



**DHI** *option*

Western Canadian Dairy Herd Improvement Services

# LACTATION CURVES

## Purpose of option

Lactation curves offer a quick visual check on herd production. Areas for possible improvement can be quickly identified, leading to management changes aimed at increasing profitability.

## Explanation of output

The lactation curve report consists of four separate graphs :

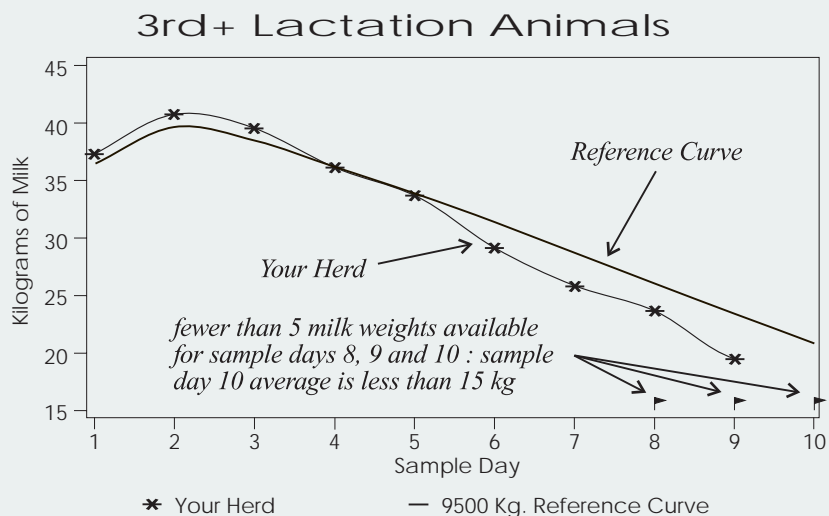
- all animals;
- 1st lactation animals;
- 2nd lactation animals, and;
- 3rd+ lactation animals.

### Your Herd

Lactation curves for Your Herd are computed from actual test day milk weights - projections are not used. Each point on the curve represents the average sample day milk weights for all milking and dry cows currently in that lactation group. A cow that has been tested for the tenth time in her current lactation will be represented in the sample day averages for tests 1-10, while a cow who has just completed one test will be represented in the average for sample day 1 only.

When there are fewer than five milk weights available for any sample day, the average may be unreliable. These sample day averages are marked with a golf flag near the top or bottom of the graph. A flag may appear without a corresponding milk weight if the milk weight is lower than the lowest value on the graph's vertical axis. For example, if the herd average 305-day production is 7500 kg, the lowest value on the vertical axis for the 3rd+ Lactation Animals will be 15 kg. If a sample day average were 13 kg and only 3 cows contributed to that average, a flag would appear but no point would be plotted on the curve.

*Example curves for cows currently in their third or greater lactation. Each point on the curve for your herd represents the average of milk weights on that sample day for cows in this lactation group.*



Curves will be incomplete for new DHI herds until they have completed at least 10 test days.

Test day averages do not include:

- milk weights that may be invalid;
- cows that have been tested but were subsequently sold;
- cows with no calving date recorded.

## Reference Curves

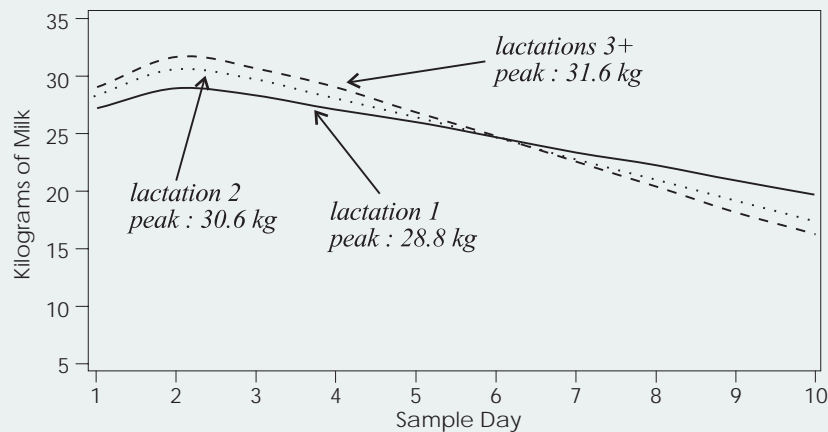
The 305-Day Production levels printed in the upper right hand corner of the lactation curve report are the current averages for each lactation group in your herd on the most recent DHI test day. These are used to select the reference curves plotted on each graph.

