ 680	
Present value @ 8%	$ 463	$ 437	$ 357	$ 500	$ 1757
Cow fails to get pregnant at breeding opportunity					
Estimated cash flow	$ 510	$ 470	$ 430	$ 680	
Present value @ 8%	$ 472	$ 403	$ 341	$ 500	- $ 1716
Economic loss from failure to get pregnant:					$ 41

The next step after the cash flows are determined is to calculate the present values of the cash flows in every year. The present value of some earning in the future is what that earning would be worth to you today. For example, making $100 next year is not as valuable as making $100 today, because you could put the $100 made today in the bank and earn interest for a year. If the bank pays 8% interest, then putting $100 in the bank today is worth $100 * (1 + 0.08) = $108 one year from now. Similarly, the present value of $100 made one year from now is $100 / (1 + 0.08) = $92.58

today. So at 8% interest, the present value of making \$92.58 today or \$100 one year from now is the same. In general, the present value (PV) of a future cash flow (FV) is calculated as $PV = FV / (1 + i)^t$ where i is the interest rate per period and t is the number of periods in the future. For this formula it must also hold that interest is paid after each period.

In the example of table 1, the present values of the future cash flows are calculated for periods of one year each. At 8% interest, a \$500 cash flow one year from now is worth \$500 / 1.08 = \$463 today. Similarly, a \$680 cash flow 4 years from now is worth \$680 / 1.08^4 = \$500 today.

The third step is to compare the sum of the present values of the two series of cash flows. This is the net present value of the cash flows. Because all future cash flows are converted to their value today, they may be summed up. In table 1, the net present value after getting pregnant is \$1757 and after failure to get pregnant is \$1716. The difference is \$41 in favor of the success of getting pregnant. In other words, the economic loss due to failure to get pregnant is \$41. But remember, these data were made up.

Considerations for More Realistic Calculations

The three basic steps in the simple example above apply also when we want calculate the economic loss from failure to get pregnant at a breeding opportunity more realistically. The main challenge is to realistically estimate future cash flows resulting after both success and failure to get pregnant.

Important factors that contribute to future cash flows are the shapes of lactation curves, pregnancy rates, feed intake, cull rates, and prices for milk, feed, breeding, calves and replacements. Under conditions in Florida, the seasonality of milk production and pregnancy rates should also be included. A calculation that takes these factors correctly into account is already rather complex. Therefore, I developed a computer program to put all these factors together. The program calculates cash flows per month for several years into the future and does the present value calculations.

The calculations are even more complex because the future is not certain. Uncertainty is considered in this computer program in the time when the cow will get pregnant (again) and when she will get culled. To take this correctly into account, a little bit of chance calculations is needed.

Table 2. The chance of being open, getting pregnant, or being pregnant in eight future months. The chance to get pregnant per month, if the cow is open, is 0.20.

Months into the future	Chance of being open at beginning	Chance of getting pregnant in certain month	Chance of being pregnant at end
1	1.00	1.00 * 0.20 = 0.20	0.00 + 0.20 = 0.20
2	1.00 – 0.20 = 0.80	0.80 * 0.20 = 0.16	0.20 + 0.16 = 0.36
3	1.00 – 0.36 = 0.64	0.64 * 0.20 = 0.13	0.13 + 0.36 = 0.49
4	1.00 – 0.49 = 0.51	0.51 * 0.20 = 0.10	0.10 + 0.49 = 0.59
5	1.00 – 0.59 = 0.41	0.41 * 0.20 = 0.08	0.08 + 0.59 = 0.67
6	1.00 – 0.67 = 0.33	0.33 * 0.20 = 0.07	0.07 + 0.67 = 0.74
7	1.00 – 0.74 = 0.26	0.26 * 0.20 = 0.05	0.05 + 0.74 = 0.79
8	1.00 – 0.79 = 0.21	0.21 * 0.20 = 0.04	0.04 + 0.79 = 0.83

Suppose for example that the chance of getting pregnant is 0.20 in every month. Then an open cow has a chance of 0.20 to get pregnant in the first month and a 0.80 chance that she will remain open. Her chances of getting pregnant in the second month are again 0.20, but only if she did not get pregnant in the first month. In reality we don't know if she gets pregnant in that first month, so her chances of getting pregnant in the second month also depend on the chances of not getting pregnant in the first month. Our prediction of her chance to get pregnant in the second month is then 0.20 * 0.80 = 0.16. Her chance to get pregnant in the third month, while we don't know if she got pregnant in the first or second month, is similarly 0.20 * 0.80 * 0.80 = 0.13. There is a 0.49 chance that the cow is pregnant after three months. Table 2 shows these calculations for eight months into the future. The average time it takes to get pregnant is simply 1 / 0.20 = 5 months in this example.

Future cash flow estimates depend for a big part on when the cow will get culled. I assumed that a cow has the same basic chance to get culled every month, because no good seasonal culling data for Florida were available. I also assumed that an open cow will be culled for sure after she has been open for a certain time, for example for 16 months. Remember that there is always some chance that the cow remains open this long. Furthermore, I assumed that a springing heifer immediately replaces a cow that is culled. The future cash flows from the heifer must be considered too, because the moment that the heifer enters the herd is affected by the initial cow getting pregnant or not.

