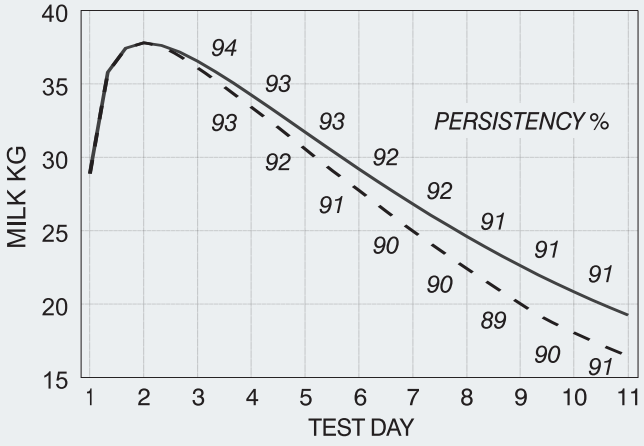
DHI info sheet
Western Canadian Dairy Herd Improvement Services

Persistency of Milk Production

Persistency is reported for individual cows on the DHI Cow Production Monthly Report and for lactation groups in the TEST DAY SUMMARY section of the Monthly Herd Summary Report. It is also relevant to the DHI Lactation Curves option where it is represented graphically.

Persistency is a measure of the rate of change of milk production between tests. Figure 1 shows two lactation curves with different persistencies after peak. The upper curve represents the average production for 2nd lactation Holsteins. The lower curve has the same peak, but the rate of decline after peak is greater - persistencies are lower. As a result, the lower curve represents lower lactation production - 439 kg less over 305 days.

Figure 1



Together, peak milk and persistency define the shape of the lactation curve and, therefore, the amount of milk produced in a lactation. As shown above, normal peaks with low persistencies can limit production. Likewise, low peaks can limit production, even if persistencies are normal. Every kg decrease in peak yield can decrease 305-day production by 200 - 250 kg, assuming persistencies remain the same.

How is persistency calculated?

Persistency is defined as *the milk yield at one test expressed as a percentage of milk yield at an earlier test, adjusted to a 30-day interval between tests.* Therefore, if two tests are exactly 30 days apart, persistency can be simply calculated as follows :

$$\text{PERSISTENCY \%} = \frac{\text{MILK KG at later test}}{\text{MILK KG at earlier test}} \times 100$$

For example, in the upper curve shown in figure 1, MILK KG on test day 4 was 34.3; on test day 5 it was 31. 7 :

$$\text{PERSISTENCY \%} = \frac{31.7}{34.3} \times 100 = 92\%$$

When tests are not exactly 30 days apart, the calculation is 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, for the upper curve in figure 1, the average persistency between test day 4 (34.3 kg) and test day 11 (19.3 kg) is :

$$\left[1 - \frac{(34.3 - 19.3) \times \frac{30 \text{ days}}{210 \text{ days}}}{34.3}\right] \times 100 = 94\%$$

What persistency is normal?

Table 1 shows average persistencies by lactation group for the four most common dairy breeds. These data were derived directly fom the Prairie DRPC database.

Table 1

TEST DAY	DIM	HOLSTEIN			AYRSHIRE			BROWN SWISS			JERSEY		
		LACTATION #											
		1	2	3+	1	2	3+	1	2	3+	1	2	3+
		PERSISTENCY %											
4	66 - 95	98	94	94	97	93	93	97	93	94	96	94	94
5	96 - 125	97	93	93	96	92	91	97	94	93	96	93	93
6	126 - 155	96	93	92	96	92	90	97	94	93	95	93	93
7	156 - 185	96	92	92	95	91	90	97	94	93	95	93	92
8	186 - 215	96	92	91	95	91	89	97	94	93	95	93	92
9	216 - 245	96	91	91	95	90	89	97	94	93	95	93	92
10	246 - 275	95	91	90	95	89	89	97	94	93	95	93	91
11	276 - 305	95	91	90	95	88	89	96	94	93	96	93	91

Notice that, within each breed, test-to-test persistencies for each lactation group are fairly constant after 66 days in milk (DIM). This makes it possible to suggest the PERSISTENCY REFERENCE values given in the TEST DAY SUMMARY section of the Monthly Herd Summary Report. These represent average values for the period from 66 to 305 DIM calculated using the formula above.

Also notice that, for all breeds, persistency decreases with each subsequent lactation. This is consistent with the observation that persistency decreases with increasing production. Table 2 shows the effect of 305-day production level on average 66 - 305 DIM persistencies by breed and lactation group from the Prairie DRPC database.

Table 2

305-DAY PRODUCTION (kg)	HOLSTEIN LACTATION # 1	2	3+	AYRSHIRE 1	2	3+	BROWN SWISS 1	2	3+	JERSEY 1	2	3+
	AVERAGE PERSISTENCY % (66 - 305 DIM)											
4000 - 4999	97	94	93	94	92	91	96	93	92	96	93	93
5000 - 5999	96	92	92	96	93	92	97	94	93	96	94	93
6000 - 6999	96	93	92	96	93	92	96	94	94	96	94	94
7000 - 7999	96	93	92	96	93	92	97	95	94	96	94	94
8000 - 8999	96	93	93	96	93	93	96	95	94	-	95	94
9000 - 9999	97	94	93	-	93	93	-	-	95	-	-	96
10000 - 10999	97	94	93	-	-	93	-	-	95	-	-	-

persistency estimates are missing where there were not enough records to calculate a reliable value

