

How Much Do Cows Eat?

In most herds, nutrient intake in early lactation is one of the main limitations to high production and good reproductive performance. Inadequate dry matter intake (DMI) will limit peak production and, if body condition loss is excessive, first ovulation can be delayed (see article 2F1).

How much dry matter can we expect cows to eat? And what factors determine the amount of feed a cow will consume? To answer these questions, we analysed several years of data from the University of Alberta dairy research herd. We only included cows for which there was complete information on calving age, weight at calving, daily feed intake and production as well as characteristics of their diets including dry matter (DM) and concentrate levels. A total of 24,925 cow-days were available for analysis.

Individual cow variation

Figure 1 shows a typical record for an individual cow. Although she reached peak production between 20 and 45 days in milk (DIM), her daily intake continued to rise for another 60 days. Notice the day-to-day variation in both production and intake. Although we commonly talk about *average* intakes for an individual or a group of cows, we should not lose sight of this variability. For example, US National Research Council (NRC) guidelines suggest that a 700 kg cow producing 35 kg of 4% fat-corrected milk will consume about 23.8 kg of DM. From 60 to 100 DIM, production for cow 8430 remained fairly constant in the 32-37 kg range but her DM intake (DMI) increased steadily in that interval by about 5 kg/day. Clearly, changes in milk yield and body weight alone cannot account for the increase in DMI. What other factors are involved?

Cow and feed effects on DM intake

Our analysis looked at both cow factors and feed variables which we thought might be important in predicting daily DMI. Of course, we had to use measures which had been routinely recorded in the course of conducting experiments and, to make our predictions useful on-farm, we wanted to use variables which could be readily measured. Our best prediction accounted for 49% of the variation among DM intakes and included the following cow factors:

- **Milk yield** - every 1 kg increase in milk yield resulted in a 0.21 kg/day increase in DMI.
- **Body weight** - DMI increased by 0.86 kg/day for every extra 100 kg of weight.
- **Calving age** had a curvilinear effect on intake. DMI increased to a peak at 5.5 years of age at calving and declined thereafter. A cow calving at 5.5 years consumed 1.2 kg of DM more than one calving at 2.0 years of age, assuming both were at the same production level, body weight and DIM.
- **Days in milk** also had a curvilinear effect on DMI. If milk yield and body weight remained constant across the lactation, DMI would steadily increase until 142 DIM before beginning to decline. Total rise from day 1 to day 142 would be 6.54 kg/day of DMI.

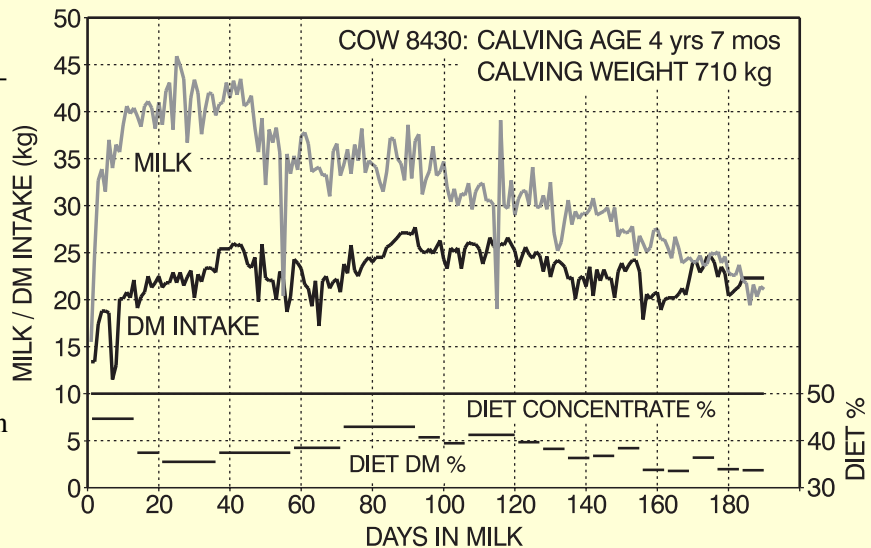


Figure 1 : Production and intake records for an individual cow. Lines at the bottom of the graph show dietary concentrate and DM levels.