| REFERENCE CURVES          |                          |
|---------------------------|--------------------------|
| if 305-day production is: | reference curve used is: |
| less than 5000            | 5000                     |
| 5000 - 5499               | 5500                     |
| 5500 - 5999               | 6000                     |
| 6000 - 6499               | 6500                     |
| 6500 - 6999               | 7000                     |
| 7000 - 7499               | 7500                     |
| 7500 - 7999               | 8000                     |
| 8000 - 8499               | 8500                     |
| 8500 - 8999               | 9000                     |
| 9000 - 9499               | 9500                     |
| 9500 - 9999               | 10000                    |
| 10000 - 10500             | 10500                    |
| more than 10500           | 11000                    |

Thirteen sets of reference curves are used, for 305-day production ranging from below 5000 kg to over 10500 kg, with each set representing a 500 kg production range as shown in the table on the left. Each set includes curves for each of the three (1st, 2nd and 3rd+) lactation groups within the herd. These reflect the expected increase in peak yield and decrease in persistency for succeeding lactations shown in the graph below.

The reference curves used on your output are for the next highest production level within each lactation group. For example, if the current average for your 2nd Lactation Animals is 7122 kg, the 7500 kg reference curve for that lactation group is used. For lactation group averages less than 5000 kg, the 5000 kg curve is used. For averages greater than 10500 kg, the 11000 kg curve is used.

*7500 kg reference curves for each of the three lactation groups. Notice that peaks are higher and persistencies lower as lactation number increases.*



## Interpretation

| TEST DAY SUMMARY         |         |             |      |      |
|--------------------------|---------|-------------|------|------|
|                          |         | LACTATION # |      |      |
|                          |         | 1ST         | 2ND  | 3RD+ |
| # OF COWS                |         | 38          | 21   | 29   |
| % OF COWS                |         | 43%         | 24%  | 33%  |
| CURRENT<br>BCA           | MILK    | 176         | 198  | 186  |
|                          | FAT     | 187         | 193  | 177  |
|                          | PROTEIN | 192         | 202  | 187  |
| PEAK<br>MILK             | AVE KG  | 29.3        | 40.4 | 43.0 |
|                          | AVE DIM | 73          | 42   | 51   |
| PERSISTENCY<br>%         | DIM     | 96          | 89   | 89   |
|                          | 66 +    |             |      |      |
| PERSISTENCY<br>REFERENCE | 66 +    | 96          | 92   | 91   |

Lactation curves should be interpreted in conjunction with the TEST DAY SUMMARY section of the Monthly Herd Summary Report. That section reports information which is similar to the information contained in graphic form on the lactation curve report. Briefly :

- PEAK MILK AVE KG is the average of the highest sample day yield recorded for each cow;
- PEAK MILK AVE DIM is the average days in milk on which peak yield was recorded;
- PERSISTENCY % reflects the rates of change in production for each of three stages of the lactation curves for your herd.
- PERSISTENCY GUIDELINES are standards for comparison with your actual results.

The interpretation of peak milk yields and persistency are discussed at length in the ADHIS publication *Persistency of Milk Production*.

**Peak sample day** Peak production normally occurs between six to eight weeks after calving. This means that the highest sample day yield for Your Herd on the **Lactation Curve Report** will normally occur on sample day 2, when most cows will have been 30 to 60 days in milk. The yield at this test represents the average yields of all cows currently in the lactation group except for those who have only been tested once. Therefore, if the yield on sample day 1 is higher than that at sample day 2, this would indicate that most of the cows in this lactation group are peaking early and failing to reach a potentially higher peak at the normal time. Early peaks most often occur in the second lactation group and are usually a symptom of energy deficiency due to:

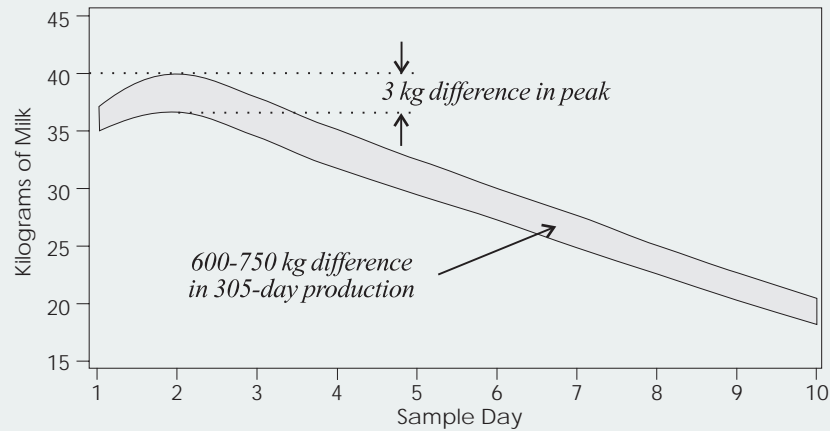
- poor body condition at calving;
- inadequate feed intake, or;
- low ration energy density.