Another factor that needs to be determined is for how far in the future we need cash flow estimates. For example, is one year enough or do we need estimates for five years? The answer is that we need to look as far in the future as the cash flow estimates are affected by getting the cow pregnant or not at the breeding opportunity considered. After that point all cash flow estimates farther into the future are the same. This means that we can ignore them for our comparison. Uncertainty about the more distant future is the main reason that cash flow estimates must at some point be considered the same. Also, converting future cash flows to present values implies that cash flows farther in the future have less impact than more current cash flows. Figures 5 through 8 will show for how far into the future we need cash flow estimates.

Important Factors That Affect Cash Flow Estimates in Florida

Milk Production

Future milk yield has obviously a large effect on future cash flow estimates. Lactation curves by month of calving were calculated for first and later lactation cows from more than 1.3 million recent test day yields of Florida DHIA herds. Figures 1 and 2 show these lactation curves for cows in their first and later lactations. The figures show similar trends, but the seasonality is greater for older cows. For cows in their first lactation, the highest peak milk yield is realized from calvings in December (67 lbs). Milk yield from cows calving in June and July peaks at about 59 lbs in December and January. Peak milk yield for older cows is over 80 lbs per day for calvings early in the winter, but is less than 70 lbs for calvings in June and July. These seasonal effects result in significantly different cash flows for calvings in the winter versus calvings in the summer.

The average milk yield per day was calculated for up to 20 months in milk. The number of test day milk yields available decreases sharply in those later months of lactation because most cows have entered their next lactation or have been culled. The average milk yield in months 17 - 20 (called Average for now) was calculated for each lactation curve. Then milk yields for months 17 and later were predicted as Average – (month – 17) / 10 * Average. For example, in month 21 the milk yield prediction is Average – (21 – 17) / 10 * Average = 0.6 * Average. An estimate of milk yield in prolonged lactations is necessary for cash flow estimates when cows keep failing to get pregnant and are not culled for being open.

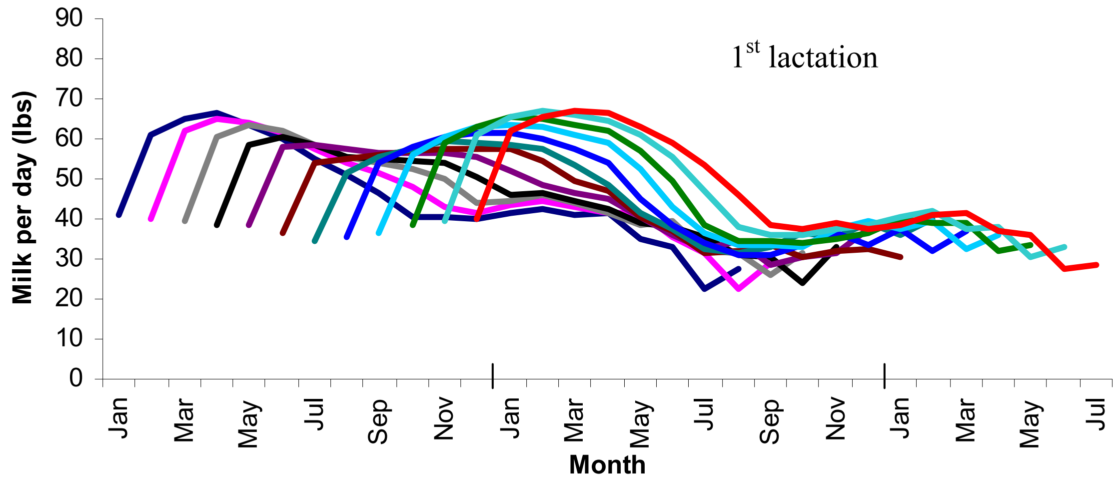

Figure 1. Average milk yield per day for lactations starting in every month of the year. The first 20 months for cows with lactation number 1 are shown.

