



The signs of milk productivity of cows bred in different climatic zones depending on the year and season of their birth

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Data on the influence of environmental factors on the milk productivity formation of cows in different climatic zones of Ukraine are presented. It was established that animals bred in the steppe zone had the highest milk yield, milk fat content, and milk fat output, and animals from the Polissia zone had the lowest values. Among the cows from different breeding zones, intergroup differentiation was also observed by milk productivity depending on the year and season of their birth. In the forest steppe zone, the highest productivity was noted for the first-calf heifers born in 2011, in the Polissia and steppe zones — for the animals born in 2015, and for the third lactation in all breeding zones, the cows born in 2015 were the most productive. A curvilinear intergroup differentiation based on the characteristics of milk productivity was also noted between animals with different seasons of birth. The highest milk yields at "Oleksandrivske" State Enterprise and "Named after Volovikov" Joint Stock Company LLC were obtained from the first-calf heifers born in the autumn period, and at Research Farm "Askaniiske" Research State Enterprise — from animals born in summer. During the third lactation, the cows born in autumn were the most productive in all breeding zones and whose first calving occurred in the steppe zone in the spring period, in the forest steppe and Polissia zones — in autumn. The year of birth and the breeding zone had the most significant effect on fertility and fat content in milk, and it was stronger in first-calf heifers, and the season of birth of animals had the least effect on signs of milk productivity.

Key words: cows, breeding zone, year and season of birth, milk productivity, influence

Introduction

The competitiveness of dairy cattle herds and breeds is determined, first of all, by the milk productivity. The maximum possible productivity of animals determined by their genotype is estimated as the genetic potential of productivity. However, the realization of this potential largely depends on environmental factors [13]. In recent years, along with the conditions of feeding and keeping animals, significant importance

have such systematic factors as the year and season of birth, as well as in connection with climate change, the area of animal breeding is becoming increasingly important [2, 5, 7, 14].

In specific natural and climatic conditions, livestock of the corresponding zonal types is more productive, since when creating Ukrainian dairy breeds, the maternal basis was precisely breeds that are well adapted and acclimatized to specific environmental conditions [8, 22, 23]. At the same time, many domestic and

foreign scientists have established a sometimes significant, but multidirectional influence of the year and season of birth and calving on the formation of milk productivity signs in cows [4, 6, 10, 12, 15, 16, 17, 21]. However, some scientists report a more significant effect of the autumn and summer seasons of birth on the productivity [1], others [20] — about significantly higher milk yields of cows born in autumn, and some observed higher productivity in animals born in the autumn and winter seasons [16, 17]. A number of authors found out that the most significant influence on the phenotypic variability of the milk productivity of first-calf heifers is caused by the “herd” factor, the year of birth is noticeably smaller, and the season of birth is the least significant [3, 5, 11, 18, 19, 21].

The purpose of the study is to find out the influence of the year and season of birth and breeding zone of cows of the Ukrainian Black-and-White dairy breed on the manifestation of signs of their milk productivity.

Materials and Methods

The research was carried out in farms located in different climatic zones of Ukraine, namely: “Named after Volovikov” Joint Stock Company LLC of Rivne (Polysia zone, n=1840), “Oleksandrivske” State Enterprise of Vinnytsia region (forest steppe zone, n=714) and Research Farm “Askaniiske” Research State Enterprise (steppe zone, n=926) on first-calf heifers and mature cows (3rd lactation) of the Black-and-White dairy breed. Animals in all farms were fed rations that provided the main elements of nutrition according to existing standards. Cows that completed at least the third lactation at the time of the research were included in the experiment. In the control cows, we investigated the signs of milk productivity (milk yield, milk fat content, and the amount of milk fat) by means of a retrospective analysis of zootechnical accounting data over the last ten years. The influence of environmental factors (herd or breeding zone, year and season of birth of animals) on the formation of signs of milk productivity of cows was studied.

To study the influence of environmental factors on the signs of milk productivity, we formed groups of animals according to belonging to the farm or breeding zone (“herd” factor) and the year and season of their birth.

The influence of environmental factors on the variability of milk yield and fat content in milk was determined by one-factor variance analysis using the *Statistica 6.1* software package.

Statistical processing of research results was carried out by methods of mathematical statistics and biometrics using *Microsoft Excel* software. The degree of intergroup differentiation was assessed by comparing group average arithmetic values for each investigated characteristic. The significance of the difference between group averages was assessed by the Student’s criterion (*t*) [9].

The difference between the average values was considered statistically significant at $P < 0.05$ (* or ¹), $P < 0.01$ (** or ²), $P < 0.001$ (***) or ³).