When the highest yield occurs after sample day 2, most of the cows in this lactation group have failed to reach their potential early peak. This can happen to individual cows of any age, usually due to a metabolic problem at calving. But, as a lactation group, poorly grown-out first- and second-lactation animals are most often affected, when the demand for continued growth competes with milk production for the available nutrients.

## Peak height

If persistencies can be maintained post-peak, each additional kg of yield at peak can result in an additional 200-250 kg of milk over a 305-day lactation. This is demonstrated in the graph below.

*In this example, a 3kg increase in peak yield results in a 600-750 kg increase in 305-day yield. At a milk price of \$50/hL, the increased production would result in an additional \$300-375 of gross return.*

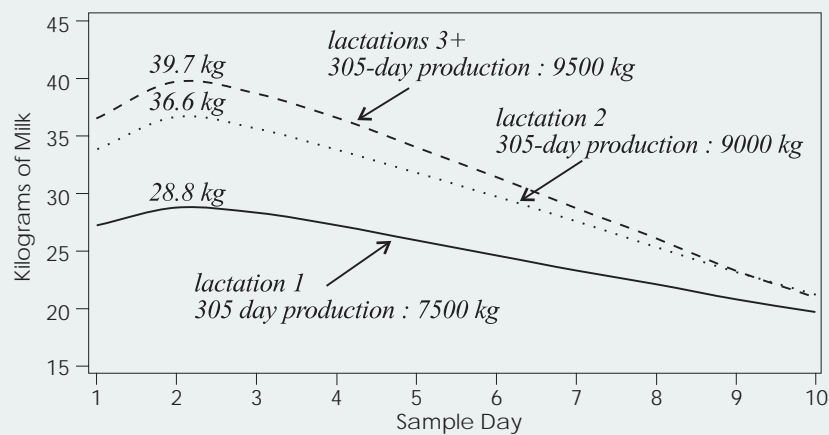


Mature cows should be expected to peak higher than first- or second-lactation heifers. Relationships between peak heights are normally as follows:

- 1st lactation peak : 70-73% of peak for mature cows;
- 2nd lactation peak : 92-93% of peak for mature cows;
- 1st lactation peak : 75-80% of peak for second lactation.

When the peak heights for Your Herd are consistent with these relationships, each lactation group is 'pulling its weight'. If peak height for one of your lactation groups is lower than expected, this may indicate that production in that group is being limited by nutrition or some other management deficiency.

*These reference curves demonstrate 'normal' relationships between peak heights for the three lactation groups within a herd.*



## Persistency

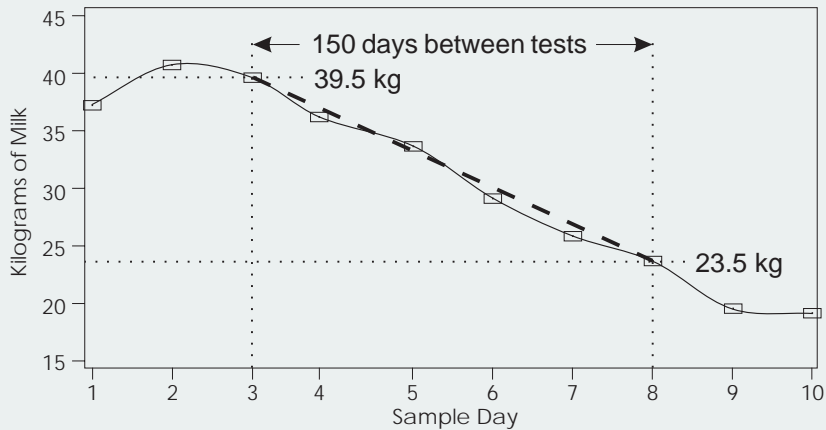
Persistency is calculated as follows :

$$\left[ 1 - \frac{(\text{MILK KG earlier test} - \text{MILK KG later test}) \times \frac{30 \text{ days}}{\text{days between tests}}}{\text{MILK KG earlier test}} \right] \times 100$$

