

# New Concepts in Dry Period Management

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## ■ Take Home Messages

- ▶ Dry periods of 35 days are suitable for today's high producing dairy cows: annual milk and component yields are increased, with no negative effects on health, metabolism and reproduction.
- ▶ Short dry period management implies both a reduction in the length of the dry period and the use of one single ration during the whole dry period
- ▶ This new management strategy might not be optimal for all herds or for all cows within a herd
- ▶ The best candidates for short dry periods are cows still producing considerable amounts of milk 60 days prior to calving, both primiparous and multiparous cows
- ▶ A minimum dry period of 29 days is required to maximize production and avoid adverse effects on transition. Accordingly, one should target 35 days dry which would account for possible early calving.
- ▶ In the Canadian supply management system, and especially when additional quota is available, this strategy will bring economic benefits to the producer

## ■ Introduction

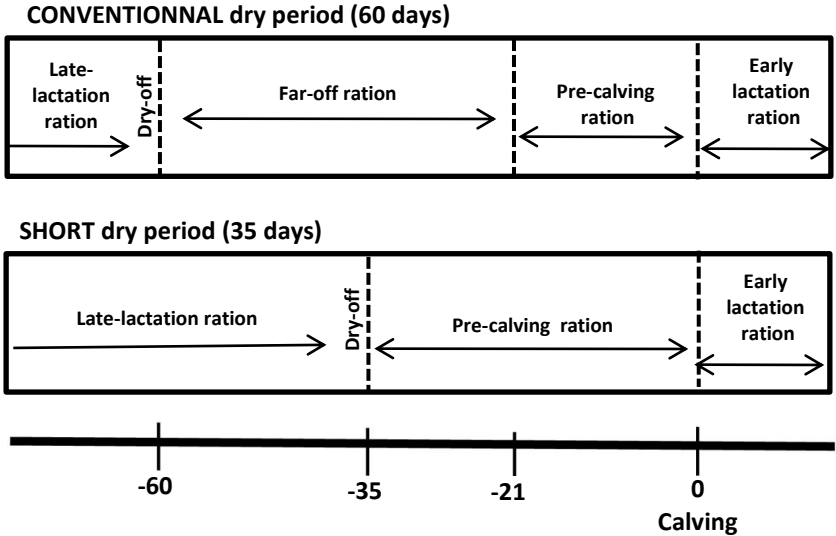
It is general practice in the dairy industry to allow cows a rest period between lactations. Traditionally, 60 days was defined as the optimal duration of the dry period. This recommendation was established several years ago mainly based on retrospective studies which suggested that maximum milk yield was obtained following a dry period of 60 days. Although these studies included data from a large number of animals, they only accounted for milk yield responses and rarely mentioned effects on component yields. Moreover, these studies did not consider the reasons for different dry period lengths (e.g., early calving, twins, imprecise management, and abortions) and did not provide information about other management factors which could influence

milk yield (e.g., calving interval and health status). Results from these studies might therefore be biased and must be interpreted with caution. In addition, retrospective studies did not consider other impacts a modification of dry period management could have on the cow, namely effects on health and reproduction in the following lactation.

Today, many cows still produce a considerable amount of milk 60 days prior to calving and represent a challenge for the producer trying to dry them off. This has triggered interest in reconsidering recommendations for dry period management. Shortening the dry period has been proposed as a potential strategy to facilitate transition, mainly because it would allow decreasing milk production prior to dry-off. In fact, recent studies suggest managing for a dry period of 30 to 35 days would be more appropriate for today's cows.

## ■ The Short Dry Period Concept

Managing cows for a short dry period implies both a reduction in the length of the dry period and a different feeding strategy during this period. Traditionally, with a conventional dry period management, cows are fed the end of lactation diet until approximately 60 days prior to calving, at which time they are dried-off. They are then typically switched to a low-energy, high forage diet (far-off diet) until 3 weeks prior to calving, when they are transferred to a moderate-energy, pre-calving diet which they will be fed until calving. With a short dry period management strategy, cows are milked for an additional 25 days, and are dried-off only approximately 35 days prior to calving. Then, instead of being fed the traditional dry cow diet, they switch directly to the pre-calving diet during the whole duration of their dry period, until calving (Figure 1).



