

EFFECT OF CALVING SEASON ON THE COURSE OF PARTURITION AND REARING RESULTS OF POLISH HOLSTEIN-FRIESIAN CALVES

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Abstract. The aim of the study was the analysis of the effect of calving season on the course of parturition and rearing results of Polish Holstein-Friesian calves of Black-and-White strain from birth to 3 months of age. Easy calvings (1;2) predominated on the farm. In spring, they accounted for 91.2% of all calvings occurring in this season. The respective values for summer, winter and autumn were 89.7%, 88.6% and 87.6%. The highest mean birth weight was characteristic of calves born in winter (40.8 kg and 44.2 kg for heifer calves and bull calves, respectively). The highest mean daily body weight gains in the whole rearing period were achieved by heifer calves born in winter (704 g) and bull calves born in spring (750 g). In the group of heifer calves and bull calves, statistically significant differences during the analysed rearing period were found ($P \leq 0.01$, $P \leq 0.05$). The highest percentage of ill calves was found in the autumn-winter season and the lowest one in spring and summer.

Keywords: calving season, daily body weight, gains, rearing of calves

INTRODUCTION

Rearing of calves plays an important part in animal production. The initial stage of their life, their management and feeding are crucial for their subsequent performance. Any neglect in this period inhibits the growth and development of an animal, which results in lengthening of rearing period and clearly affects the farm effectiveness [Razzaque et al. 2009]. Hygienic management conditions, quality, functionality and microclimate of farm buildings have direct influence on the well-being, health and, consequently, productivity of animals. The diet of newborn calves is also important [Górka and Kowalski 2007]. Stillbirths, diarrhoea, and disorders of respiratory system belong to the most frequent causes of calves' losses [Szewczuk et al. 2006 b, Ansari-Lari 2007]. The worst effects for the life of newborns are caused by lack of immunity and susceptibility to bacterial and viral infections resulting from this. The first dozen or so days after calving coincide with the very difficult period of adaptation to the new conditions of life. At this time, the highest incidence

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of diseases and mortality rate are observed in calves [Ansari-Lari 2007, Gulliksen et al. 2009, Razzaque et al. 2009]. Therefore, the high immunity during the first weeks of life is a factor determining the results of the whole rearing and the minimization of the incidence of diseases typical of this period [Nowak et al. 2005].

The aim of the study was the analysis of the effect of calving season on the course of parturition, rearing results and health of calves up to 3 months of rearing.

MATERIAL AND METHODS

The study was performed on a farm located in the West Pomerania Province. Research material consisted of 809 Polish Holstein-Friesian calves of Black-and-White strain. The detailed analysis included 375 heifer calves and 338 bull calves from birth to 3 months of age.

Calves after birth stayed with their dams in calving pens in a barn for 24 hours. Next, they were moved to the igloo boxes with a run outside the building, where they were reared up to 90 days of age.

After the period of feeding with colostrum up to 30 days of rearing, the calves were fed 2 litres of full-cream milk 3 times a day, whereas older calves (approx. 30 days old) were given 10 litres in 3 meals a day. The Milsan milk replacer provided by Sano was introduced gradually. The calves were given up to 6 litres of the milk replacer daily (2 x 3 l). The milk replacer was used till 90 days of rearing. From 15 days of age, calves were fed calf starter in the form of pellets, and from 3 months of age they were fed *ad libitum* meadow hay. Milk, milk replacer and water (*ad libitum*) were given to animals from the bucket fitted with a teat.

The evaluation of the course of the development of calves was performed based on the results of body weight in consecutive months of life, that is, after birth, at the age of 30, 60 and 90 days. On the basis of the obtained weighing results, the daily body weight gains for the whole period of rearing were calculated (from birth to 90 days). The course of calvings was evaluated on a 5-point scale: 1 – spontaneous parturition, without help, 2 – easy parturition with a help of man, 3 – difficult parturition with the help of more than one person, using greater force, 4 – difficult parturition (dystocia) with the help of veterinarian (surgery, injury of cow or calf), 5 – spontaneous abortion. The viability of the examined animals was also evaluated according to the 3-level scale: 1 – normal calf alive, 2 – stillborn calf or calf dead within 24 hours, 3 – calf with malformations or monstrosity.