Using this formula, it is possible to calculate persistencies between any two points on the lactation curve. For example, in the graph below, the persistency between the 3rd and 8th tests is :

$$\left[ 1 - \frac{(39.5 - 23.5) \times \frac{30 \text{ days}}{150 \text{ days}}}{39.5} \right] \times 100 = 92\%$$

*In this example, the persistency between the 3rd and 8th sample days was 92%. This means that every 30 days during this period, milk yield dropped to an average of 92% of what it was 30 days before.*



Between first and second sample days, persistency should be between 105 and 107%, indicating a rapid rise to peak. Lower values suggest a failure to reach potential peak production. This is most commonly due to energy deficiency as discussed above under Peak sample day.

Lower than normal persistencies post-peak may also be due to energy deficiency, but almost any type of ration imbalance can be the cause. A period of low persistency post-peak is often followed by a period of higher than normal persistency. In general, high post-peak persistencies point to an opportunity to improve production in a previous interval when persistency and/or peak yield was low.

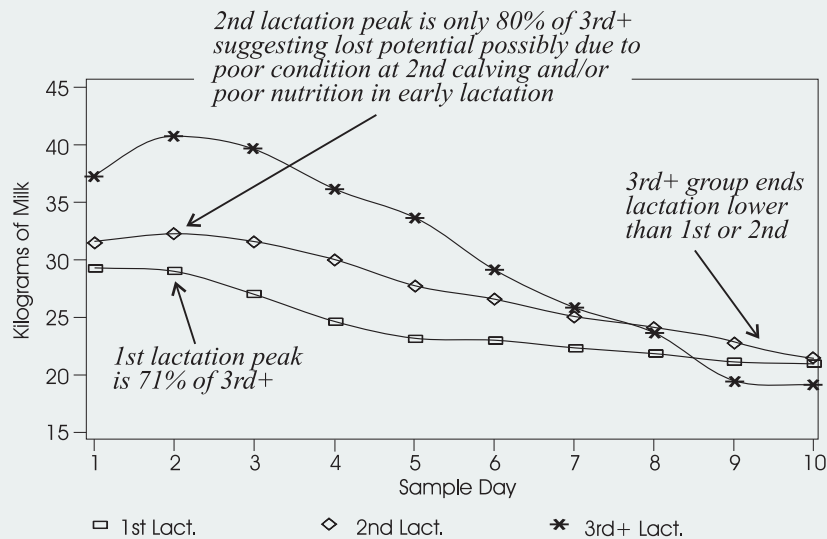
## Evaluation of Curves

The key points to look at when evaluating lactation curves are as follows :

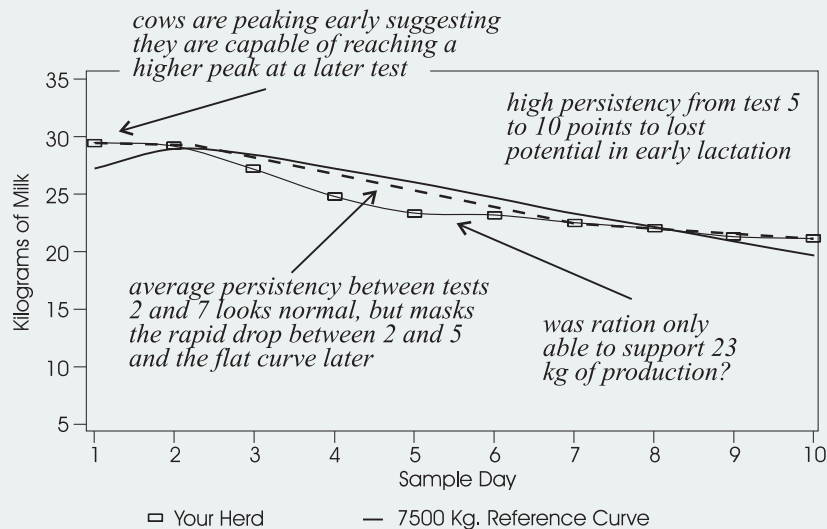
- on the All Animals graph, check the relationships between peak heights for 1st vs 3rd+, 2nd vs 3rd+ and 1st vs 2nd lactation groups - this will help to focus on which group, if any, is limiting herd productivity;
- on the graphs for each lactation group, compare the shape of the curve for Your Herd against the shape of the reference curve :
  - do peaks for Your Herd occur at sample day 2?
  - are persistencies lower or higher than reference curves?
  - is there a smooth decline in production after peak or are there distinct breaks which might indicate a change in cow status?

