Is There a Place for Short Dry Periods for High Producing Herds?

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Take Home Messages

- The retrospective approaches using dairy records that traditionally have been used to establish recommendations for optimal dry period length in dairy cows substantially overestimate the negative impact of shorter dry periods on subsequent production.
- Recent studies suggest that dry periods can be shortened to 30 to 40 days, particularly for multiparous cows, without effect on subsequent production.
- Management of multiparous cows that merits continued milking down to a target of 40-days dry translates into substantial economic benefit (US system) and enables farms to move toward simpler strategies for nutritional management of dry cows.
- Newer guidelines for nutritional management for close-up cows appear to be suitable for one-group dry cow programs up to 40-days dry.

Introduction

Varying the length of, or even eliminating, the dry period for dairy cows has been an active area of research investigation and field application for the past several years. Assuming that there is no detrimental effect on production, reproductive performance, or health during the ensuing lactation, the benefits of shortening the dry period for high-producing cows are obvious. First, milk produced by extending the lactation through shortening the dry period clearly represents “marginal milk” for most farms in that a traditionally nonproductive unit (far-off dry cow) remains in the milking string. Second, and perhaps the most significant advantage for the many farms that have an insufficient number of cows to maintain two groups of dry cows, is the ability to move toward a one-group nutritional strategy for dry cows that more closely meets the needs of close-up cows without overfeeding those during the early dry period.

As indicated above, researchers have sought to reevaluate the reasons for the longstanding recommendation for a dry period approximating 60 days in length and have challenged this recommendation through research conducted in modern high-producing cattle (for detailed reviews see Bachman and Schairer, 2003; Annen et al., 2004; Grummer and Rastani, 2004). The purpose of this paper is not to recreate these excellent reviews, rather to overview the evolution of thought underpinning the evolution in dry period length recommendations and to discuss nutritional management of dry cows in the context of shortened dry period length.

■ Research that Supports the Traditional 60-Day Dry Period

The vast majority of research conducted during the past 70 years suggests that shortening the length of the dry period to 40 days or less results in decreased milk production during the ensuing lactation. Bachman and Schairer (2003) summarized the results from 12 separate studies published from 1936 to 1996 that retrospectively evaluated performance during the next lactation as affected by dry period length (for examples see Schaeffer and Henderson, 1972; Keown and Everett, 1986). Many of the studies that they included in their summary involved thousands of cows or hundreds of thousands of records. Virtually all of these experiments indicated a reduction in milk yield during the next lactation for cows provided with 30 to 40 days dry or less compared with those provided 50 to 70 days dry, and the cows that had shortened dry periods produced approximately 90 to 95% of the amount of milk produced by cows having 50 to 70-day dry periods. Bachman and Schairer (2003) astutely pointed out that relying on retrospective approaches to determine the optimal length of the dry period was flawed because the majority of cows having shortened dry periods were not managed for having shorter dry periods, rather they were cows that calved early for a variety of reasons (i.e., carrying twins, spontaneous abortions, missed breeding or dry off dates), and that none of these reasons for calving early would predispose cows to having excellent performance in the ensuing lactation. Despite their clear and convincing argument that retrospective analyses of dry period length should not be used to determine the optimal length of the dry period, this approach to evaluating dry period length continues to be perpetuated (Kuhn et al., 2004).

■ Research Conducted to Evaluate Planned Management of Dairy Cows for Dry Periods of Varying Length

Bachman and Schairer (2003) also summarized the results from several experiments in which cows were managed for varying dry period lengths. All of

the early experiments (Swanson, 1965; Smith et al., 1966; Ackerman et al., 1967) and one experiment conducted more recently (Remond et al., 1997) compared subsequent production in cows managed for zero days dry versus 60 days dry. Collectively, results from these experiments indicated that cows managed for zero days dry produced only 60 to 80% of the milk produced by cows managed for 60 days dry.