Individual cow persistencies

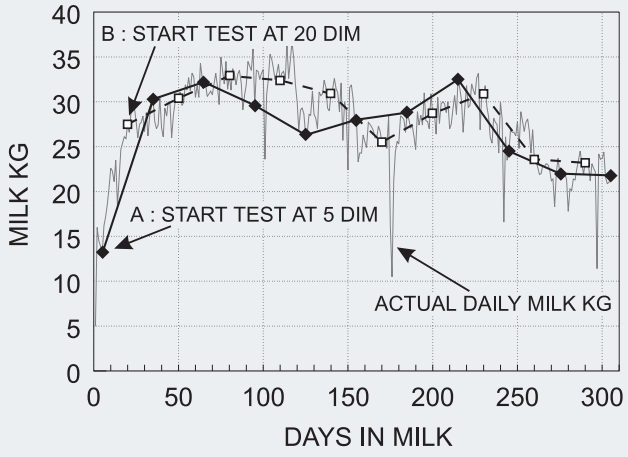
Figure 2

COW IDENTIFICATION	LAST CALVING DATE MM - DD / AGE AT CALVING YR - MO	LACT. NO.	TEST DAY INFORMATION MILK KG	FAT % / PROTEIN %	DATA FLAG	PERSIST% CURRENT / PREVIOUS	DAYS IN MILK
ANN	05-19	2	22.9	4.8		122	238
2	03 04			3.5		71	
BELLA	09-28	4	37.6	3.0		89	106
6	05-02			3.0		100	
DEBRA	05-09	8	26.3	3.1		88	248
14	10-08			3.0		96	

Persistencies for individual cows are reported on the Cow Production Monthly Report (see figure 2). PERSIST% : CURRENT compares MILK KG for the current test with MILK KG for the immediately previous test. PERSIST% : PREVIOUS compares the immediately previous MILK KG to that for the test prior to the immediately previous test. For example, if the current test is the 5th for an individual cow, then PERSIST% : CURRENT compares MILK KG for the 5th with that for the 4th test; PERSIST% : PREVIOUS compares the 4th with the 3rd.

Lactation curves for individual cows seldom resemble the smooth curves shown in figure 1. Figure 3 shows a typical daily production pattern for a single cow from the research herd at the University of Alberta. Curve A is the result of testing this cow at 30-day intervals starting at 5 DIM; testing for curve B starts at 20 DIM.

Figure 3



Because of the variation in daily milk production, the lactation curve resulting from monthly test day samples will depend on the particular sampling schedule. This will also affect the persistencies calculated at each test. For example, the persistency reported at 155 DIM (curve A) would be 106%, reflecting an increase in MILK KG from the previous test. At 170 DIM (curve B), persistency would be reported as only 85%.

Individual cow persistencies, reported on the Cow Production Monthly Report, are useful indicators of test-to-test changes in production. However, they are very sensitive to the inherent variability in each cow's daily production pattern and should, therefore, be interpreted with this in mind.

Lactation group persistencies

Figure 4

TEST DAY SUMMARY

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

Persistencies for each lactation group are given in the TEST DAY SUMMARY section of the Monthly Herd Summary Report (see figure 4). These are the average current PERSISTENCY % (current test compared with previous test) for cows in each group having at least 2 tests after 65 DIM. PERSISTENCY REFERENCE values are computed from average production curves as described on page 2.

Lactation group persistencies can be visualized in the graphic output provided by the DHI Lactation Curves option. Figure 5 is an example of this output. The values plotted at each sample day are the average MILK KG produced at that sample (test) day for all cows currently in the respective lactation groups (including dry cows). Reference curves provide guidelines which can be used to judge the adequacy of both peaks and persistencies.

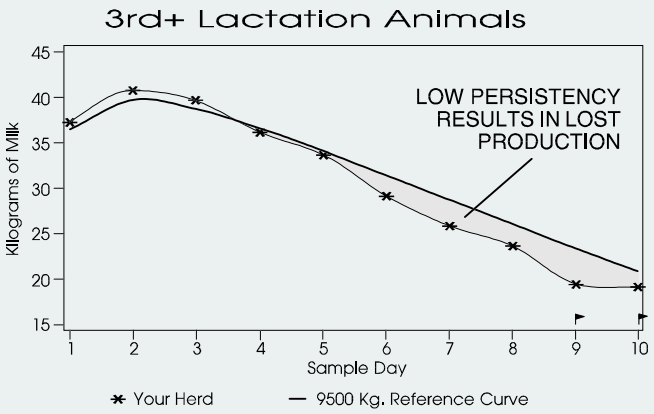
Interpretation of persistency values

Low individual persistencies at any stage of lactation may be caused by a number of environmental, reproductive or health-related factors, such as :

- reduced feed intake due to estrus, infection, changes in management, the ration or the weather;
- changes in herd social interactions resulting from regrouping or the introduction of new animals;
- metabolic and digestive disorders, including acidosis and liver abscesses;
- mastitis.

Consistently low post-peak persistencies in individual cows or a lactation group are most commonly due to inadequate nutrition. In early lactation, cows will normally draw on body reserves in an attempt to produce to their genetic potential. Post-peak rations should be formulated to provide nutrients for milk production, the replenishment of reserves and later, gestation. Cows in poor body condition fed rations which do not satisfy these requirements will partition nutrients away from milk production, with the result that production declines rapidly - persistency decreases.

Figure 5



Higher than normal post-peak persistencies may reflect lower than normal peaks. Early lactation rations may be poorly balanced or intake may be inadequate with the result that cows cannot reach the peaks they are capable of. Often, as intake inevitably increases, production capacity recovers.