

EFFECT OF EXTENDED LACTATIONS ON MILK AND REPRODUCTIVE PERFORMANCE OF COWS

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Abstract. The study involved 132 Polish Black-and-White Holstein-Friesian cows, kept in a public sector farm located in the Kujawsko-Pomorskie province. The yield of the analysed cows averaged 12,800 kg milk. The aim of the study was to determine the effect of lactation length in high-yielding cows on milk yield, milk composition and indicators of fertility. The results show that in high-yielding herds, cows often have lactations beyond the traditional 305 days. In the analysed herd, 89.4% lactations were extended. With extended lactations, milk production increased from 9,278 kg for a 305-day lactation to 16,497 kg for lactations >420 days. With extended lactations, milk yields during the extended lactation period and % yield in relation to 305-day lactation gradually increased, with statistically significant differences between the groups. The cows that completed their standard 305-day or shorter lactations were characterized by optimum indicators of fertility, which decreased with extended lactations. The longest lactations were found in third and fourth lactation cows, and the shortest in older cows beyond the fourth lactation. First calvers were characterized by poorer indicators of fertility compared to older cows.

Keywords: dairy cows, indicators of fertility, lactation length, milk yield

INTRODUCTION

The annual milk yield per cow has considerably increased as a result of long-term breeding work with dairy cattle, improved nutrition, and veterinary care. The Polish Federation of Cattle Breeders and Dairy Farmers [2011] reports that the annual yield of milk-recorded cows in 2010 was 6,980 kg, but many currently used cows reached milk yields in excess of 10,000 kg. The increasing milk yield increases the frequency of extended lactations and decreases fertility parameters in high-yielding dairy cows [Hibner et al. 1999]. Based on the opinions of different authors, Krzyżewski and Reklewski [2003] concluded that the negative effects associated with high milk yields – manifested in higher frequency of metabolic diseases, reproductive disorders and increased susceptibility to mastitis – shorten the productive life of cows and raise both treatment and herd replacement costs. The cited authors believe that reduction in energy deficit during the early stage of lactation, extension of the calving interval

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and improvement of functional traits may alleviate the adverse effects of high milk yields. A 305-day lactation is considered a standard in Poland. In practice, it is generally shorter or longer. Lactations shorter than 260 days and longer than 360 days are regarded as undesirable [Czaplicka et al. 2003]. However, in many high-yielding cows lactations are extended to avoid drying-off issues and deteriorating health problems. Knight [2005] holds that modern dairy cows not only have high yields but also can maintain high milk production for longer periods of time. Extended lactations are most often due to extension of the calving interval [Szarek 1998]. The Polish Federation of Cattle Breeders and Dairy Farmers [2011] reported that the mean calving interval for all dairy cows in Poland in 2011 was 430 days. According to Juszcak and Hibner [2000], there is no justification for the rule that calving interval should last around 365 days in high-yielding cows, because it shortens the productive life and reduces the lifetime yield of cows with high conception rates. Sorensen et al. [2008] hold that the benefits of longer lactation periods in cows are a reduction in morbidity and fewer reproductive problems.

The aim of the study was to determine the effect of lactation length in high-yielding cows on milk yield, milk composition and indicators of fertility.

MATERIAL AND METHODS

The study was carried out with 132 Polish Black-and-White Holstein-Friesian cows maintained in one of leading public sector dairy farms in the Kujawsko-Pomorskie province. The mean yield of the investigated cows was 12,800 kg milk (data for 2009). Animals were kept in a loose-housing system, milked three times daily (4.30, 12.00, 18.00) in a herringbone milking parlour, and fed TMR diets, which contained maize silage, ensiled hay, hay or straw, CCM (Corn Cob Mix) silage, soybean meal, rapeseed meal, ground wheat, minerals and vitamins. The cows participate in A4 milk recording scheme.

Analyses were performed based on data collected in the SYMLEK database and information from the farm's breeding records. A database was created to include one lactation per cow calved in 2007–2009.