In the first large-scale experiment conducted to evaluate managing for dry periods of different lengths, Coppock et al. (1974) assigned cows on 65 dairy farms across New York to dry period lengths of 20, 30, 40, 50, and 60 days. They determined that cows that averaged approximately 21 days dry produced 636 kg less milk in the first 305 days of the next lactation than those that averaged approximately 64 days dry. Furthermore, most of the decrease was confined to the first lactation following assignment to treatment and the decrease was not pronounced until cows averaged 30 days or less dry. Interestingly, they concluded that "cows with dry periods of 40 ± 10 days produced as much milk as cows with 50 days dry or more".

Sorensen and Enevoldsen (1991) evaluated the effects of managing cows for 28, 49, or 70 days dry on subsequent milk production and health. They enrolled 366 cows across eight commercial dairy farms in Denmark. They determined that production of milk and 4.0% fat-corrected milk during the first 84 and 168 days of the ensuing lactation was nearly identical for cows managed for 70 or 49 days dry; however, cows managed for 28 days dry produced 2 to 3 kg/d less milk and 4.0% fat-corrected milk during the first 84 and 168 days of the next lactation. There was no interaction between lactation number and treatment, implying that cows entering their second lactation did not respond differently than older cows to the varied length of the dry period.

During the late 1990s and early in this decade, Florida researchers conducted a series of experiments designed to compare planned dry periods of 30 to 35 days with the traditional 60-day dry period (summarized in Table 1). Although the number of cows per treatment in these three experiments was relatively small, these results suggested collectively that managing cows for dry periods of approximately 30 to 35 days did not result in decreased milk yield during the subsequent lactation compared to cows given 60-day dry periods.

Table 1. Summary of results from shortened dry period studies conducted by the University of Florida.

Trial	Days Dry	Number of Cows	Adj. 305-day actual (kg)	305-day mature equivalent (kg)
Bachman, 2002	34	15	9799	9214
	57	19	9978	9011
Schairer, 2001	32	10	11635	…
	61	9	10222	…
Gulay et al, 2003	31	29	9580	9586
	61	27	9836	9700

(adj)= adjusted for previous lactation milk yield.

In an experiment published recently, Annen et al. (2004) compared subsequent performance of both primiparous and multiparous cows on three dairy farms following assignment to a 60-day dry period treatment, a 30-day dry period treatment, or one of two continuously milked treatments. Cows that were continuously milked were removed from bST treatment at parturition or continuously administered bST under an Investigational New Animal Drug (INAD) permit from the US Food and Drug Administration. Results from their study are summarized in Table 2 and indicate a more pronounced effect of shortening or eliminating the dry period on subsequent milk production of primiparous cows than multiparous cows. Although differences were not significant, it appeared as though continuous administration of bST to continuously milked cows may have decreased the loss of milk during the subsequent lactation when the dry period was eliminated. Although they did not report colostrum volume as affected by shortening or eliminating the dry period, they determined that colostrum quality as assessed through IgG concentration was not affected by shortening or eliminating the dry period.

Table 2. Milk production during the first 17 weeks of the subsequent lactation for primiparous and multiparous cows as affected by shortening or eliminating the dry period (Annen et al., 2004).

	Treatment			
Group	**60 days dry**	**30 days dry**	**0 days dry, label bST**	**0 days dry, continuous bST**
Primiparous				
n	14	13	13	16
Actual days dry	55	30	2	1
Milk yield, kg/d	44.1[a]	38.3[b]	35.1[b]	37.5[b]
Multiparous				
n	10	10	9	10
Actual days dry	63	32	5	3
Milk yield, kg/d	47.7	46.6	43.4	46.5

[a,b] Means within rows with different superscripts differ, $P < 0.05$.

In one of the few experiments evaluating the metabolic aspects of shortened or eliminated dry periods, Rastani et al. (2003) targeted dry period lengths of 58, 28, or zero days for multiparous cows. They determined that yield of 4% fat-corrected milk was not different for cows managed for either 58 or 28 days dry during the first 10 weeks of the ensuing lactation; however, cows managed for zero days dry produced approximately 5 kg/d less milk compared to the other two treatment groups. Periparturient dry matter intakes and metabolic profiles (plasma NEFA and BHBA; liver triglyceride content) were not different between cows managed for 58 or 28 days dry; however, cows managed for zero days dry had higher peripartal dry matter intakes and lower concentrations of plasma NEFA, plasma BHBA, and liver triglycerides. Remond et al. (1997) also reported improved metabolic health indices in response to elimination of the dry period. Despite the apparent improvement in these key indicators of metabolic health when the dry period is eliminated, the magnitude of the loss of milk yield during the next lactation for cows having zero days dry is too large to consider this practice on a widespread basis.