Results and discussion

By the retrospective analysis of zootechnical records, we established that the milk productivity of the Ukrainian Black-and-White dairy cows depended on their breeding zone. Thus, cows from the steppe zone had the highest milk yield and milk fat output during both the first and third lactation — 6492 and 264.2 kg, respectively, which is significantly ($P < 0.001$) more than in cows of the same age from the forest steppe zone by 377 and 45.2; 268 and 40.6, and more than in the Polissia zone by 1042 and 66.6; 1035 and 63.0 kg. In turn, for the above-mentioned lactations, 665 and 767 kg of milk and 22.3 and 22.4 kg of milk fat were obtained from the cows of “Oleksandrivske” State Enterprise, compared to animals of “Named after Volovikov” LLC at $P < 0.001$ in all cases.

The intergroup differentiation was also observed in milk fat content in the control cows. The highest fat content in milk during both the first and third lactations was also in cows from the steppe zone — 4.08 and 4.01%, which was significantly ($P < 0.001$) more than in cows from the forest steppe zone by 0.48 and 0.44, and from the Polissia zone by 0.45 and 0.36%. At the same time, the advantage according to the mentioned indicator between first-calf heifers from “Oleksandrivske” SE and “Named after Volovikov” Joint Stock Company LLC was 0.03 for the first, and 0.08% for the third lactation with $P < 0.001$ in both cases.

Among the systematic factors of the environment, “herd-year-season” plays a special role, the consideration of which is important for adjusting the breeding characteristics of cows, in particular, their milk productivity. However, the year the animal was born in itself does not have a direct impact on its productivity, however, the conditions (especially feeding) created in one or another year significantly affect the formation of economically useful traits of cows. It is known that animals born in years that are unfavorable in terms of fodder, do not receive the necessary amount of nutrients for the development of the body, they lag behind in growth and in the future are characterized by lower productivity.

The analysis of yield for 305 days of lactation of the first-calf heifers of the Ukrainian Black-and-White dairy breed of different years of birth proved that the highest productivity was achieved by the first-calf heifers in 2011 in the “Oleksandrivske” SE, in the “Named after Volovikov” SP LLC and Research Farm “Askaniiske” SE — animals born in 2015 (table 1). At the same time, animals born in the years 2006–2012 in the “Named after Volovikov” LLC had the lowest milk yield (4101–6232 kg) and milk fat output (149.8–228.5 kg). According to these indicators, they were significantly inferior ($P < 0.05–0.001$) to the same age groups from the forest steppe zone by 343–1701 and 6.8–60.0 kg and steppe — by 442–2377

and 38.5–126.4 kg, respectively. Among the cows born in 2013, the best in terms of milk yield were animals from the Polissya zone (6854 kg), in terms of milk fat yield, first-calf heifers from the steppe zone (255.5 kg), and the worst in terms of these indicators were the cows of the forest steppe (6120 and 219.6 kg). Among the animals born in 2014–2015, the most productive were the first-calf heifers of Research Farm “Askaniiske” SE, their weight was 6676 and 7250 kg, and the amount of milk fat was 264.3 and 282.6 kg, respectively.

Table 1. Milk productivity of first-calf heifer of the Ukrainian Black-and-White dairy breed depending on the year of birth

Year of birth	n	Sign		
		yield, kg	fat, %	milk fat, kg
“Oleksandrivske” SE, forest steppe zone				
2006	68	5118±108.5	3.67±0.013	187.7±3.95
2007	69	5317±126.1	3.63±0.008	192.9±4.59
2008	71	5802±106.2	3.62±0.008	209.8±3.88
2009	73	5907±97.5	3.60±0.008	212.6±3.49
2010	74	6368±105.3	3.60±0.009	228.9±3.82
2011	76	6864±120.4	3.59±0.007	246.5±4.19
2012	67	6575±94.5	3.58±0.006	235.3±3.30
2013	75	6120±103.8	3.59±0.007	219.6±3.65
2014	72	6249±136.1	3.59±0.007	223.9±4.82
2015	69	6754±121.5	3.54±0.012	238.7±4.07
“Named after Volovikov” LLC, Polissia zone				
2006	167	4345±65.0*** ³	3.61±0.004*** ³	157.0±2.36*** ³
2007	191	4331±57.6*** ³	3.61±0.003* ³	156.3±2.09*** ³
2008	275	4101±54.5*** ³	3.65±0.004*** ³	149.8±2.01*** ³
2009	177	4490±85.7*** ³	3.67±0.007*** ³	164.7±3.15*** ³
2010	137	5402±94.7*** ³	3.68±0.007*** ³	198.8±3.45*** ³
2011	138	5244±129.1*** ³	3.68±0.011*** ³	192.9±4.77*** ³
2012	159	6232±110.6* ²	3.67±0.005*** ³	228.5±4.07 ³
2013	146	6854±155.2*** ¹	3.62±0.007** ³	247.3±5.42***
2014	211	6502±100.9	3.57±0.007* ³	232.3±3.59 ³
2015	239	7219±100.6**	3.58±0.006*** ³	258.5±3.57*** ³
Research Farm “Askaniiske” SE, steppe zone				
2006	61	6033±119.1***	4.29±0.040***	258.3±5.20***
2007	60	6262±137.5***	4.13±0.049***	257.7±5.60***
2008	66	6478±149.8***	4.26±0.033***	276.2±6.72***
2009	101	5896±104.8	4.35±0.032***	256.2±4.88***
2010	91	6052±96.3*	4.15±0.016***	250.8±4.04***
2011	92	6615±96.5	4.06±0.034***	268.6±4.65***
2012	125	6674±98.6	4.00±0.013***	267.0±4.23***
2013	109	6496±79.6**	3.94±0.014***	255.5±3.13***
2014	104	6676±85.0**	3.96±0.007***	264.3±3.51***
2015	117	7250±85.1**	3.90±0.003***	282.6±3.25***