Analysis was made of the effect of lactation length (≤ 305 , 306–330, 331–360, 361–390, > 390 days) on milk performance of cows (whole lactation milk yield, milk yield during extended lactation, milk yield per day of extension, proportion of milk obtained during extended lactation in relation to milk yield for 305-day lactation, content of fat, protein and solids) and indicators of fertility (calving interval, reproductive rest period, service period, services per conception), also taking account of lactation number (1, 2, 3–4, > 4).

The results were analysed statistically by analysis of variance using the least square means method [SAS/STAT®2008].

RESULTS AND DISCUSSION

When analysing the results in Table 1, it was found that only 10.6% of the cows completed their standard 305-day or shorter lactation. The mean yield of these cows was 9,278 kg milk.

In the herd studied, 89.4% of the cows had extended lactations. Most cows (30.3%) extended lactation by 1–25 days. In 22% of the cows, lactation was longer than 390 days. The milk yield of the cows increased steadily as the lactation period was extended (up to 16,186 kg for a lactation longer than 390 days). The highest milk yield per day of extension (26.8 kg) was observed for lactations of 331–360 days, and the same group was also characterized by the highest content of fat (4.12%). The highest protein yield (3.31%) and the highest solids content of milk (12.85%) were noted for lactations of 361–390 days. With longer lactation duration, milk yield during the extended lactation period and the proportion of milk obtained during the extended lactation period in relation to the milk yield for a 305-day lactation gradually increased, with statistically significant differences between the groups. It is worth noting the high milk yields (over 25 kg milk per day) in the group of cows with lactation extended by over 85 days.

Table 1. Milk yield and composition according to lactation length

Tabela 1. Wydajność i skład mleka w zależności od długości laktacji

Lactation length, days Długość laktacji, dni	n	%	Total yield, kg Wydajność pełna, kg	Yield per day of extension, kg Wydajność na dzień przedłużenia, kg	Yield during the extension period, kg Wydajność w okresie przedłużenia, kg	Yield relation to 305-day lactation, % Wydajność w stosunku do laktacji 305-dniowej, %	Fat, % Tłuszcz, %	Protein, % Białko, %	Dry matter, % Masa sucha, %
305	0		B				3	5	3
30 330	0	30 3	D	a	3 a	00 a	3	3	0
33 3 0	3		0		0 B	0 aB		3	
3 3 0			33 BF		3 a	0		3 3	5
3 0		0	D	5 a	35 B	3 0 B	00	3	

Mean values in within examined factors followed by the same letters differ significantly: capital letters – at $P \leq 0.01$; small letters – at $P \leq 0.05$.

Wartości średnie cech oznaczone tymi samymi literami różnią się statystycznie istotnie: dużymi przy $P \leq 0,01$; małymi przy $P \leq 0,05$.

The results obtained for indicators of fertility, depending on lactation length, are presented in Table 2. The cows that completed their standard 305-day or shorter lactations were characterized by optimum fertility parameters (calving interval 366 days, reproductive rest period 81 days, services per conception 1.14). The cows that extended their lactations by 1–25 days were still characterized by good fertility (calving interval 378 days). In the cows with lactations extended by 26–55 days, calving interval increased to 416 days and the other indicators were also slightly higher than in cows with shorter lactation periods. In the cows that increased milk production by 56–85 days, the indicators of fertility deteriorated (calving interval 438 days, service per conception 2.65). The poorest fertility parameters were noted in cows with lactations longer than 390 days (calving interval 537 days, service period 163 days, services per conception 4.17). Except the reproductive rest period, the differences were statistically significant ($P \leq 0.01$).

Table 2. Reproductive parameters according to lactation length
Tabela 2. Wskaźniki płodności w zależności od długości laktacji

Lactation length, days Długość laktacji, dni	n	%	average interval, days średni kres międzyżywieniowy, dni	average resting period, days średni kres spoczynku rozrodczego, dni	average service period, days średni kres usługi, dni	average per conception index średni indeks inseminacji
305		0	3 a		B	B
303	0	30	3 B		5 D F	0 D F
330	3			5	53 D	D
330			3 a D	3	B	5 B
303		0	53 B D		3 F	F

Mean values in within examined factors followed by the same letters differ significantly: capital letters – at $P \leq 0.01$; small letters – at $P \leq 0.05$.