We recently reported results from an experiment that we conducted in cooperation with two commercial dairy farms in New York (Fernandez et al., 2004). Cows producing at least 27 kg/d of milk at approximately 60 d before expected calving were assigned to either a 60-day dry period group, a 40-day dry period group, or a zero-day dry period group. Results summarized in Table 3 indicate that performance for the first 6 months of the ensuing lactation was similar for cows managed for 60 or 40 days dry; elimination of the dry period decreased milk yield by approximately 9 kg/d compared to the other groups.

Table 3. Least squares means for milk yield and milk composition during the first 6 months of the subsequent lactation for cows managed for 60, 40, or zero days dry (Fernandez et al., 2004)[1].

	Treatment			
Item	**60 days dry**	**40 days dry**	**0 days dry**	**SEM**
N	22	23	22	
Actual days dry	57	41	1	
Milk yield, kg/d	47.1[a]	46.3[a]	37.1[b]	1.8
Fat, %	3.51	3.62	3.40	0.14
Fat, kg/d	1.68[a]	1.62[a]	1.28[b]	0.09
True protein, %	2.74[a]	2.84[b]	2.83[b]	0.06
True protein, kg/d	1.31	1.30	1.06	0.04

[1]Means within a row with different superscripts differ, P <0.05.

One of the shortcomings of all of the experiments in which the dry period has been either shortened or eliminated in a planned manner is that all of them have enrolled very small numbers of cows per treatment, which has prevented the detection of economically relevant differences in milk yield as statistically significant. Furthermore, only Annen et al. (2004) gave careful consideration to the effects of dry period length of primiparous cows on subsequent performance. Currently, we are conducting an experiment in cooperation with three commercial dairy farms in New York in which we are enrolling approximately 150 cows each to 60-day and 40-day dry period treatments. Both primiparous and multiparous cows have been enrolled in the study, so we should be able to determine whether primiparous cows can be managed for 40 days dry. Furthermore, we are evaluating both quality and quantity of colostrum produced at the first milking as affected by dry period length.

We have been actively recommending shortened dry periods (targeting approximately 40 days dry) for multiparous cows producing sufficient amounts of milk to justify continued milking. Looking collectively at all of the results from experiments in which dry periods have been shortened to 28 to 35 days, it appears as though that timeframe represents the minimum dry period required to avoid a marked reduction in milk yield during the subsequent lactation. Given the variation in actual versus expected calving date that exists in most herds due to cows calving with twins, errors in recordkeeping, and simply normal distribution of calving dates relative to due date that exists on farms, 40 days dry looks like a solid general recommendation. At the present time, continuous lactation should be reserved for consideration for mature cows that are of high risk for culling at parturition because of udder issues, etc. Anecdotal evidence suggests that this practice will reduce cull rates of high-risk cows and can be considered for such cows.

■ Nutritional Management of Dry Cows in the Context of Shortened Dry Periods

The primary goal of nutritional management strategies of dairy cows during the dry period should be to metabolically pre-position the cow to best meet the dramatic changes in metabolic demands that occur during the transition to lactation. Industry-standard nutritional management of dairy cows during the dry period in the US has consisted of a two-group nutritional scheme. The NRC (2001) recommended that a diet containing approximately 1.25 Mcal/kg of NE_L be fed from dry off until approximately 21 d before calving and that a diet containing 1.54 to 1.62 Mcal/kg of NE_L be fed during the last three weeks preceding parturition. The primary rationale for feeding a lower energy diet during the early dry period is to minimize body condition score gain during the dry period; furthermore, Dann et al. (2003) suggested recently that supplying excessive energy to dairy cows during the early dry period may actually have detrimental carryover effects during the subsequent early lactation period. The nature of these carryover effects is not known. One could speculate, however, that effects could be mediated through metabolic machinery responsible for tissue responsiveness to endocrine signals during the late prepartum period (Holtenius et al., 2003).