The following examples will help to clarify the interpretation of lactation curve reports :

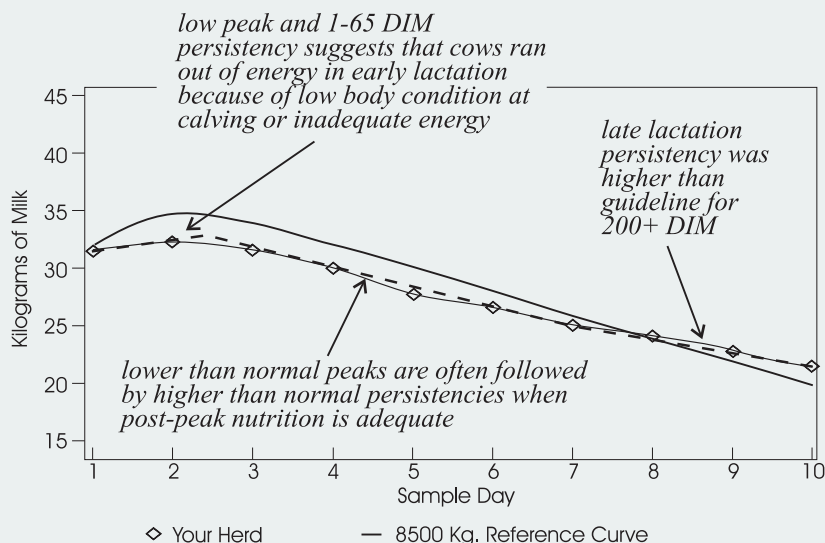
*Herd curves for All Animals. Relationship of peak heights for 1st vs 3rd+ lactation is normal, but second lactation peak is low. Post-peak persistency of 3rd+ cows results in their production after sample day 8 being lower than 1st and 2nd lactation cows.*



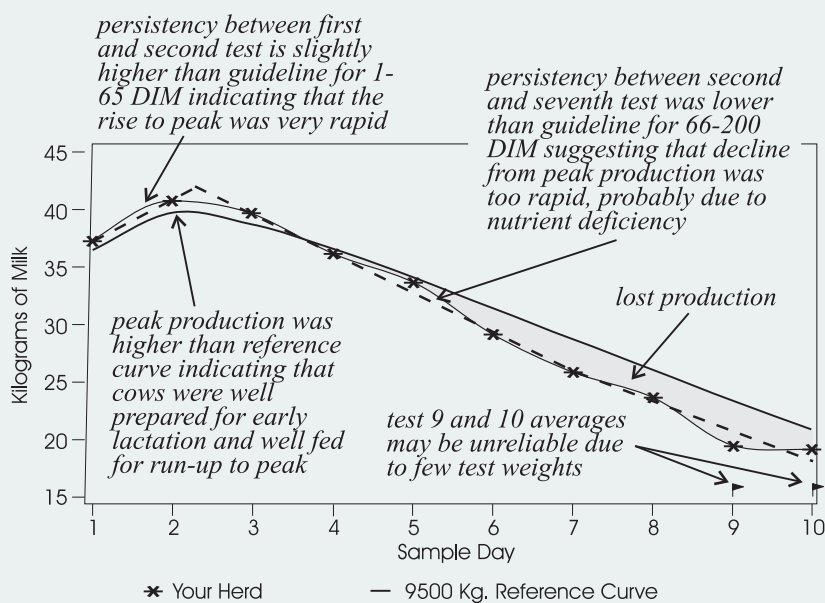
*Lactation curves for 1st lactation animals. Early peak and low persistency to sample day 5, followed by high persistency to end of lactation suggests that ration was inadequate in early lactation.*



Lactation curves for 2nd lactation animals. Peak of herd curve is lower and post-peak persistency higher than for reference. This is a picture typical of 'sophomore slump' where heifers failed to put on adequate condition after 1st lactation peak due to demands for continued growth and production.



Curves for 3rd+ lactation animals demonstrating a herd curve with a higher peak but lower post-peak persistencies than reference. Dashed lines represent average changes in production over three stages of curve.



## For more information

Lowry, Dennis. : *Persistency of Milk Production*. Alberta Agriculture (November 1990)

Jones, Lawrence R. : *Lactation Curves for Herd Management and Goal Setting*. Northeast DHI Records Specialist Conference (1992)

these articles are available at no charge from the WCDHIS library