Wartości średnie cech oznaczone tymi samymi literami różnią się statystycznie istotnie: dużymi przy $P \leq 0.01$; małymi przy $P \leq 0.05$.

First-calf heifers extended their lactation the most often. In this group, no 305-day or shorter lactations were noted (Table 3), lactation in first-calf heifers was 344 days long on average, and these animals achieved the highest milk yield and content of fat, protein and solids (13,793 kg, 4.25%, 3.31% and 13.01%, respectively). The longest lactations (388 days) were found in 3rd and 4th lactation cows, and the shortest (327 days) in older cows beyond 4th lactation. Compared to first-calf heifers, the milk yield of these cows was lower by 1,181 and 1,909 kg, respectively. The differences were not significant.

Table 3. Milk yield and composition in consecutive lactations according to lactation length
Tabela 3. Wydajność i skład mleka w kolejnych laktacjach w zależności od długości laktacji

Lactation number numer laktacji	Lactation length, days Długość laktacji, dni	n	Total yield, kg Wydajność pełna, kg	Fat, % Tłuszcz, %	Protein, % Białko, %	Dry matter, % Masa sucha, %
	305					
	3		3 3	5	3 3	3 0
	305	5	0		3 0	
	355 0			3	3	3
3	305		555	3	3 3	3
	3	0	3 5	03	3	3
	305	5		3	3	
	3				3	

The data in Table 4 confirm the results contained in Table 2 that animals which did not extend their lactations beyond 305 days showed optimum indicators of fertility. The longest calving interval (528 days) was found in first-calf heifers that extended lactation by 39 days on average. Cows in their second and later lactations had a short calving interval despite the fact that they extended their lactations by 50–83 days. The other indicators of fertility were also worse in first-calf heifers than in older cows. The long service period of 155 days in first-calf heifers is evidence that this group of animals had difficulties in conceiving. This may be influenced by the high milk yield of first-calf heifers because Ouweltjes et al. [1996] believe that higher-yielding cows conceive later and require a greater number of inseminations for successful conception.

Table 4. Reproductive parameters in consecutive lactations according to lactation length
Tabela 4. Wskaźniki płodności w kolejnych laktacjach w zależności od długości laktacji

Lactation number olejna laktacja	Lactation length, days Długość laktacji, dni	Calving interval, days kres międzywycieleniowy, dni	Rest period, days kres spoczynku rozrodczego, dni	Service period, days kres usługi, dni	Services per conception indeks inseminacji
	305				
	3	5	3	55	3 0
	305	5	3	0	0
	355 0		3		3
3	305	3 3		0	00
	3	0	5		
	305	5	35	0	00
	3	0		5	0

Januś and Borkowska [2011] were found that frequency of extended lactations was 78.7% and moreover the most frequently (25%) the period of extension lasted up to 30 days. During extension period milk production was higher by 2.5–43.0% in compare to milk yield in standard lactation. Dymnicki et al. [2003] and Miciński [2008] showed that a considerable group of cows extended lactation spontaneously. In a study by Czaplicka et al. [2003], mean lactation length ranged from 349.46 days in the second lactation to 362.25 days in the fourth. In a study by Salamończyk and Guliński [2007], whole lactation milk yield increased with extended lactation; the authors also found that the highest milk production during the extended lactation period was obtained by cows with the highest 305-day lactation yield (>8,000 kg) and the lowest milk production during the extended lactation period was characteristic of animals with the lowest level of milk production (<4,000 kg). Likewise, Sawa and Bogucki [2009] demonstrated that the longer the lactation and the higher the milk yield that cows obtained during standard lactation, the higher the extended lactation milk yield was found. Hibner et al. [1999] also reported that daily milk yield of

cows remained high in the final period of extended lactation. Similarly, Czaplicka et al. [2003] found that extended lactations in high-yielding cows did not reduce milk yield per day of lactation. Guliński and Salomończyk [2007] observed that mean daily production during the extended lactation period was 18 kg milk. Sorensen et al. [2008] report that high-yielding cows achieve better production results in 14-month compared to 12-month lactation cycles, and consider longer lactations to be profitable with no threat to milk quality.