**Figure 1. Feeding program for a short (35 days) or conventional (60 days) dry period management strategy.**

Drackley (2011) has recently proposed and reviewed the single dry period diet concept. Although not specifically designed for cows managed for a short dry period, recommendations emerging from this concept have proven suitable for today’s high producing cows, and could be adapted to the short dry period approach. The composition of this ration should meet but not significantly exceed energy requirements while providing adequate amounts of metabolizable protein as well as all required minerals and vitamins to meet late gestation cow needs (NRC, 2001). High fibre – low energy density diets (1.30-1.38 MCal NE<sub>L</sub>/kg) should be preferred, which will allow high DM intake without greatly exceeding daily energy requirements. However, there has been little research evaluating the most appropriate energy level in a short dry period management strategy. Crude protein content should be 12-15 %, towards the high end if heifers are included in this group. Mineral and vitamin pre-calving recommendations from the NRC (2001) should be followed.

**Potential Benefits of Short Dry Period Management**

During the last months of gestation and the first weeks of lactation, cows are exposed to several stress factors:

- Physiological and endocrine stress: the calving process itself and the associated hormonal changes as the cow transitions from gestation to lactation

- Nutritional stress: several dietary changes within a short period according to gestation or lactation stage forcing the rumen microbes to adapt continuously to diets that are significantly different
- Stress on the udder: milking is stopped abruptly to dry-off the cow, and production increases rapidly after calving
- Social and environmental stress: to provide adequate feeding and care, cows are often grouped according to gestational stage (dry group, pre-calving group, calving, fresh-cow group). These frequent group changes imply numerous social and environmental changes.

This accumulation of stress within a short period of time is what makes the transition period the most critical time in a cow's lactation cycle. Obviously, some stresses cannot be avoided, such as calving itself and all hormonal changes accompanying this process. However, short dry period management could alleviate some of the other stress factors, which could therefore facilitate transition:

- The single-diet approach described previously as part of the short dry period management strategy reduces the number of dietary changes during the transition period. Omitting the far-off diet, which is often based on different forages than the lactation and pre-calving diets, reduces stress on the rumen microflora. In addition, feeding the pre-calving diet for 35 days allows plenty of time to ensure proper adaptation of the rumen microbes, even in the case of an early calving.
- Together with the reduction in the number of dietary changes comes a diminution in frequency of group changes, which reduces social and environmental stress.
- Finally, milking cows until 35 days prior to calving (instead of the traditional 60 days prior to calving) will allow time to lower production prior to dry-off, which will reduce the stress imposed on the mammary gland, while providing additional end of lactation milk and allowing sufficient time dry for antibiotic treatment.

## ■ What about Research Results?

### Milk and Component Yields

Before the year 2000, few studies had randomly assigned cows to planned dry period lengths. Results suggested up to 20% reduction in milk yield following a shorter than 60 days dry period (reviewed by (Bachman and Schairer, 2003; Grummer and Rastani, 2003; Overton, 2005). However, authors of these studies raised the concern that planned treatments could rarely be respected: most cows dried off spontaneously prior to the pre-

determined dry-off date because their production level was insufficient. Results from recent studies report only minimal milk losses (2 to 6 %) associated with a short dry period (Pezeshki et al., 2008; Rastani et al., 2005; Watters et al., 2008). However, additional end of lactation milk which can be obtained by keeping cows in lactation for an additional month largely compensates for this loss in the following lactation. Studies report from 243 to 510 kg of extra milk for cows kept in lactation for an additional 21 to 30 days (Annen et al., 2004; Gulay et al., 2003; Rastani et al., 2005; Watters et al., 2008). Component yields are increased during these extra days in milk at the end of lactation, but results are variable during the following lactation.

