

# Dry period length and performance of cows in the subsequent production cycle

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## Abstract

The effect of dry period length on performance in the next production cycle was investigated in the active population of cows from the Pomerania and Kuyavia regions of Poland. Dry length period of the cows was calculated and classified (0, 1-20, 21-40, 41-60, 61-80, 81-100, >100 days). The GLM, FREQ and CORR PEARSON procedures of the SAS package 9.1 were used in the statistical calculations. The problem of dry period length was found to be debatable. A dry period of 40-60 days would be the most favourable in terms of milk, fat and protein yield in the next lactation, the course of parturition and the proportion of calves born alive, and a dry period of 21-60 days would be the most beneficial in terms of the proportion of cows surviving the next production cycle. Extending or shortening the standard dry period of 40-60 days by 20 days causes a slight decrease in performance determined by the above parameters, whereas extending and especially shortening the dry period by another 20 days, or the absence of a dry period, have a severely negative effect. Compared to cows that had been dry for 40-60 days, the cows whose calving was not preceded by a dry period had lower lactation yield (by 25 % for milk, by 24 % for fat and by 20 % for protein), lower daily milk yield (by 22 %), were significantly more prone to miscarriage, and more frequently gave birth to dead calves, calves with physical defects or grossly malformed calves. Too long a dry period (beyond 100 days) may carry a risk of higher culling levels in the herd, shorter lactations, health abnormalities, and poorer reproductive performance.

**Keywords:** cows, dry period, milk, fertility, culling

## Introduction

Intensive breeding work that has been carried out over the last 40 years coupled with improvements in environmental conditions caused the milk yield of cows to double in many countries. Higher milk yields increased changes in cow productivity, among others by extending lactations. It is therefore necessary to revise the length of the dry period which, according to the current management strategy for a dairy herd should be 6-8 weeks long with the optimum, 305-day lactation (Guliński *et al.* 2004, Salamończyk & Guliński 2007, Sawa & Bogucki 2009). Lormore & Galligan (2001) found a negative effect of drying high-yielding cows (with daily milk yield during the dry period often exceeding 30 kg) on their health status (metabolic disorders, fatty liver, ketosis, periparturient hypocalcemia). However, Grummer & Rastani (2004) reported that the dry period may be shortened without adversely affecting

milk yield in the subsequent lactation. In addition, the shorter dry period may eliminate the need to separate dry cows from the other cows and reduce the number of ration changes in the periparturient period and the associated stress in animals. On the other hand, Annen *et al.* (2004), Andersen *et al.* (2005) and Rastani *et al.* (2005) state that the absence of a dry period reduces the yield of milk and milk nutrients by 20-40%. Other authors indicate varying effects of dry period length on milk yield and composition. According to Borkowska *et al.* (2006) and Węglarzy (2009), too short a dry period (up to 20-30 days) caused a decrease in the yield of milk, fat and protein per standard and full lactation and in daily milk yield. Other studies (Bachman 2002, Bachman & Schairer 2003) showed a 30-day dry period to have no effect on milk yield. Also Gulay *et al.* (2003) found that shortening the dry period from 60 to 30 days had no effect on milk yield in the next lactation, and on the body condition and health of periparturient cows. Meanwhile, extending the dry period (>70 days) reduced the yield of milk and its components (Kuhn *et al.* 2007).

The aim of the study was to analyse the effect of dry period length on the productivity of cows in the next production cycle, based on a large body of data on milk production, reproductive performance and reasons for culling, collected from performance recorded cows.

## Material and methods

Data used in the study originated from the SYMLEK database - an information system, covering all issues related to the evaluation and breeding of cattle in Poland - and concerned milk productivity, reproductive performance and reasons for culling of 22 906 Black-and-White cows improved with the Holstein-Friesian breed and belonging to the active population in the Pomerania and Kuyavian regions of Poland. The cows first calved in 2000 and 2001 and were used or culled until 2008. Dry length period of the cows was calculated and classified (0, 1-20, 21-40, 41-60, 61-80, 81-100, >100 days). The length of calving interval (CI), rest period (RP), service period (SP) and insemination index (II) in the subsequent reproductive cycle were calculated.