In general, available information supports feeding the higher energy close-up diet for two to three weeks prior to parturition (Mashek and Beede, 2001; Corbett, 2002; Contreras et al., 2004). Results from two of these experiments indicated farm-specific negative effects on subsequent production and health if cows were fed the higher energy diet for the entire dry period (Contreras et al., 2004) or for an average of 37 d prepartum (Mashek and Beede, 2001). These responses may correspond to the negative carryover effects of overfeeding energy during the early dry period described by Dann et al. (2003).

As described above, in addition to the increased production of saleable milk through shortening the dry period, one of the major attractions of many dairy producers to shortening the dry period is the potential to simplify management of dry cows through moving toward a one-group nutritional strategy for dry cows. However, shortening the dry period for all cows is not practical because on all farms there will be a population of cows that will not produce sufficient quantities of milk to justify continued milking and will have dry periods of 60 days or longer. Feeding a high-energy close-up diet to these cows according to NRC (2001) appears to be problematic. Cows that are not managed for shorter dry periods should continue to be fed a moderately low energy diet (~ 1.25 to 1.30 Mcal/kg of NE_L) during the early dry period; frequently, the diet fed to bred heifers can be used as a reasonable substitute if grouping presents an issue.

Based upon considerations for providing adequate but not excessive energy to dairy cows during the late dry period, we have moderated our

recommendations for nonfiber carbohydrate (NFC) and energy content of diets fed to dairy cows during the close-up period (Overton et al., 2003; Overton and Waldron, 2004). Nutrient guidelines for this nutritional strategy are detailed in Table 4. I believe that this formulation is suitable for either the close-up group within two-group dry cow management systems or one-group dry cow programs up to 40 day dry periods, regardless of the use of anionic supplements in the diet.

Table 4. General goals for diet formulation for close-up cows and one-group dry cow programs with shortened dry periods

	Partial anionic	**Full anionic**
NE_L, Mcal/kg	1.50 to 1.54	
Metabolizable protein, g/d	1100 to 1200	
NFC, %	34 to 36	
Starch, %	19 to 21	
Dietary Ca, g/d	100	140
Dietary Ca, %	0.90	1.20
Dietary P, %	0.30 to 0.35	
Mg, %	0.4 to 0.42	
Cl, %	0.3	0.8 to 1.2
K, %	> 1.3	> 1.3
Na, %	0.10 to 0.15	
S, %	0.20	0.3 to 0.4
Added Se (organic), ppm	0.3	
Vitamin A (IU/d)	100000	100000
Vitamin D (IU/d)	30000	30000
Vitamin E (IU/d)	1800	1800

■ Shortened Dry Periods – Economic Aspects

The economic advantages, at least in the U.S. system without costs for quota, of shortening the dry period are remarkably substantial for such a simple management practice. A simple partial budget for the economics of shortening the dry period for cows of varying production level is presented in Table 5. In the U.S. system, this strategy offers many farms the opportunity to increase their net farm income per cow by 20% or more. Obviously, quota complicates this calculation for the Canadian system; however, recalculating the economics within the framework of the Canadian system should be conducted and may encourage adoption within the Canadian dairy industry.

Table 5. Marginal profits (U.S. system and currency) for adoption of 40-day dry periods based upon production level.

Item	Additional daily milk from 60 vs. 40 days dry	
	23 kg/d	27 kg/d
Marginal income		
Milk ($0.31/kg)	$140	$168
Marginal expense[1]		
Extra lactating diet	$48	$56
Extra close-up diet	$14	$14
Variable cost	$15	$15
Total marginal expense	$77	$85
Net per cow	$63	$83

[1]Assumes lactating diet cost of $3.00 per cow-day, far-off diet cost of $0.75 per cow-day, and close-up diet cost of $1.50 per cow-day, and that cows managed for shortened dry periods are fed the close-up diet for their entire dry period.

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