It has been reported that production responses might be more negative for primiparous cows assigned to a short dry period management. Among others, Watters et al. (2008) reported a non-significant loss of 1.8 % for multiparous cows following a short dry period, but cows entering their second lactation produced 7.8 % less milk after a dry period of 35 compared to 55 days.

### ***Colostrum***

Only a few studies measured the effect of short dry period management on colostrum quality and quantity. Their results suggest no negative effect on quality as long as the dry period is not totally omitted. Although reducing the length of the dry period from 60 to 40 days decreased the quantity of colostrum produced at the first milking from 8.9 to 6.8 kg (Grusenmeyer et al., 2006), the level of production is still sufficient to ensure proper immunity transfer to the calf.

### **Mammary Gland**

Capuco et al. (1997) established that a dry period is absolutely essential to renew damaged mammary epithelial cells. According to these authors, this process is completed after 25 days in the mammary gland of cows managed for 60 days dry. Hence, renewal of the mammary gland is not impaired as long as the cows have a minimum dry period of 25 days. This was recently confirmed by Bernier-Dodier et al. (2011) who demonstrated that early and mid-lactation apoptosis and proliferation rates of mammary cells as well as expression of genes involved in tissue function were not different between cows managed for 65 or 35 days dry.

Regarding udder health and somatic cell counts, studies suggest no negative effect as long as a minimum dry period of 25 to 30 days is respected.

## **Metabolism and Health**

The few studies comparing dry matter intake of cows assigned to short or conventional dry period management report higher intake for cows managed for 30-35 days dry during the dry period as well as in early lactation (Gulay et al., 2003; Jolicoeur et al., 2009; Rastani et al., 2005). This increased intake is probably the main explanation for the improved energy balance observed with short dry period management. Studies report lower early lactation plasma NEFA and BHB concentrations following a 35-40 day dry period (Jolicoeur et al., 2009; Watters et al., 2008). Although these results suggest better transition which could have an impact on incidence of metabolic disorders, most studies do not include enough cows to assess the effect of reduced dry period length on disease incidence.

## **Reproduction**

Improved early lactation energy balance should also have a positive impact on reproductive performance. Accordingly, studies report improved heat expression as well as a more rapid return to normal reproductive cycle following a short dry period (Gumen et al., 2005; Pezeshki et al., 2007). In a Wisconsin study involving 781 cows, shortening the dry period from 55 to 34 days reduced the number of days before the first ovulation from 43 to 35 days (Watters et al., 2009). These authors also observed an increased proportion of cows pregnant at 70 days in milk.

## **Could the Dry Period be omitted?**

Most of the studies looking at the effects of continuous milking (no dry period) report a loss of production of at least 15 % during the following lactation. Even the most recent studies still mention that a certain proportion of cows will dry-off spontaneously due to insufficient production to be kept in lactation until the next calving (Andersen et al., 2005; de Feu et al., 2009; Klusmeyer et al., 2009). In addition, omitting the dry period prevents colostrum formation and does not allow antibiotic treatment at dry-off. However, cows milked continuously show better energy balance and increased intake levels during the transition period compared to cows with short or conventional dry periods.

## **■ Short Dry Period Management in the Canadian Context**

Although there have been many studies in the past decade looking at effects of short dry periods, most of these studies involved a limited number of cows and did not have enough statistical power to evaluate impacts of this new management strategy on reproduction and health. Moreover, the economic

impact and feasibility of this new management practice under field conditions and more specifically under the Canadian quota system had not been assessed. In order to find some answers to these points, our team designed a project to evaluate the impacts of short dry period management on production, reproduction, health and metabolism of cows as well as the economic impact for eastern Canadian producers.

## **Trial Design**

Our trial involved 850 Holstein cows in 13 commercial herds. Within each herd and every two months, cows in their 6<sup>th</sup> or 7<sup>th</sup> month of gestation were assigned to one of two dry period management strategies based on parity (primiparous vs. multiparous), previous 305 d milk yield and estimated calving interval. The dry period management strategies compared were a conventional (CDP) and a short (SDP) dry period. In the CDP group, cows were dried 60 days prior to the expected calving date. They received the late-lactation ration until dry-off, and then switched to a far-off dry cow ration until 21 days prior to the expected calving date, from when on they were fed the pre-calving ration. The cows on SDP were dried 35 days prior to expected calving date. They were fed the late-lactation ration until dry-off and were switched directly to the pre-calving ration for the whole duration of their DP. Rations were formulated by each herd's nutritionists and were variable among herds.