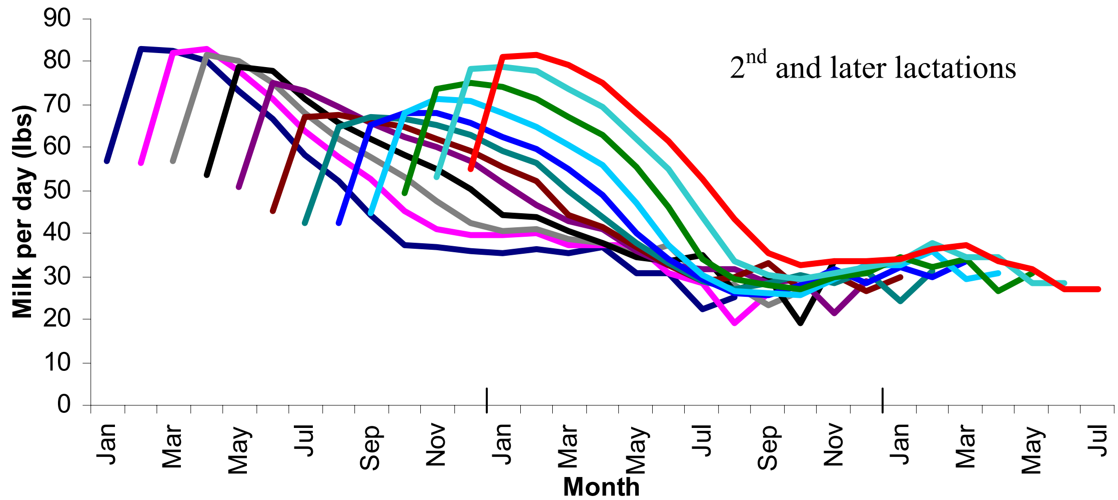

Figure 2. Average milk yield per day for lactations starting in every month of the year. The first 20 months for cows with lactation numbers ≥ 2 are shown.

Pregnancy Rates

Future pregnancy rates are important for two reasons. First, they determine the chance of pregnancy in the same lactation if the cow fails to get pregnant. Secondly, cows that get pregnant will likely calve and have a chance of pregnancy in the next lactation. Of course, the timing of pregnancy determines for a major part the estimated milk yield and thus cash flows in the future. Thus pregnancy rates have a major effect on future cash flow estimates.

Average pregnancy rates per month of the year were taken from the DHI-202 (12-2001) Herd Summary for Florida state averages based on 104 herds, including private herds. Figure 3 shows these pregnancy rates. The pregnancy rates in November and December were estimated. Clearly, pregnancy rates in the summer are quite a bit lower than in the winter and spring. The average pregnancy rate of 0.094 means that on average only about 9 out of 100 breeding opportunities resulted in a pregnancy.

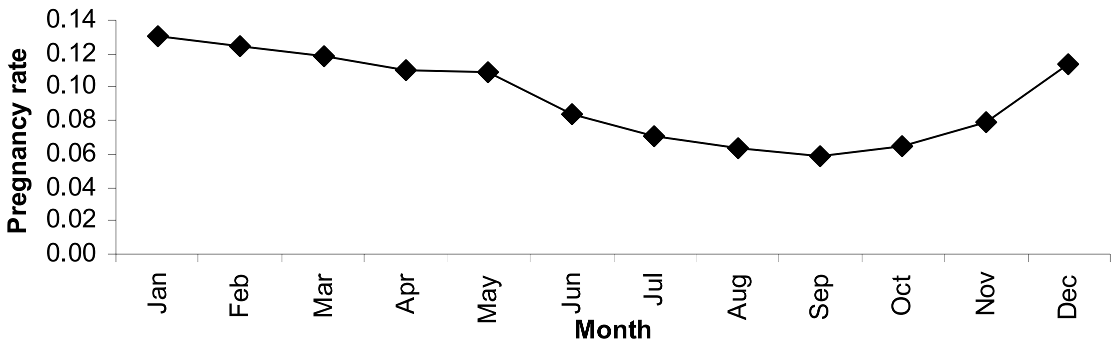

Figure 3. Average pregnancy rates in various months of the year from Herd Summaries DHI-202 (12-2001) for Florida state averages, including private herds. Pregnancy rates in November and December were estimated.

Future cash flows in this paper are calculated per month. That means that the average chance of getting pregnant in a certain month, if the cow is open, is the pregnancy rate in that month times 30.5 / 21 = 1.45. The 30.5 is the average number of days in a month and 21 is the average estrus cycle length. So there are on average 1.45 opportunities to get pregnant every month. For example, if the pregnancy rate in January is 0.13, then her chance to get pregnant in January is about 0.13 * 1.45 = 0.19 if she is open and we have no other information about when she was previously in estrus.

The pregnancy rates in figure 3 are used to calculate relative pregnancy rates. For example, the average pregnancy rate in figure 3 is 0.094 and the pregnancy rate in July is 0.071. Then the relative pregnancy rate for July, compared to the average, is 0.071 / 0.094 = 0.75. So the chance to get pregnant in July is only 75% of the average chance for the year. Relative pregnancy rates are helpful when the level of pregnancy rates is varied, but the seasonal effects are kept the same.

Table 3. Relative pregnancy rates calculated as pregnancy rate in the month / average pregnancy rate for the year from figure 3.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.39	1.33	1.26	1.17	1.16	0.89	0.75	0.67	0.62	0.70	0.85	1.21

Another important factor for future cash flow estimates is the relationship between pregnancy rate and days open. Figure 4 shows pregnancy rates by days open from PC-DART report 106 for six Florida farms with reference date 12-31-2001. The average pregnancy rate between 61 and 81 days open is 0.0983. This is quite similar to the average pregnancy rate of 0.094 from the DHI Herd Summary.