Analysis of variance was used to determine the effect of dry period length on milk performance (days of milking, yield of milk, fat and protein, content of fat and protein) and reproductive performance (CI, RP, SP and II) in the subsequent production cycle of the cows. Significant differences were determined using the Scheffe test.

Using a chi square independence test of the SAS package 9.1 (SAS Institute Inc., Cary, NC, USA) the following were analysed depending on the length of the dry period:

- percentage of cows whose next calving was unassisted, easy, difficult (using much more force than normal), abnormal (surgery, cow or calf injuries, embryotomy), or with miscarriage,
- percentage of calves born alive, dead, with physical defects, or grossly malformed,
- percentage of cows surviving the next production cycle, sold and culled, taking into account the reasons provided by the SYMLEK system (low milk yield, udder diseases, infertility and reproductive diseases, infectious diseases (including leukaemia), old age, metabolic and gastrointestinal diseases, respiratory diseases, locomotor diseases, accidents, and others).

## Results and discussion

Among 52 928 dry periods, most (39.33 %) were 40-60 days long and fell within the range of 6-8 weeks prescribed in breeding practice. Dry period length caused statistically significant differences in milk and reproductive performance in the next production cycle (Table 1).

The highest yield of milk, fat and protein was found in cows that were dried for 40-60 days. Pytlewski *et al.* (2009) reported that in Polish Black-and-White Holstein-Friesian cows, the most beneficial dry period lengths in terms of milk yield per 305-day lactation were those of 64-70 days (for cows with >87.5 % HF genes) and 57-63 days (for cows with ≤87.5 % HF genes), with the period of ≤42 days being the worst. Both shortening and extending the dry period caused the yield of milk and milk nutrients to decrease in the next lactation. In terms of the yield of milk and milk components, shortening the dry period was found to be less favourable than extending it beyond the standard period of 40-60 days. Similar relationships were reported by Kuhn *et al.* (2005). Extending the dry period to 60-80 days caused a slight (about 1-2 %) decrease in milk yield, but the highest decreases were recorded when the dry period was absent (by 25 % for milk yield, by 24 % for fat yield, and by 20 % for protein yield). Dry period is important for replacing senescent mammary epithelial cells and increasing the epithelial component of the gland prior to the next lactation. During the production cycle before the expected calving a period of rest is needed and in that time milking is ceased and thus the production of milk in the udder stops. The dry period is required for the regeneration of the mammary gland and its preparation for lactation, during that time papillae of the rumen and the small intestine are regenerated, and the organism of the cows prepares for increased nutrient requirement of the mammary gland during lactogenesis (Capuco *et al.* 1997, Annen *et al.* 2004). Shortening the dry period to <20 days caused an about 15 % decrease in the yield of milk and milk components. This decrease was slightly higher than when the dry period was extended beyond 100 days. The yield of cows whose dry period was 21-40 or 80-100 days proved about 5 % lower than that of cows dried for 40-60 days. These findings are consistent with the results of Węglarzy *et al.* (2007), who reported that too short (<1 month) and too long (>3 months) dry periods adversely affect the yield of milk, fat and protein in the next lactation. This agrees with the earlier studies by Borkowska *et al.* (2006) and Winnicki *et al.* (2008).

Dry period length also caused differences in daily milk yield but in a different way than full lactation milk yield. The absence of a dry period and its considerable shortening considerably reduced daily milk yield in the next lactation. The least amount of milk (15.8 kg/day) was obtained from cows whose lactation was not preceded by drying. Daily milk yield increased (up to 20.4 kg/day) as the dry period was extended to 80 days and there was a slight decrease in milk yield (by 0.6 kg/day) when the dry period exceeded 100 days. A relationship between dry period length and milk yield was reported by other authors (Gulay *et al.* 2003, Borkowska *et al.* 2006, Kuhn *et al.* 2006).

Analysis of the effect of dry period length on the content of basic milk components in the next lactation showed that it was the highest in cows given no dry period, whereas protein content decreased and fat content tended to decrease with the extending dry period. Likewise, Borkowska *et al.* (2006) showed generally lower fat and protein content for extended dry periods. A similar relationship was reported by Gulay *et al.* (2003) and Rastani *et al.* (2005).