Each herd was visited every other week for two years. On each visit, all cows were body condition scored and a keto-test was performed for cows between 3 and 21 days in milk to detect ketosis. Health problems, calving disorders, production and reproduction were also recorded.

## **Results**

A summary of the results is presented here. Complete results have been published (Santschi et al., 2011a, b, c).

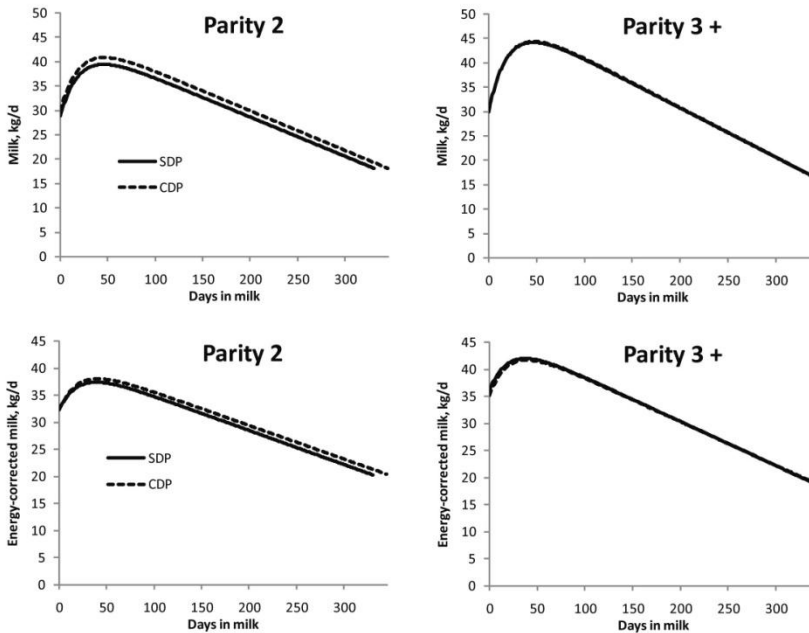
### ***Effects on Production***

Cows managed for a 35 days dry period were milked for an extra month at the end of lactation, which yielded an average of 530 kg of additional milk per cow. This milk contained 4.4 % fat and 3.8 % protein on average, representing 23.8 kg of additional fat and 20.6 kg of additional protein per cow.

As mentioned previously, some studies have suggested that short dry periods might not be optimal for cows ending their 1<sup>st</sup> lactation, leading to decreased milk production in the following lactation. This decrease was not observed in

our study: cows that had a short dry period at the end of their 1<sup>st</sup> lactation produced 543 kg of extra milk during the additional month of lactation. During the following lactation, they produced on average 4% less milk than cows which had a conventional dry period, but had higher fat and protein content. Reported in energy-corrected milk, i.e. considering milk components, there was no significant difference between the two dry period management strategies on milk production during the following lactation (Figure 2). Regarding cows ending their 2<sup>nd</sup> or greater lactation, the dry period management had no impact on production of milk or energy-corrected milk during the following lactation (Figure 2). Additional milk obtained during the extra month of lactation is therefore bonus milk.

According to these results, short dry period management can be used for cows ending their first lactation as well as for multiparous cows.



**Figure 2.** Milk and energy-corrected milk yields for the subsequent lactation according to parity and dry period (DP) management strategy. SDP = short DP, 35 d dry, continuous line; CDP = conventional DP, 60 d dry, dashed line.