Although many feed characteristics may have effects on DMI, we restricted our analysis to 2 variables which could be routinely monitored on-farm, with the following results:

- **Dietary DM%** - a 5 percentage point increase in dietary DM% (e.g., from 50% to 55% DM) was associated with a 0.32 kg increase in daily DMI.
- **Dietary concentrate %** - within the range of diets fed, a 5 percentage point increase in dietary concentrate content raised DMI by 0.48 kg/day.

Cow Profitability

This project was initiated and partially funded by Alberta DHI whose main objective was to evaluate cow profitability in terms of the feed cost associated with milk output. To estimate profitability, we used the equation described above to predict feed intakes, calculated the cost of that feed and the milk produced, then determined milk income over feed cost.

Table 1 presents predictions for 3 cows at 30 and 60-day intervals during their lactation cycles. Mean DM intakes are in line with on-farm estimates, recognizing that feed intake is commonly 10-15% less than feed offered due to wastage.

Notice that the most profit (highest Milk \$ - Feed \$) is associated with peak lactation in each case. This should not be surprising since peak milk precedes peak intake by 60-90 days. But even at peak DMI, profit is higher than in later lactation when both milk output and feed intake are lower.

----- 305-DAY -----		
PRODUCTION kg	PREDICTED DMI kg	MILK\$ - FEED\$ \$
6924	5475	2498
7712	5642	2883
8603	5832	3317
9503	6022	3756
10457	6225	4222
11407	6427	4686

Table 2 : The relationship between production, predicted DMI and profitability over 305 days in second lactation Prairie Holsteins. Assumptions are as described for table 1.

The association between high DM intake and high profitability is also demonstrated in table 2 where production levels represent DHI averages for second lactation cows in 6 production ranges from 6000-6999 to 11000-11999 kg. DM intakes are the sums of daily intakes for the complete 305-day lactation.

Summary

The results of this analysis demonstrate the effects of both cow and feed factors on voluntary dry matter intake. Cost calculations based on those relationships confirm the importance of high dry matter intakes in driving production and profitability.

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DIM	LACTATION 1 CALVING AGE 2.25 YEARS CALVING WEIGHT 575 kg			LACTATION 2 CALVING AGE 3.4 YEARS CALVING WEIGHT 600 kg			LACTATION 3 CALVING AGE 4.5 YEARS CALVING WEIGHT 625 kg		
	MILK KG	DMI KG	MILK\$- FEED\$	MILK KG	DMI KG	MILK\$- FEED\$	MILK KG	DMI KG	MILK\$- FEED\$
5	21.1	12.3	8.54	29.9	15.0	12.67	31.4	15.9	13.28
35	31.2	17.1	12.93	40.5	19.9	17.29	45.1	20.9	19.52
65	31.7	19.0	12.76	39.3	21.5	16.27	43.9	22.5	18.56
125	30.2	20.3	11.66	34.5	22.1	13.60	38.6	22.9	15.58
185	27.9	19.5	10.61	29.4	20.7	11.18	32.6	21.3	12.71
245	25.3	17.6	9.67	24.3	18.2	8.97	26.5	18.7	10.08
305	22.6	15.5	8.67	19.1	15.6	6.81	20.6	15.9	7.51
MEANS	27.3	17.9	10.68	30.4	19.4	12.00	33.5	20.1	13.51

Table 1 : Predicted dry matter intakes and income over feed cost for lactating cows. Milk kg amounts are averages for Prairie Holsteins on DHI producing 8000-8999, 9000-9999 and 10000-10999 kg in 1st, 2nd and 3rd+ lactations, respectively. Diet is a single total mixed ration (TMR) fed ad libitum, containing 55% dry matter and 50% concentrate. Feed \$ is based on a TMR cost of \$220/tonne of DM. Milk \$ is based on \$55/hectolitre, gross revenue minus milk cheque deductions. Means are calculated over complete lactations.