Data on the course of calvings and viability of calves were obtained from the breeding documentation. The evaluation of health was performed within the first 3 months of age. It was based on the observations by the staff and veterinarian. The disease entities occurring in calves were divided into 3 groups: disorders of respiratory system (pneumonia), disorders of alimentary canal (diarrhoea of various etiology), dermatomycosis. The obtained results concerning mean body weight, daily body weight gains, course of calvings, viability and health of calves were subjected to analysis taking into account season (spring, summer, autumn, winter).

The obtained results were analysed statistically using one-way ANOVA. Significant differences between the groups were determined with the Duncan's multiple range test.

The statistical analysis of the data was done using Excel[®] software. Arithmetic mean (\bar{x}) and standard deviation (SD) were taken into consideration. Statistical calculations were performed using Statistic[®]9 PL software.

RESULTS AND DISCUSSION

On the analysed farm, easy calvings (1;2) predominated, which should be regarded as a positive fact (Table 1). In spring, they accounted for 91.2% of all calvings occurring in this season. The respective values for summer, winter and autumn were 89.7%, 88.6% and 87.6%. Szewczuk et al. [2006 a], in the research on the course of calvings in Holstein-Friesian cows and heifers of Black-and-White strain performed on several farms, also noticed the most frequent occurrence of easy calvings (95%; 1, 2). Similar results were obtained by Sablik et al. [2007]. Chociłowicz et al. [2010] found the occurrence of only easy calvings both in a group of cows imported from Germany and Sweden. In the study by Nogalski [2005], difficult calvings (dystocia), with the help of veterinarian, accounted for 15.1% of the calvings of Holstein-Friesian heifers and 2.6% of the calvings of Jersey heifers. Czerniawska-Piątkowska et al. [2009], studying Holstein-Friesian cows imported from Germany, found the highest number of difficult calvings (with the help of more than one person) amounting to even 49.4%.

Table 1. Assessment of labour ease of cows and heifers including calving season
Tabela 1. Ocena przebiegu porodów krów i jałówek z uwzględnieniem sezonu wycielenia

Code of birth Kod porodu	Spring – Wiosna (N = 171)		Summer – Lato (N = 185)		Autumn – Jesień (N = 225)		Winter – Zima N = (228)	
	n	%	n	%	n	%	n	%
1	122	71.3	142	76.8	163	72.5	112	49.1
2	34	19.9	24	13	34	15.1	90	39.5
3	15	8.8	17	9.2	21	9.3	24	10.5
4	–	–	1	0.5	2	0.9	2	0.9
5	–	–	1	0.5	5	2.2	–	–

Difficult calvings requiring help of veterinarian were definitely in minority. One such parturition occurred in summer, 2 ones in autumn and 2 ones in winter. No difficult calvings were observed in spring. In summer and autumn, spontaneous abortions occurred as well. A low number of such abortions may indicate a professional zootechnical and veterinary care, as well as optimum living and environmental conditions provided to pregnant cows and heifers.

The course of parturition of heifers and cows is adversely affected by excessive body condition and too high emaciation [Przysucha et al. 2009]. According to Nogalski and Górak [2008], in overconditioned animals, fat deposited in the pelvis reduces the inside diameter of the birth canal and may cause difficulties in calving, whereas emaciated animals

do not have the proper relaxation of the pelvis during parturition and the effort necessary for the unassisted parturition is too great and often exceeds the capabilities of heifers.

Also the anatomy of the reproductive tract and the hormonal mechanism associated with the parturition and the effort during parturition are not without significance. More and more frequently the selection for the improvement of calving ease is taken into consideration. Much importance is attached to the selection for the improvement of rump and legs conformation [Przysucha and Grodzki 2007]. Sex of calf, its birth weight and condition are also significant [Jankowska et al. 2005, Przysucha and Grodzki 2007].

In summer, alive and normal calves accounted for 90.2% of all the calves born (Table 2). Similar viability was recorded in the remaining seasons. There were not many calves that had died at birth or within 24 hours after birth. Such calves accounted for 9.8%, 12.3%, 12.3% and 10.5% in summer, spring, winter and autumn, respectively. No calves with malformations or monstrosities were found on the examined farm.