### *Effects on Health and Metabolism*

As suggested in the literature, short dry period management reduced the incidence of ketosis (Table 1), indicating that cows which had a 35 day(s) dry period management had improved energy balance in early lactation. The dry



period management strategy used did not influence the incidence of milk fever and displaced abomasum. However, we observed an increased incidence of retained placenta (from 11 to 23 %) associated with shorter dry periods, specifically for cows entering their 3<sup>rd</sup> or greater lactation. The reason for this increase is unclear, but it did not lead to higher incidence of metritis, suggesting that there are no major negative long-term effects associated with it. Gestation length was similar for both dry period management groups, as was the proportion of cows calving prior to the expected date. Dry period management strategy had no effect on body condition score or the incidence of mastitis throughout the project.

**Table 1. Incidence of metabolic disorders according to dry period management and parity (%)**

	Parity 2		Parity 3+	
	Conventional	Short	Conventional	Short
Ketosis	27 <sup>a</sup>	16 <sup>b</sup>	36	30
Displaced abomasum	2	4	8	7
Milk fever	2	5	16	19
Retained placenta	19	17	11 <sup>a</sup>	23 <sup>b</sup>
Metritis	7	5	5	6
Number of cows	190	224	238	198
Dry days	60.1	34.9	70.8	40.5

<sup>a,b</sup> Means within the same row and with different superscripts differ;  $P \leq 0.05$ .

### *Effects on Reproduction*

Overall reproductive performances were not influenced by the dry period management strategy used. Although the number of breedings per conception decreased from 2.7 to 2.5 following a short dry period management for cows entering their 3<sup>rd</sup> or greater lactation, this result was not statistically significant. Similarly, although we observed a decrease of 9 days in the number of days open for both parity groups following a short dry period, this result was not significant.

### *Economic Impact*

Data obtained from the 13 commercial Holstein herds were used to generate an average herd, which was then used for calculations. This herd had 70 cows and 68.5 kg of available quota. Results comparing conventional and short dry period management strategies are presented in Table 2. These results are slightly different from the ones presented previously because they are converted to a yearly basis rather than a lactation basis. Complete

calculation details and explanations have been published (Santschi et al., 2011a).

**Table 2. Economic results according to dry period management strategy**

	Dry period management		Difference
	Short	Conventional	
Dry period length (Days)	37.2	65.3	↓ <b>28.1</b>
Calving interval (Days)	387	406	↓ <b>19</b>
Breedings / cow / year	2.1	2.1	--
Veterinary costs (\$ / cow / year)	22.66	21.14	↑ <b>1.52</b>
Replacement rate (%)	26.1	28.9	↓ <b>2.8</b>
Feeding costs (\$ / cow / year)	1891	1688	↑ <b>203</b>
Milk (kg / cow / year)	9821	9230	↑ <b>591</b>
Fat (kg / cow / year)	386	358	↑ <b>28</b>
Protein (kg / cow / year)	331	307	↑ <b>24</b>
Milk value (\$ / cow / year)	6888	6390	↑ <b>498</b>
Number of cows needed	65	70	↓ <b>5</b>
Quota needed (kg BF / day)	74.0	68.5	↑ <b>5.5</b>

Of major interest in these results is the increase in feeding costs and in annual milk and component yield. The increase in feeding costs is mainly due to the fact that cows managed with a short dry period are fed the end of lactation and the pre-calving rations for a longer period of time. These cows therefore do not receive the far-off ration, which is usually less expensive.

In the Canadian supply management system, the observed increase in milk and especially in fat yield is of great interest. More fat per cow per year implies that less cows will be required to produce the same quota, or that more quota will be needed in order to sell all the milk produced. Both scenarios were analyzed, and both strategies increased annual income: \$41 / cow / year if 5 cows are sold and quota is kept constant; and \$245 / cow / year if the producer decides to keep all cows and buy 5.5 kg of quota (including interest costs on quota bought). In a supply management system, this strategy might be very beneficial, specifically in periods when production level is below available quota.