Our findings confirm the results of other authors [Czaplicka et al. 2003, Guliński et al. 2004, Miciński 2008], who showed that a considerable proportion of cows extend lactation beyond 305 days. Szarek [1998] holds that longer lactation, and thus longer calving interval and number of days open have greater economic justification in high-yielding cows. Based on their study, Krzyżewski et al. [2004] found that in cows producing at least 8,000 kg milk per lactation, it is practically impossible to maintain traditional 12-month calving intervals, and the number of days open in such animals averaged 111. Krzyżewski et al. [2004], Strzałkowska et al. [2004] and Sawa and Bogucki [2009] showed that the slightly less favourable fertility parameters in cows from groups with longer lactations are compensated by higher milk yields.

Piech and Tarkowski [2001] found that lactations extended as cows became older, and also Krzyżewski et al. [2004] reported that lactations were 10 days longer in older cows (second and later lactations). Meanwhile, longer lactations in first-calf heifers than in multiparous cows were reported by Dymnicki et al. [2003], Guliński et al. [2004] and Salomończyk and Guliński [2007]. Krzyżewski and Reklewski [2003] believe that longer calving interval is favourable especially in first-calf heifers characterized by greater lactation persistency, which allows them to reach full maturity more quickly and puts them in proper body condition before the next conception.

CONCLUSIONS

In the herd under study, 89.4% of the cows extended their lactations beyond 305 days. As the lactation period was extended, milk production increased and the proportion of milk obtained during the extension period in relation to 305-day lactation yield increased from 2 to 42%. With extended lactation, the extended lactation milk yield and percentage milk yield in relation to 305-day lactation gradually increased, with significant differences between the groups. The cows that completed standard 305-day or shorter lactations were characterized by optimum fertility parameters, but these parameters deteriorated as lactation became longer. The longest lactations were found in 3rd and 4th lactation cows, and the shortest in older 4th and later lactation cows. First-calf heifers had poorer fertility parameters than older cows. The results obtained indicate that cows achieved better production results in 14-month than 12-month production cycles. Lactation extension may reduce the number of calves obtained per year, but at the same time it decreases the outlays on calving. Poorer fertility parameters in cows with extended lactations may be compensated by higher profitability of milk production.

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WPŁYW PRZEDŁUŻONYCH LAKTACJI NA UŻYTKOWOŚĆ MLECZNĄ I ROZPŁODOWĄ KRÓW

Streszczenie. Badania przeprowadzono na 132 krowach rasy polskiej holsztyńsko-fryzyjskiej odmiany czarno-białej, utrzymywanych w jednym z gospodarstw sektora publicznego w województwie kujawsko-pomorskim. Średnia wydajność badanych krów wyniosła 12 800 kg mleka. Celem pracy było określenie wpływu długości laktacji u krów wysoko wydajnych na ich wydajność i skład mleka oraz wskaźniki płodności. Otrzymane wyniki wskazują, że w stadach o wysokiej wydajności mlecznej krowy często przedłużają laktację ponad 305-dniowy standard. W ocenianym stadzie wydłużenie to dotyczyło 89,4% laktacji. Wraz z dłuższą laktacją wzrastała produkcja mleka od 9278 kg, przy laktacji 305-dniowej, do 16 186 kg przy laktacjach >390 dni. Wraz z dłuższą laktacją wydajność mleka w okresie przedłużenia laktacji, jak i procent wydajności w stosunku do laktacji 305-dniowej stopniowo wzrastała, różnice między grupami zostały potwierdzone statystycznie. Krowy, które ukończyły standardową 305-dniową laktację lub krótszą, charakteryzowały optymalne wskaźniki płodności, natomiast wraz z dłuższą laktacją wskaźniki płodności były obniżone. Najdłuższe laktacje stwierdzono u krów po 3.–4. wycieleniu, natomiast najkrótsze u krów starszych >4. laktacji. U krów pierwiastek odnotowano słabsze wskaźniki płodności niż u krów starszych.

Słowa kluczowe: długość laktacji, krowy mleczne, wskaźniki płodności, wydajność

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