Table 2. Evaluation of viability of calves, taking into account the season of birth
Tabela 2. Ocena żywotności cieląt z uwzględnieniem sezonu urodzenia

Viability of calves Żywotność cieląt	Spring – Wiosna (N = 171)		Summer – Lato (N = 184)		Autumn – Jesień (N = 220)		Winter – Zima (N = 228)	
	n	%	n	%	n	%	n	%
1	150	87.7	166	90.2	197	89.5	200	87.7
2	21	12.3	18	9.8	23	10.5	28	12.3
3	–	–	–	–	–	–	–	–

Increasing viability of calves is very important from the breeding and economic point of view. Unfortunately, despite the significant progress in the systems of rearing, increasingly adjusted to physiological requirements of animals, the death rate of calves in the world has increased significantly in the recent years [Goff 2006, LeBlanc et al. 2006]. According to Skrzypek et al. [2006], it may be presumed that crossing with the Holstein-Friesian breed reduces the viability of calves. These authors consider that, in the genetic improvement of crossbreds with HF or of purebred HF cattle aimed at increasing viability of calves, the ability to ingest colostrum should be the selection trait of the utmost importance.

The highest mean birth weight (Table 3) was characteristic of calves born in winter (40.8 kg and 44.2 kg for heifer calves and bull calves, respectively). In heifer calves born in summer, a significantly higher ($P \leq 0.05$) body weight (40.7 kg) was found in comparison with their age mates born in spring (39.5 kg).

Bull calves born in autumn-summer season had the lowest mean birth weight (43.2 kg) compared to those born in spring or winter (43.7 and 44.2 kg, respectively). Similar results were obtained by Gradowska et al. [2002]. In their study, calves born in summer were characterised by the lowest mean birth weight (37.8 kg and 41.9 kg, respectively), whereas animals born in winter had the highest birth weight (39 kg). Szewczuk et al. [2006 b] recorded the lowest birth weight in bull calves that were born in summer (41.9 kg) and the highest one in their age mates born in autumn (42.6 kg).

Table 3. Mean body weight (kg) of calves from birth to the 3rd month of rearing in relation to season of birth

Tabela 3. Średnie masy ciała (kg) cieląt od urodzenia do 3. miesiąca odchowu w zależności od sezonu urodzenia

Sex Płeć	Birth season Sezon	Parameters Parametry	Body weight, kg – Masa ciała, kg			
			birth przy urodzeniu	1st months 1. miesiąc	2nd months 2. miesiąc	3rd months 3. miesiąc
Heifers – Cieliczki	Spring Wiosna (n = 85)	\bar{x}	39.5 ^a	59.5 ^a	78.8 ^A	102.8 ^A
		S	3.27	3.10	3.64	4.63
	Lato Summer (n = 91)	\bar{x}	40.7 ^a	60.1	78.2 ^B	102.8 ^B
		S	3.78	4.09	4.22	5.64
	Autumn Jesień (n = 102)	\bar{x}	39.8	60.3	79.0 ^C	101.8 ^C
		S	4.46	4.52	4.20	4.72
	Winter Zima (n = 97)	\bar{x}	40.8	61.1 ^a	81.8 ^{ABC}	104.9 ^{ABC}
		S	4.41	5.35	4.17	4.97
Bull calves – Buhajki	Spring Wiosna (n = 65)	\bar{x}	43.7	65.0	85.0 ^A	111.2 ^{AB}
		S	3.63	3.89	4.37	6.10
	Lato Summer (n = 75)	\bar{x}	43.2	63.7	82.2 ^{ABa}	108.4 ^{Aa}
		S	3.89	3.91	3.86	4.92
Autumn Jesień (n = 95)	\bar{x}	43.2	64.4	84.1 ^a	107.5 ^{BC}	
	S	4.60	5.59	5.48	5.99	
Winter Zima (n = 103)	\bar{x}	44.2	64.5	84.5 ^B	110.7 ^{Ca}	
	S	4.77	5.79	4.97	6.8	

A, B, C – differences significant at $P \leq 0.01$; a, b – differences significant at $P \leq 0.05$.

A, B, C – różnice statystycznie istotne na poziomie $P \leq 0,01$; a, b – różnice statystycznie istotne na poziomie $P \leq 0,05$.