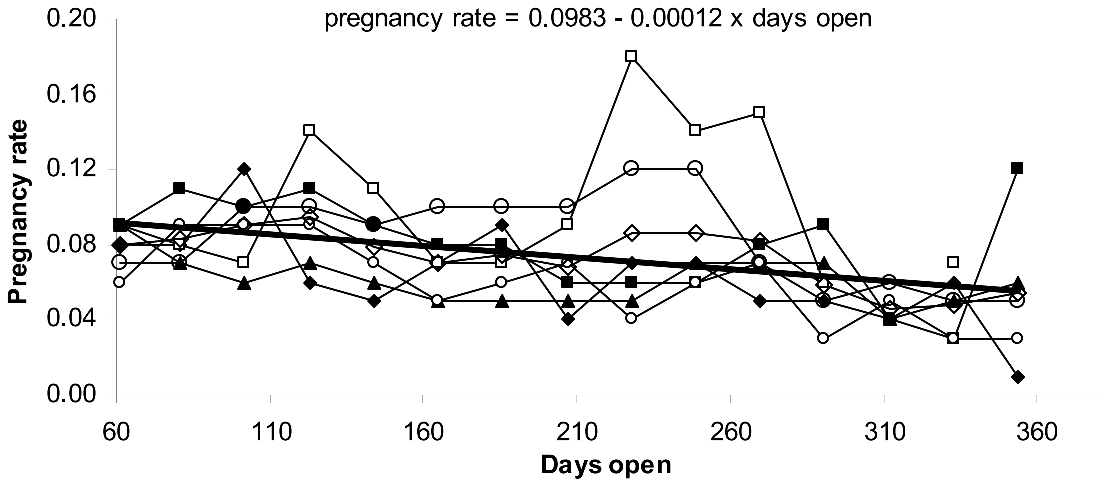

Figure 4. Average pregnancy rates by days open for six Florida herds (PC-DART report 106). The estimated average pregnancy rate at a certain days open is 0.0983 – 0.00012 * days open.

The regression line shows that the pregnancy rate decreases with the number of days open, but this decrease is only 0.01 pregnancy rate per 83 days open (0.01 / 0.00012). So, without any further information about why the cow is open, there is still a reasonable chance to get her pregnant later in lactation.

The pregnancy rate in a certain month in the year (from figure 3) and for a certain number of days open (from figure 4) is combined as follows:

Pregnancy rate = (initial pregnancy rate – 0.00012 * days open) * relative pregnancy rate

The pregnancy rate in a certain month thus depends on the initial pregnancy rate, the days open, and the season. The initial pregnancy rate will be set to 0.1, 0.2, or 0.3 to see the effect of different levels of pregnancy rate on the economic loss of failure to get pregnant at a breeding opportunity.

Other factors that may affect pregnancy rate over time, such as the level of milk production, were not included in the calculations. Embryonic mortality or abortion was not considered.

Other Factors That Affect Future Cash Flow Estimates

Future feed cost is strongly related to future dry matter intake. Dry matter intake is calculated according to the NRC equation for lactating Holsteins (NRC 2001, page 4). Assumptions in this equation are 1212 lbs bodyweight in the first lactation, 1322 lbs bodyweight in later lactations, and 3.3% fat in milk. A dry matter intake of 22 lbs per day for dry cows is used.

Another assumption is that that 50% of all breeding opportunities result in breeding. This is only used to estimate the future breeding cost per month if the cow is open.

The basic chance of being culled is assumed to be 2.5% per month, regardless of the cow's age or reproductive status. However, the cow will be culled immediately if she is open at the end of 16 months in milk. Therefore, the cull rate per month is typically more than 2.5% after 16 months. Every cull results in an immediate purchase of a springing heifer that calves and enters the herd.

Table 4. Basic assumptions for future cash flow calculations.

Chance of culling per month	2.5%	Calf price	$200.00
Milk price per lbs milk	$0.18	Cull price	$500.00
Feed cost per lbs dry matter	$0.09	Replacement heifer price	$1800.00
Cost per breeding	$20.00	Voluntary waiting period	2 months
Initial pregnancy rate	0.10	Interest per year	8%

All the factors for the calculations of the future cash flows in the case of pregnancy or failure to get pregnant are now described. Remember that the difference in the net present value of theses two series of cash flows is the economic loss due to failure to get pregnant.

The computer program can also calculate how long it takes on average to get pregnant in the case of failure to get pregnant at the breeding opportunity considered. The economic loss divided by the average time to get pregnant is the economic loss per extra day open, or the average cost of an extra day open.

Results

A major result that determines the economic loss from failure to get pregnant is the chance that the cow, or her replacement, is open in a certain month in the future. Figure 5 shows the chance of being open or pregnant in 60 months after getting pregnant, or failure to get pregnant, in May of the first year.

Obviously, if the cow gets pregnant in May, then we would expect her to be pregnant in June too. However, there is a 2.5% cull rate per month, so there is a 2.5% chance that the pregnant cow is culled and (we assumed) replaced by a calving heifer that is open in June. Thus the chance that the cow, or her replacement, is pregnant in June is only 97.5%. Similarly, there is a 2.5% chance of having an open cow in June. In July, there is again a 2.5 % chance that the cow is culled and replaced by a heifer that is open the rest of the month. So the chance of having a pregnant cow in July is only 97.5% * 97.5% = 95.1%. In August there is again a 2.5% chance of culling of the pregnant cow and so on.