A more practical method of calculation would be to estimate short time costs and revenues on an individual cow basis rather than on a whole herd basis. Accordingly, in the situation where the quota limit is not met and the producer has cows still producing a considerable amount of milk 60 days prior to calving, it would be economically beneficial for this producer to keep these

cows in lactation until 35 days prior to calving. Although it would cost him an additional \$37/cow due to the different feeding management (\$219 instead of \$182 for the 60 last days prior to calving), he would get \$350/cow in extra milk. On the other hand, if the producer is already producing over-quota, managing cows for 35 days dry will obviously be more expensive in feeding costs but no money will be obtained for the extra milk produced. Short dry period management in this situation would therefore not be a good strategy.

### *Variation among Herds*

One observation from our trial is the important difference among herds. For 12 of the 13 herds (except herd 4; Figure 3), the additional milk obtained by milking the cows an additional month at the end of lactation compensated for possible losses during the following lactation. Annual production of energy-corrected milk per cow therefore increased following a short dry period, both for cows ending their 1<sup>st</sup> lactation and for older cows. Figure 4 illustrates the impact on yearly income estimated for each herd involved in our study as well as for the average herd. This graph shows that a short dry period management strategy might not be optimal for all herds. However, this new practice is likely to result in economic benefits for many herds. Further analyses are required to identify parameters which could account for this variation between herds.

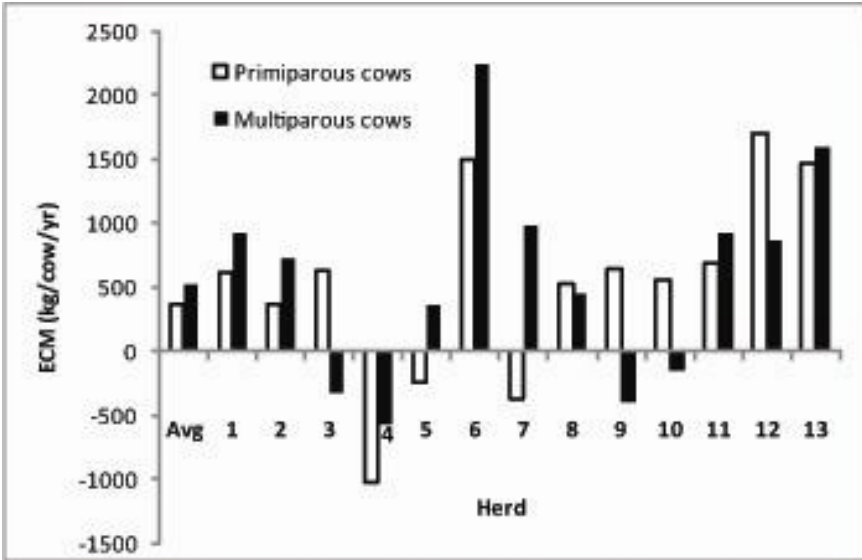
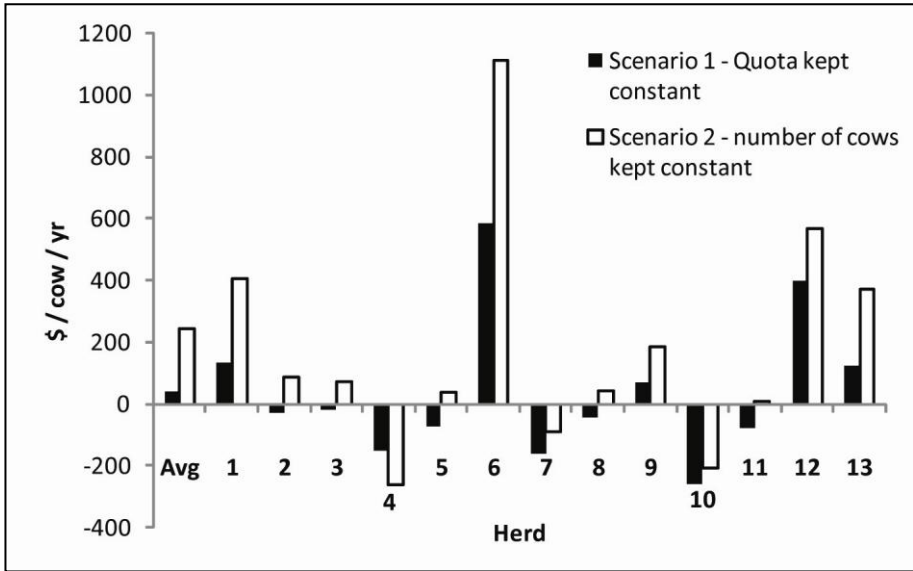