Table 1  
Effect of dry period length on efficiency of using cows

Parameters of the cows	Dry period length, days						Significance of differences
	0	1-20	21-40	41-60	61-80	>100	
	1	2	3	4	5	6	7
Number of periods	1 200	2 075	8 046	20 815	12 529	4 014	4 249
Days of milking	307	314	329	329	323	316	295
Milk in lactation, kg	4 890	5 625	6 207	6 575	6 512	6 305	5 837
% in relation to group 4	74.4	85.6	94.4	100.0	99.0	95.9	88.8
Fat, %	4.41	4.27	4.28	4.29	4.28	4.31	4.36
Fat, kg	214	238	265	281	278	271	252
% in relation to group 4	76.2	84.5	94.3	100.0	98.9	96.4	89.7
Protein, %	3.54	3.40	3.34	3.31	3.26	3.24	3.24
Protein, kg	174	192	209	219	215	207	193
% in relation to group 4	79.5	87.7	95.4	100.0	98.2	94.5	88.1
Milk, kg/day of milking	15.8	17.9	19.0	20.2	20.4	20.2	19.8
CI, days	395	406	408	411	414	420	429
RP, days	78	82	84	85	88	89	98
SP (days)	37	41	41	42	43	45	50
II	1.80	1.95	1.91	1.93	1.94	1.97	2.03

\*\*P≤0.01, \*P≤0.05

Table 2  
Effect of dry period length on calving character ( $\chi^2=2.086^{**}$ )

Course of parturition	Type of parturition in % depending on dry period length, days						Mean proportion of the cows, %
	0	1-20	21-40	41-60	61-80	> 100	
Unassisted	40.58	43.08	46.36	44.84	42.55	43.3	44.12
Easy	39.58	46.70	52.35	54.41	56.59	55.73	54.19
Difficult	0.17	0.67	0.34	0.51	0.69	0.68	0.55
Abnormal	0.00	0.00	0.01	0.03	0.04	0.00	0.03
Miscarriage	19.67	9.54	0.94	0.20	0.13	0.10	0.10

\*\*P≤0.01

Lactation length varied according to the length of the preceding dry period. The longest lactations (329 days) were those after dry periods of 21-60 days. In the other cases, lactations were shorter (by as much as 34 days) the longer or the shorter the preceding dry period. The results given in Table 3 suggest that this may be associated with the fact that cow survival to the next lactation decreased with increasing or decreasing dry period length.

As the dry period was extended, fertility of the cows decreased in the next reproductive cycle, with extended CI having a greater effect on extended RR than SP. The positive effect of a shorter dry period (34 days) on reproductive parameters of multiparous cows was reported by Watters *et al.* (2009). However, Gallo *et al.* (2008) failed to confirm a considerable effect of dry period length on the calving interval.

Analysis of the results in Table 2 shows that the course of parturition was significantly influenced by the length of the preceding dry period. This particularly concerned miscarriages, the proportion of which was almost 20% for the absence of a dry period and almost 10% when the dry period was 1-20 days long, compared to about 0.1-0.2% of miscarriages in the other groups of cows. The unfavourable consequences of shorter dry periods may raise fears, but these results should be attributed to the fact that the statistical analysis used SYMLEK data on the milk and reproductive performance of the cows, so the absence of a dry period was generally the result of a miscarriage rather than the breeder's well-thought-out decision. The proportion of unassisted and easy parturitions is considered to be similar (97.7-99.2%) in the groups of cows whose dry periods exceeded 20 days.

Considering calf vigour at birth (Table 3), it was found that a period of 40-60 days (96.8% of calves born alive) would be the most favourable. Extending this period by a further 20 days caused a slight increase in the proportion of stillborn calves (up to 4.21%) and calves with physical defects or grossly malformed calves (up to 0.99%). Where the dry period was shortened, the proportion of stillborn calves, calves with physical defects and grossly malformed calves also increased, this increase being the greater the shorter the dry period (no dry period, 5.5% of dead calves and 20.7% of calves with physical defects or grossly malformed calves).