But more is happening in August. There is a 2.5% chance that the cow is culled in June and replaced by a calving heifer. That heifer also has a 2.5% chance of being culled, and replaced, in every month. In other words, the heifer from June has a 95.1% chance of making it to August. This is her third month after calving and now she may get bred and get pregnant. Her chance of getting pregnant in August is 6.1%. So there is a 95.1% * 6.1% = 5.8% chance of a new pregnancy as a result of culling the first cow in June. In other words, the chance of having a pregnant cow depends on the chance of the cow being pregnant in the previous month and the chance that an open cow gets pregnant. Also, a cow that survives pregnancy for nine months will calve and be open again. The relatively simple examples show that the herd dynamics are quite complex. Fortunately, with the help of a computer program we can keep track of these herd dynamics.

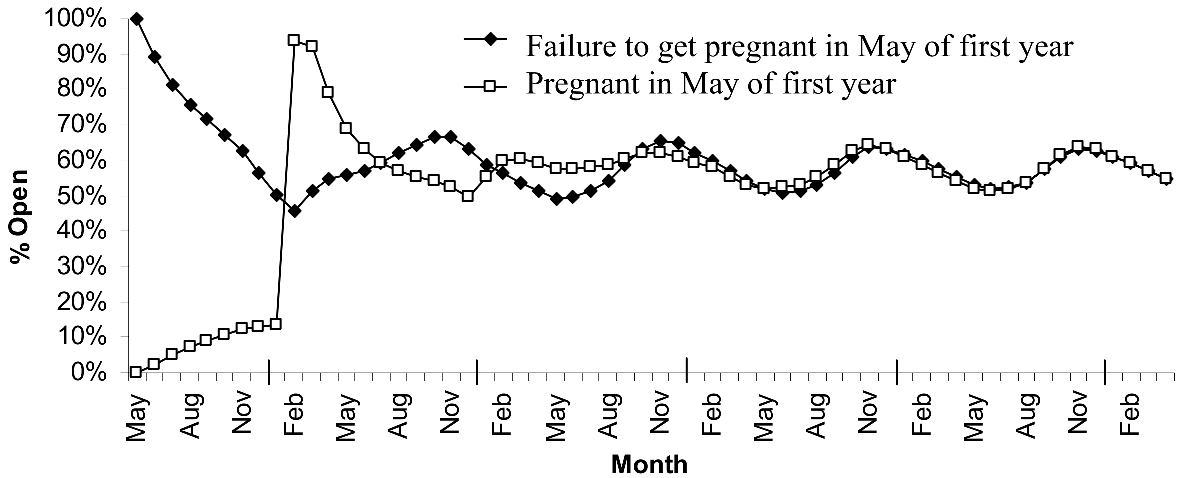

Figure 5. The chance of the cow or her replacement being open for 60 months after getting pregnant in May of the first year (–□–) or after failing to get pregnant in May of the first year (–♦–).

Figure 5 shows that there is a high chance that the cow, or her replacement, that gets pregnant in May, is open in February of the second year. This is the result of calving in February after a nine-month pregnancy. Similarly, if the cow fails to get pregnant in May, then her first chance of getting pregnant is in June. This pregnancy most likely results in a calving at the beginning of March in the second year, and thus increases the chance of the cow, or her replacement, being open in that month.

After a while, the chances of being pregnant or open only depend on the season of the year, and not on the success of getting pregnant in May of the first year. This is the case at the end of the fourth year in figure 5. The future cash flows after this point are the same for both cases and can be ignored because we are only interested in the differences.

The most important, and difficult, step in the analysis is to determine the chances of being open or pregnant in every month in the future. From this we can estimate the milk production, dry matter intake, number of breedings, and so on in every month.

Figure 6 shows the chances that the cow, or her replacement, is milking in every one of 60 months after getting pregnant, or failure to get pregnant, in May of the first year. If the cow gets pregnant in May of the first year, then there is a good chance that she will be dry in December and January. But there is also a small chance that she gets culled and replaced before dry-off.

Finally, it is a small step to calculate the estimated cost and revenue in each month and determine the cash flows. The difference between both cash flow series, after discounting to take the time value of money into account, is the economic loss due to the failure to get pregnant. Figure 7 shows the estimated cash flows in 60 months after getting pregnant, or failure to get pregnant, in May of the first year. Figure 8 shows the sum of the present values of these estimated cash flows. The loss due to failure to get pregnant is the difference at the end, $473.