Bull calves born in spring were characterised by the highest body weight during the first three months (65 kg, 85 kg and 111.2 kg, respectively). At 1 and 2 months of rearing, bull calves born in summer had the lowest body weight (63.7 kg and 82.2 kg, respectively). However, only from the second month of rearing statistically significant differences ($P \leq 0.01$; $P \leq 0.05$) were noted. At three months of rearing, bull calves born in spring were characterised by the highest body weight (111.2 kg). Significant differences ($P \leq 0.01$; $P \leq 0.05$) were found

between some groups of calves. In heifer calves born in winter, the highest mean body weights were observed during the first 3 months of age compared to those born in the remaining seasons. At one month, heifer calves born in winter were 1.6 kg heavier than those born in spring, whose body weight was the lowest amounting to 59.5 kg ($P \leq 0.05$).

Different results were obtained by Szewczuk et al. [2006 b]. These authors found that the highest mean birth weight was characteristic of heifer calves born in autumn (43.1 kg), whereas heifer calves born in winter had the lowest birth weight (41.7%). In other studies, heifers born in spring were lighter than those born in autumn [Czaja et al. 2002].

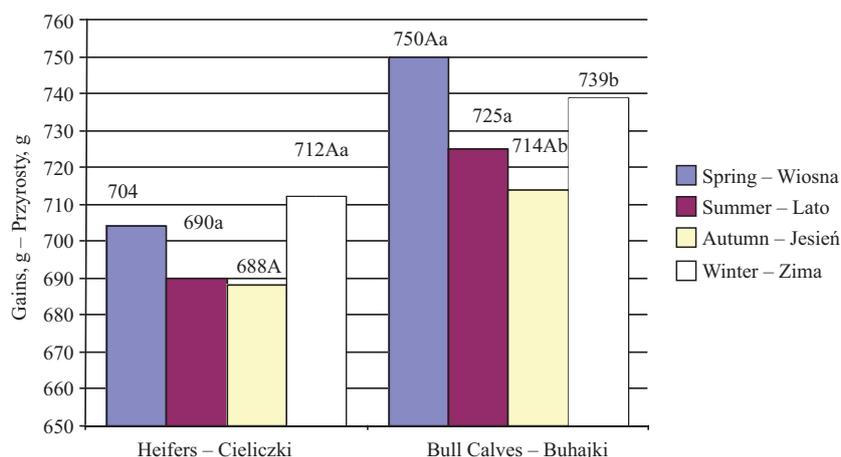
Analysing the mean body weight at 2 and 3 months of age, it was found that the highest values were obtained by heifer calves born in winter (81.8 and 104.9 kg, respectively) compared to heifer calves from the remaining seasons and the differences were statistically significant ($P \leq 0.01$).

Analysis of the mean daily body weight gains of calves from birth to 3 months of age including sex and calving season (Fig. 1) allowed us to observe that the calves born in winter and bull calves born in spring had the highest body weight gains (712 and 750 g, respectively). In the groups of heifer calves and bull calves, statistically significant differences were found between the values of the mean body weight gains in the analysed period of rearing ($P \leq 0.01$; $P \leq 0.05$). The lowest mean daily body weight gains were characteristic of heifer calves that were born in autumn (688 g). Among heifer calves born in autumn and summer, similar values of the daily body weight gains were noted (688 and 690 g, respectively). This may have been caused by high incidence of diseases among calves born in this season. Bull calves born in spring obtained significantly ($P \leq 0.01$; $P \leq 0.05$) higher values of daily body weight gains (750 g) from birth to 3 months of rearing compared to their age mates. Bull calves born in winter obtained higher daily body weight gains than did calves born in autumn ($P \leq 0.05$). In the analysed rearing period, bull calves obtained significantly higher mean body weights and daily body weight gains compared to heifer calves.

Many factors affect the magnitude of daily body weight gains of young animals. These factors are associated, among others, with the organization of feeding and the time of introducing milk replacers and solid feed [Bilska and Wójcik 2003, Górka and Kowalski 2007]. The health condition of cows in the last stage of pregnancy including occurrence of metabolic disorders is also significant [Mordak and Nicpoń 2006]. According to Choroszy et al. [2003] and Szewczuk et al. [2006 b], the factor influencing the difference in the birth weight of calves and their subsequent growth rate is also the sex of animals. Bull calves usually have higher birth weights than heifer calves do and grow faster during rearing. Different results were obtained by Szewczuk et al. [2006 b]. They found, in some periods, higher body weight and daily body weight gains in heifer calves reared till 6 months of age.