Figure 3. Response variability between the 13 herds, including the additional milk produced at the end of lactation and the milk produced during the following lactation (expressed in terms of energy-corrected milk). The results are presented as differences between the short dry off period and the conventional dry off period. “Avg” represents the average of all 850 cows.



**Figure 4. Economic results for each herd involved in the study as well as results for the average herd**

■ **How Short is too Short?**

Data collected during our trial was used to determine the optimal dry period length within a short dry period management strategy to maximize production and facilitate transition. Although target length of the short dry period group was 35 days, some variation was obtained due to several factors (early or late calvings, early dry-off due to low production level or any other factor). Cows assigned to the short dry period group were therefore divided into groups according to the actual length of their dry period (Table 5).

**Table 5. Milk yields and disease incidences according to actual dry period length within the short dry period management group**

	DP length in a 35d of pre-calving ration management				se	P(DP)	P(Parity)
	≤28d	29-35d	36-42d	≥43d			
N	100	132	106	74			
d dry	22.3 <sup>a</sup>	32.0 <sup>b</sup>	38.6 <sup>c</sup>	56.2 <sup>d</sup>	1.2	<0.01	0.79
Avg ECM (kg/d)	29.8 <sup>a</sup>	31.8 <sup>b</sup>	32.5 <sup>b</sup>	31.5 <sup>b</sup>	0.7	<0.01	<0.01
Ketosis (%)	7.3 <sup>a</sup>	26.2 <sup>b</sup>	15.7 <sup>b</sup>	26.9 <sup>b</sup>	7.6	<0.01	0.02
RP (%)	31.0 <sup>c</sup>	18.7 <sup>bc</sup>	13.4 <sup>ab</sup>	8.1 <sup>a</sup>	6.6	<0.01	0.05

DP= dry period; ECM = energy-corrected milk; RP = retained placenta.

This analysis of the data revealed that a dry period of 28 days or less negatively affected energy-corrected milk yield in the following lactation, and increased incidence of retained placenta. On the other hand, cows in this group had the lowest incidence of ketosis. Our analysis also revealed that cows ending up having 28 days dry or less had a shorter gestation length, suggesting that most cows in this group calved earlier than expected.

From these results, we concluded that a minimum dry period of 29 days was required to maximize production and avoid adverse effects on transition. Accordingly, aiming for 35 days dry is the best solution and would account for some possible early calvings.

## ■ Conclusions and Recommendations

Results obtained from our study indicate that a short dry period management strategy could be beneficial for today's Canadian cows, with no major negative effects on annual milk production, health or reproduction. Actually, this new management strategy would provide additional milk at the end of lactation and reduce the incidence of ketosis in the following lactation. This strategy could be very beneficial especially in situations where additional quota is available. Variability among herds indicates that this management strategy might not be optimal for all herds, nor for all cows in a herd. However, it is reasonable to think that this solution should be considered for cows that still produce a considerable amount of milk 60 days prior to calving and that are difficult to dry off.

From our point of view, here are the main recommendations which should be respected when thinking about short dry period management:

- Aim for 35 days dry
  - This will allow getting additional end of lactation milk, rich in components, without affecting milk yield in the following lactation.
  - 35 days provide a reasonable safety margin in case of an early calving
- Use a single ration during the whole dry period
  - Cows should be fed the same ration from the day of dry-off until the day of calving. A well-balanced ration formulated to meet but not exceed pre-calving needs should be used.
- Select potential candidates:
  - Cows producing 20 kg or more 60 days prior to calving will likely continue producing milk until 35 days prior to calving
  - Both primiparous and multiparous cows can be good candidates
  - Other cows should be kept on a conventional dry period management.

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