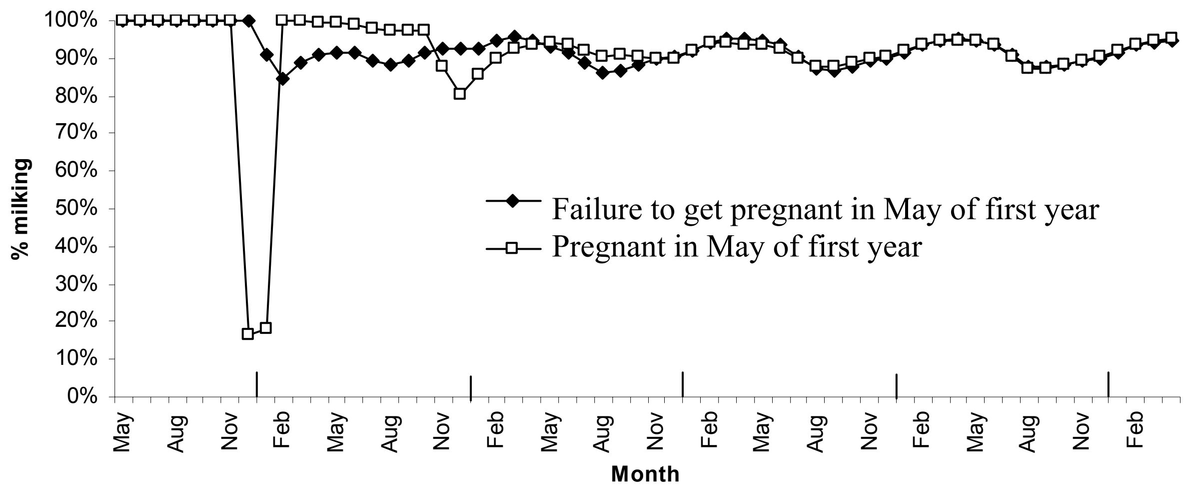

Figure 6. The chance that the cow or her replacement is milking for 60 months after getting pregnant in May of the first year (–□–) or after failing to get pregnant in May of the first year (–♦–).

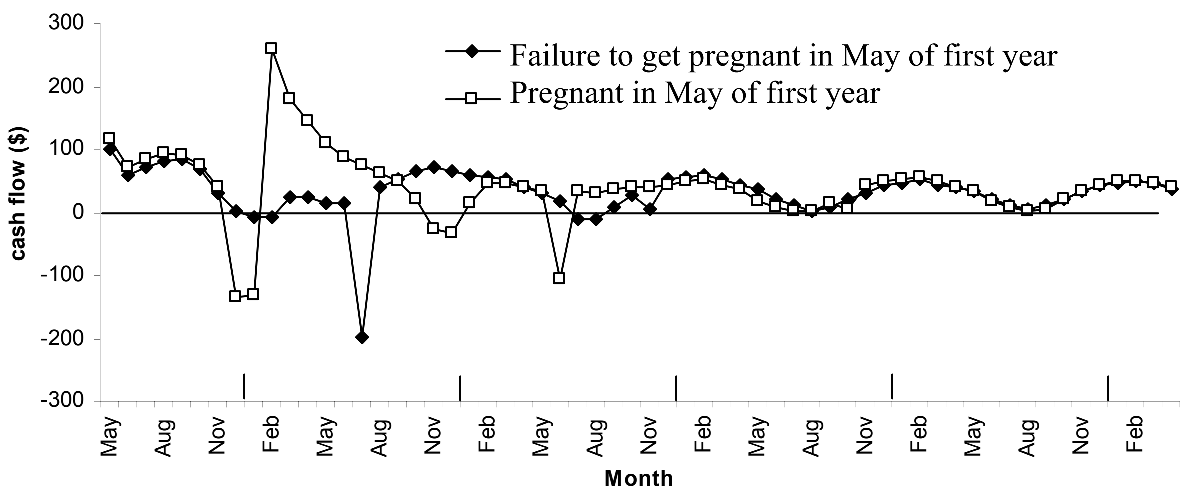

Figure 7. The estimated cash flows in 60 months after getting pregnant in May of the first year (–□–) or after failing to get pregnant in May of the first year (–♦–).