Analysing the data concerning occurrence of diseases in the examined herd, it can be observed that calves born in autumn and winter were ill most frequently (Table 4). Szewczuk et al. [2006 b] found the highest percentage of ill animals in analogous periods. In the present study, from among 197 individuals born in autumn, 25 ones had respiratory system diseases, 33 ones suffered from disorders of digestive system and 5 ones were diagnosed with dermatomycosis. In calves born in winter, the high incidence of diseases was also found (18.5% of herd was ill). In the study on Simmental calves, Choroszy et al. [2003]

recorded even 39.96% of ill animals in this season. In the examined herd, the diseases of digestive system were the most frequent. Out of 200 calves that were born in winter, 19 suffered from diseases of digestive system manifesting themselves in a diarrhoea. Also 16 cases of respiratory system disorders with the symptoms of catarrh were recorded, whereas dermatomycosis was diagnosed in 2 calves.



A – differences significant at $P \leq 0.01$; a, b – differences significant at $P \leq 0.05$.

A – różnice statystycznie istotne na poziomie $P \leq 0,01$; a, b – różnice statystycznie istotne na poziomie $P \leq 0,05$.

Fig. 1. Mean values daily gains of calves from birth (g) to the 3 month of rearing in relation to season of birth

Rys. 1. Średnie wartości przyrostów dobowych (g) cieląt od urodzenia do 3. miesiąca odchowu w zależności od sezonu urodzenia

The highest incidence of diseases in autumn may have been caused by the lowest mean birth weights of calves born in this season as well as their weakness and greater susceptibility to diseases. Inappropriate feeding (low temperature of colostrum, cold milk) and inadequate hygiene in this period could also have negatively influenced the health in single cases.

Calves born in spring and summer were ill the least frequently. They were also characterised by the highest mean daily body weight gains. In heifer calves and bull calves born in spring, 2 cases of respiratory system diseases were recorded, whereas in 4 individuals diseases of alimentary canal were diagnosed. In the case of calves born in summer, a similar incidence of diseases was observed. It should be noted that in calves born in spring–summer season, dermatomycosis did not occur. In the aforementioned seasons, Szewczuk et al. [2006 b] also did not observe any cases of this disease. As can be seen from data presented in Table 4, in each season, the diseases of digestive and respiratory systems were the most frequent. Their frequency depended on the calving season. This is in accordance with the studies by Czaja et al. [2002] and Choroszy et al. [2003].

Table 4. Diseases of calves in relation to season of birth
Tabela 4. Choroby cieląt w zależności od sezonu urodzenia

Diseases Schorzenia	Spring Wiosna (N = 150)		Summer Lato (N = 166)		Autumn Jesień (N = 197)		Winter Zima (N = 200)	
	n	%	n	%	n	%	n	%
Airways diseases Układu oddechowego	2	1.3	3	1.8	25	12.7	19	9.5
Alimentary tract diseases Przewodu pokarmowego	4	2.7	6	3.6	33	16.8	16	8
Fungoses Grzybice skóry	–	–	–	–	5	2.5	2	1

The overall analysis of the incidence of diseases (Fig. 2) allowed us to conclude that the most advantageous season for rearing of calves was spring. In this season, only 4% of calves were ill. Most calves (even 32%) were ill in autumn. Szewczuk et al. [2006 b] in the research on the relationship between calving season and the incidence of diseases also recorded the highest incidence of diseases in the autumn season – ill animals accounted for 30.6% of the herd. In another study, Gradowska and Sablik [2001] showed that calves that were born in winter were characterised by the higher susceptibility to diseases of digestive and respiratory systems and were prone to the occurrence of mycosis.