Dry period length was found to have a statistically significant effect on cow survival and culling levels in the next production cycle (Table 4). The largest (73%) proportion of cows surviving the next production cycle was ascertained for cows that were dried for 21-40 days. Where the dry period was absent or shortened to 1-21 days, the proportion of cows surviving the next production cycle was lower by 3.7% and 5.6%. At the same time, the greater was the decrease in the proportion of cows surviving the next production cycle, the longer was their dry period. For example, the difference was 2.4% between cows dried for 21-40 days and those dried for 40-60 days, and as much as 21.5% between cows dried for 21-40 days and those dried for >100 days. These results showed an unfavourable distribution of the reasons for culling, regardless of dry period length. The percentage of unforced cullings decided by the breeder (animals sold for further breeding, low milk yield, old age) was the lowest (4.7%) among cows dried for 40-60 days and increased (to 9%) as dry period length increased or decreased. Most often the cows were culled due to infertility and reproductive diseases, with the smallest proportion of cows culled for that reason found among cows dried for 21-40 days, and the shorter or the longer was the dry period, the greater was the proportion of cows culled for that reason (17.4% in the group dried for over 100 days). There

Table 3  
Effect of dry period length on calves mortality ( $\chi^2=1782^{**}$ )

Calf status	0	Proportion in % of calves depending on dry period length, days					Mean proportion of the calves, %	
		1-20	21-40	41-60	61-80	81-100	>100	
Live calf	73.83	84.34	95.05	96.79	96.50	96.04	94.80	95.23
Dead calf	5.50	4.77	3.44	2.61	2.99	3.06	4.21	3.14
Calf with physical defects or grossly malformed	20.67	10.89	1.50	0.61	0.51	0.90	0.99	1.63

$^{**}P\leq0.01$

Table 4  
Effect of dry period length on culling of cows ( $\chi^2=1060^{**}$ )

Reasons for culling	0	Proportion in % of cows depending on dry period length, days					Mean proportion of the cows, %	
		1-20	21-40	41-60	61-80	81-100	>100	
Cows surviving the next production cycle	68.58	66.65	72.28	69.90	66.75	60.14	50.76	67.08
Sold for further breeding	7.42	7.04	5.08	3.52	3.89	4.24	6.12	4.34
Low yield	1.50	1.45	0.85	0.90	0.88	1.20	1.72	1.01
Udder diseases	2.75	3.57	2.80	3.78	4.46	6.00	6.54	4.15
Fertility and reproductive diseases	11.17	9.83	9.11	10.86	11.85	14.28	17.42	11.58
Infectious diseases (including leukemia)	0.17	1.06	0.82	0.79	0.97	1.74	1.73	0.98
Old age	0.08	0.14	0.12	0.30	0.49	0.75	0.45	0.35
Metabolic and digestive diseases	0.42	0.48	0.57	0.79	1.02	1.10	1.25	0.85
Respiratory diseases	0.00	0.05	0.05	0.03	0.06	0.02	0.07	0.04
Diseases of the locomotor system	0.33	1.06	0.71	1.21	1.42	1.92	2.31	1.30
Accidents	6.42	6.51	5.83	5.91	5.76	6.13	8.38	6.11
Other	1.17	2.17	1.78	2.00	2.47	2.49	3.23	2.22

$^{**}P\leq0.01$

was a tendency for the proportion of culled cows to increase due to udder diseases as the dry period exceeded 40 days. The longer was the dry period, the greater was the proportion of cows culled due to metabolic diseases (0.42 % when the dry period was absent and 1.25 % when the dry period exceeded 100 days). A similar tendency occurred for the proportion of cows culled due to locomotor diseases (0.33 % when the dry period was absent and 2.31 % when the dry period exceeded 100 days).

It is concluded that the problem of dry period length is debatable. A dry period of 40-60 days would be the most favourable in terms of milk, fat and protein yield in the next lactation, the course of parturition and the proportion of calves born alive, and a dry period of 21-60 days would be the most beneficial in terms of the proportion of cows surviving the next production cycle. Extending or shortening the standard dry period of 40-60 days by 20 days causes a slight decrease in performance determined by the above parameters, whereas extending and especially shortening the dry period by another 20 days, or the absence of a dry period, have a severely negative effect. Compared to cows that had been dry for 40-60 days, the cows whose calving was not preceded by a dry period had lower lactation yield (by 25 % for milk, by 24 % for fat and by 20 % for protein), lower daily milk yield (by 22 %), were significantly more prone to miscarriage, and more frequently gave birth to dead calves, calves with physical defects or grossly malformed calves. Too long a dry period (beyond 100 days) may carry a risk of higher culling levels in the herd, shorter lactations, health abnormalities, and poorer reproductive performance.

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