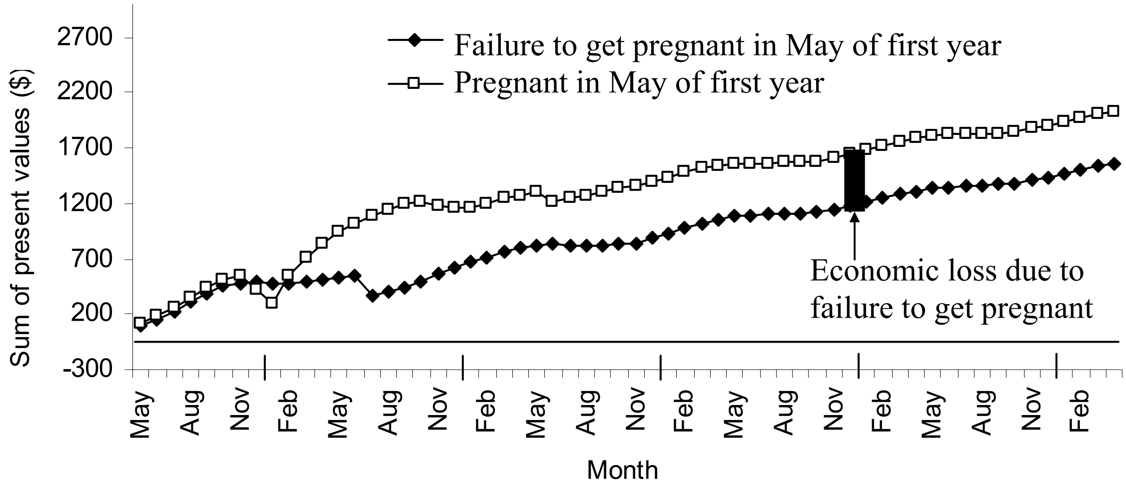

Figure 8. Sum of the present values of the estimated future cash flows in 60 months after getting pregnant in May of the first year (–□–) or after failing to get pregnant in May of the first year (–♦–). The difference in the sum of the present values (█) is the economic loss due to failure to get pregnant in May of the first year. This difference of $473 is fully obtained after about four years.

This loss of $473 may seem high, but remember that the pregnancy rate is only on average about 0.10. There is a 38% chance that the cow will not get pregnant in 16 months in milk and is therefore culled. It takes her on average 162 days to get pregnant after failure to get pregnant in May. The chance that she is culled before pregnancy is not factored in in this time. The average loss per day is then $473 / 162 = $2.92.

Table 5 shows the economic loss from failure to get pregnant in different months of the year and for three levels of initial pregnancy rate. There are several interesting results.

The first important result is that the economic loss is the highest in the winter and spring months. It is more important to get cows pregnant in the winter or spring than in the summer or fall. This is not a surprise if you think about it. If the cow conceives in say March then she will calve and start her next lactation in December when the conditions to produce milk are more favorable. Also, she will be eligible to be bred again in February when her chances of getting pregnant are the highest. This reduces her days open. So she has a reasonable chance to be pregnant through the challenging summer months again. Cows that do get pregnant in the summer will likely reach their peak milk production in the next summer and face the challenge of getting pregnant again in the next summer. This costs money compared to getting cows pregnant in the winter or spring.

Another result is that the loss from failure to get pregnant decreases with higher pregnancy rates. For example, at an initial pregnancy rate of 0.1, the loss from failure in May was $473. With a pregnancy rate of 0.2 this loss is reduced to $308 and at 0.3 the loss is $307. The loss is reduced in all months of the year, but depends on the season. Also, the reduction in the economic loss from 0.2 to 0.3 initial pregnancy rate is less than the reduction in the loss from 0.1 to 0.2. This shows that the marginal value of improving pregnancy rate is the highest when the pregnancy rate is low.

Table 5. Economic loss from failure to get pregnant in various months of the year and by three initial pregnancy rates for the basic situation (first lactation, third month open). Loss and loss per day are in $.

Month	Pregnancy rate 0.1			Pregnancy rate 0.2			Pregnancy rate 0.3		
	Loss	Days	Loss/d	Loss	Days	Loss/d	Loss	Days	Loss/d
January	516	128	4.03	276	87	3.17	118	57	2.07
February	542	136	3.99	346	94	3.68	216	62	3.48
March	549	144	3.81	381	102	3.74	303	68	4.46
April	498	152	3.28	343	110	3.12	311	74	4.20
May	473	162	2.92	308	121	2.55	307	88	3.49
June	410	162	2.53	229	124	1.85	228	93	2.45
July	343	158	2.17	133	122	1.09	100	92	1.09
August	284	149	1.91	55	114	0.48	–6	87	–0.07
September	288	138	2.09	37	103	0.36	–48	78	–0.62
October	291	127	2.29	27	92	0.29	–75	67	–1.12
November	349	120	2.91	80	83	0.96	–39	57	–0.68
December	414	121	3.42	149	82	1.82	4	54	0.07

The third interesting result is that at an initial pregnancy rate of 0.3, the loss in August through November is negative. This means that we expect to make more money down the road when the cow fails to get pregnant than when she gets pregnant in these months. In other words, it pays to postpone breeding in this situation. This result is also not a surprise. The important driver for this result is the high pregnancy rate: the cow has a good chance to get pregnant soon after she fails to get pregnant in these summer and fall months. The result is that it is likely that the cow becomes pregnant in the winter or the spring. As we just saw, these are the more favorable months for milk production and the chance of getting pregnant again. Table 5 shows that the average time to get pregnant after a failure can be less than 60 days in the winter at an initial pregnancy rate of 0.3.

Table 6 shows that the economic loss for cows that are open longer also depends on the season of calving and pregnancy rate. For calvings in January and an initial pregnancy rate of 0.1, the loss remains at about $540 regardless of the number of months open. For an initial pregnancy rate of 0.3, the loss decreases after three months open when less favorable conditions start. For calvings in July, the loss increases with the number of months open (at least through month eight which is March of the next year). This corresponds to better conditions for milk production and conception in the winter and spring.