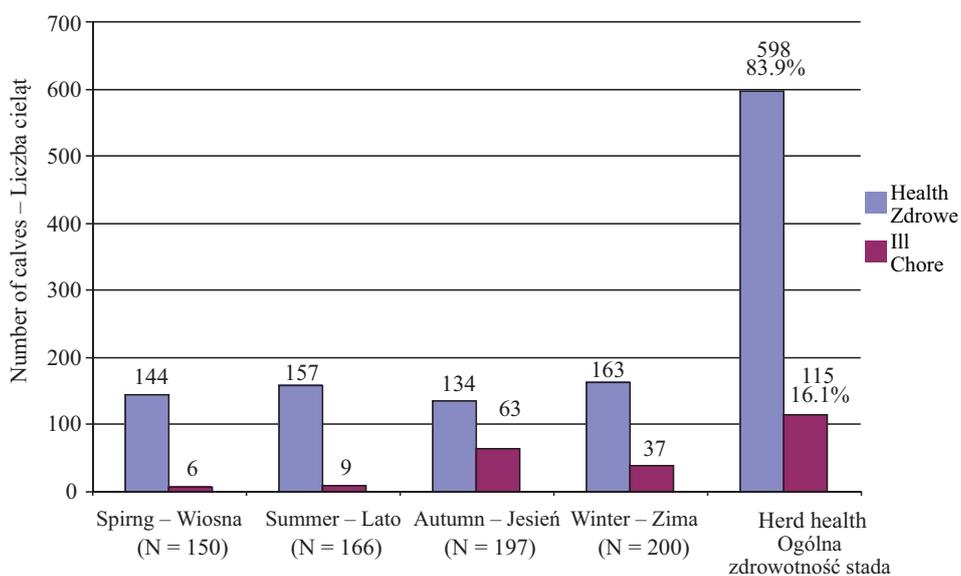


Fig. 2. Health analysis of calves from birth till the 3rd month of rearing, including season of birth

Rys. 2. Analiza zdrowotności cieląt od urodzenia do 3. miesiąca odchowu z uwzględnieniem sezonu urodzenia

Taking into consideration the overall incidence of diseases in a herd (Fig. 2), it can be seen that 115 out of 713 individuals were ill (16.1%). High incidence of diseases causes both economic and breeding losses. Garcia-Graells et al. [2000] found that losses of calves up to 3 weeks of age were associated in 75% with diarrhoea, which is mainly affected by the environmental and nutritional factors as well as by enterotoxigenic *E. coli* strains, corona- and rotaviruses and *Cryptosporidium* sp. [Garcia-Graells et al. 2000, Stec and Mochol 2003]. In calves managed under improper zoohygienic conditions (e.g. low temperature and high humidity) the course of disorders of digestive and respiratory systems may be turbulent [Stec and Mochol 2003].

CONCLUSIONS

It was found that calving season significantly affected body weight of calves, their daily body weight gains and their health in the analysed period of rearing.

Alive and normal calves were born most frequently. No calves with malformations, nor monstrosities were recorded. Also, relatively low percentage (11.8%) of calvings in which calf was stillborn or died within 24 hours from birth was found. The largest number of easy calvings was observed in summer (89.7%) and the smallest one in spring (81.2%).

The highest mean birth weight was found in calves born in winter, whereas the lowest mean birth weights were characteristic of heifer calves born in autumn and bull calves born in summer and autumn. These calves were also ill most frequently (32%), which unquestionably resulted in their lowest mean daily body weight gains from birth to 3 months of rearing. Calves were ill most frequently in autumn–winter season and least frequently in spring and summer.

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WPLYW SEZONU URODZENIA NA PRZEBIEG PORODU I WYNIKI ODCHOWU CIELĄT RASY POLSKIEJ HOLSZTYŃSKO-FRYZYJSKIEJ

Streszczenie. Celem pracy była analiza wpływu sezonu urodzenia na przebieg porodu i wyniki odchowu cieląt rasy polskiej holsztyńsko-fryzyjskiej odmiany czarno-białej od urodzenia do 3. miesiąca życia. W gospodarstwie przeważały porody łatwe (1;2). Wiosną stanowiły one 91,2% wszystkich porodów przypadających na ten sezon, latem 89,7%, zimą 88,6%, zaś jesienią 87,6%. Największą średnią masą ciała po urodzeniu charakteryzowały się cielęta z porodów zimowych (cieliczki 40,8 kg; buhajki 44,2 kg). Największe średnie przyrosty dobowe w całym okresie odchowu osiągnęły cieliczki urodzone zimą (704 g) i buhajki wiosną (750 g). W grupie cieliczek jak i buhajków stwierdzono statystycznie istotne różnice w analizowanym okresie odchowu ($P \leq 0,01$, $P \leq 0,05$). Największy procent cieląt chorych stwierdzono w okresie jesienno-zimowym, najmniejszy wiosną i latem.

Słowa kluczowe: masa ciała, odchów cieląt, przyrosty dobowe, sezon wycielenia

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