The economic loss from failure to get pregnant depends, among other things, on the culling policy. Culling in this paper depends on a 2.5% chance to be culled per month in all situations. Additionally, there is a chance that the cow fails to get pregnant within 16 months after calving (the basic situation). Such a cow is also culled. A first lactation cow that fails to get pregnant in the third month after calving has in general about a 65% chance to get pregnant within 16 months after calving when the initial pregnancy rate is only 0.1. At an initial pregnancy rate of 0.3, this chance to get pregnant is more than 92%. As a result, the average cull rate at an initial pregnancy rate of 0.1 is about 44% per year and for 0.3 it is about 30% per year.

Table 6. Economic loss from failure to get pregnant for various months open after calving in January or July, by two initial pregnancy rates for the basic situation (first lactation). Loss and loss per day are in $.

Months Open	January calving				July calving			
	Preg. rate 0.1		Preg. rate 0.3		Preg. rate 0.1		Preg. rate 0.3	
	Loss	Loss/d	Loss	Loss/d	Loss	Loss/d	Loss	Loss/d
2	549	3.81	303	4.46	288	2.09	–48	–0.62
3	544	3.70	323	4.31	338	2.73	–48	–0.72
4	553	3.66	322	3.62	441	4.01	13	0.22
5	540	3.65	257	2.73	544	5.28	80	1.45
6	525	3.78	158	1.68	645	6.52	184	3.17
7	533	4.20	92	1.03	674	7.17	263	4.38
8	562	5.06	68	0.86	711	8.08	363	5.85

The question arises how long one should keep breeding cows that fail to get pregnant. No attempt was made in this paper to determine the optimal culling policy. However, figure 9 shows the effect of maximum months open on the economic loss of failure to get pregnant in the third month of the first lactation. Clearly, the loss is higher when the initial pregnancy rate is 0.1 compared to 0.3.

Interesting is that the loss at a 0.1 initial pregnancy rate is higher for the maximum of 8 or 24 months open, compared to 16 months. The higher loss at a maximum of 8 months is a result of a high culling rate at the end of the 8th month, because only 49% of open cows will become pregnant. Thus, the high cow turn over rate after failure to get pregnant adds to the loss. On the other hand, the higher loss at a maximum of 24 months is a result of breeding open cows too long. The cull rate is low, but the cow has a very long lactation where she spends much time at the low end of the lactation curve.

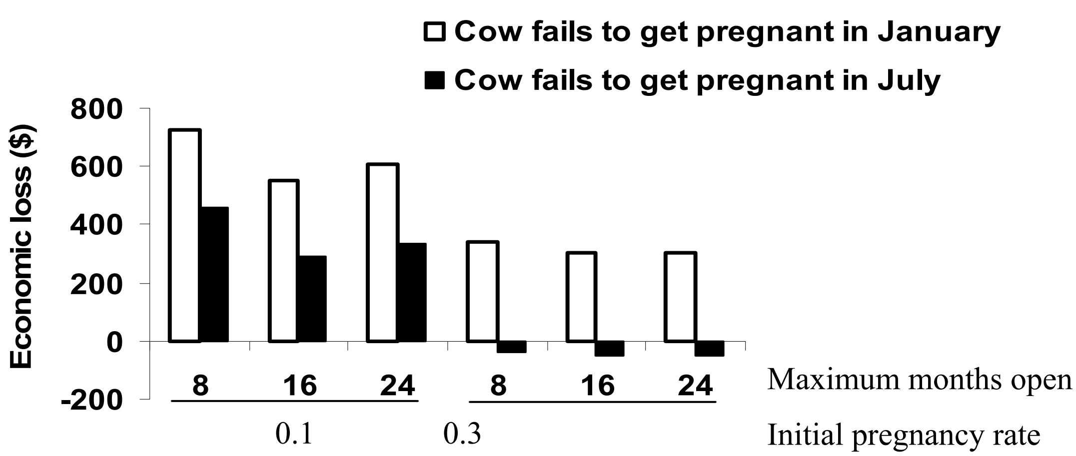

Figure 9. The effect of maximum months open to continue breeding on economic loss. An open cow at end of the maximum months open is culled. Results are shown for a cow in her the first lactation and failure to get pregnant in the third month after calving.

The results from these calculations will be somewhat different for your dairy business. Major factors that determine your loss from cows that fail to get pregnant are your lactation curves, pregnancy rates, and prices. Also, herd constraints such as using the parlor to capacity year round or the availability of replacement animals will affect your true economic loss. However, the concepts and trends in the results are valid for a wide range of businesses and conditions.

Conclusions

The first conclusion is that the economic loss from failure to get pregnant can be estimated using the net present value of cash flows resulting from both success and failure to get pregnant. In fact, this approach is the best method for analyzing any investment opportunity and is worth understanding.

The second conclusion is that the economic loss is higher in the winter and in the spring. If you can be seasonable, it is best to get your cows pregnant in the winter or the spring.

The third conclusion is that the economic loss is lower with higher pregnancy rates. Clearly, with higher pregnancy rates the cow is expected to get pregnant sooner after initial failure to get pregnant. This results in fewer days open.

The fourth conclusion is that the culling policy for open cows partially determines the economic loss from failure to get pregnant. Every business has its own optimal culling policy, known or not, but a bit more research is needed to get more insight in this issue.