Note. In this and the following tables *, **, *** — the significance between the “Oleksandrivske” State Enterprise and the “Named after Volovikov” LLC and “Oleksandrivske” State Enterprise and the Research Farm “Askaniiske” State Enterprise, 1; 2; 3 — significance between “Named after Volovikov” LLC and Research Farm “Askaniiske” SE.

After the third lactation, cows born in 2015 had the highest yield and yield of milk fat in all farms (table 2). At the same time, for all the studied years, the lowest indicators mentioned above were in the animals of “Named after Volovikov” LLC. In terms of milk yield and milk fat yield, cows born on this farm between 2006 and 2015 were, in most cases, significantly ($P < 0.05–0.001$) inferior to animals born in the same years at the Research Farm “Askaniiske” State Enterprise on 353–1851 and 25.3–117.9, and in the “Oleksandrivske” State Enterprise on 96–1889 and 1.4–65.2 kg,

Table 2. Milk productivity of mature cows of the Ukrainian Black-and-White dairy breed depending on the year of birth

Year of birth	n	Sign		
		yield, kg	fat, %	milk fat, kg
“Oleksandrivske” SE, forest steppe zone				
2006	68	6851±132.2	3.58±0.011	245.2±4.77
2007	69	6590±122.6	3.56±0.011	234.8±4.42
2008	71	6367±149.9	3.58±0.007	229.1±5.43
2009	73	5961±133.7	3.58±0.011	213.3±4.71
2010	74	6530±145.4	3.56±0.008	232.2±5.21
2011	76	7146±148.6	3.54±0.010	252.7±5.14
2012	67	7010±150.5	3.54±0.009	247.9±5.20
2013	75	7373±137.4	3.59±0.007	264.6±3.65
2014	72	7249±151.6	3.62±0.009	261.9±5.30
2015	69	7895±128.9	3.60±0.012	284.2±4.75
“Named after Volovikov” LLC, Polissia zone				
2006	167	4962±96.4*** ³	3.63±0.007*** ³	180.0±3.64*** ³
2007	191	5225±104.8*** ³	3.64±0.007*** ³	190.0±3.80*** ³
2008	275	5268±77.9*** ³	3.66±0.006*** ³	192.4±2.81*** ³
2009	177	5865±121.6*** ³	3.62±0.008*** ³	211.9±4.35 ³
2010	137	6257±123.4 ³	3.64±0.009*** ³	227.3±4.42 ³
2011	138	6419±137.1***	3.59±0.012** ³	229.7±4.74** ³
2012	159	6168±101.7*** ³	3.58±0.005*** ³	220.8±3.61*** ³
2013	146	7140±117.5 ¹	3.58±0.008 ³	255.4±4.17*** ³
2014	211	6661±84.1*** ³	3.74±0.012*** ³	249.0±3.07* ³
2015	239	7526±90.3* ²	3.75±0.010*** ³	281.8±3.38 ³
Research Farm “Askaniiske” SE, steppe zone				
2006	61	6813±173.8	4.35±0.046***	297.9±9.07***
2007	60	6321±179.4	4.33±0.037***	274.6±8.68***
2008	66	6543±223.6	4.14±0.035***	270.5±9.36***
2009	101	6670±147.6***	3.99±0.022***	266.0±5.96***
2010	91	6980±144.2*	4.01±0.017***	279.7±5.89***
2011	92	6774±145.6	4.03±0.010***	273.2±6.08*
2012	125	7547±109.7**	3.92±0.004***	295.9±4.22***
2013	109	7501±122.3	3.90±0.003***	292.2±4.70***
2014	104	7646±115.9*	3.90±0.002***	297.8±4.46***
2015	117	7879±84.5	3.90±0.007***	307.1±3.08***

respectively. Cows of the steppe zone of all studied years of birth significantly ($P < 0.05$; 0.001) outperformed the animals of the forest steppe zone by 22.9–52.7 kg in terms of milk fat yield, and a significant ($P < 0.05$ – 0.001) advantage was observed in terms of milk yield only in cows born in 2009; 2010; 2012 and 2014 by 397–709 kg, respectively.

One of the most important quality characteristics of milk is its fat content. It was established that among the first-calf heifers and adult cows born in 2006–2015, animals from the Research Farm “Askaniiske” State Enterprise had the most fat milk (3.90–4.35% both heifers and cows). On the second position there were the animals from “Named after Volovikov” LLC (3.57–3.68 and 3.58–3.75%) and the lowest fat content was observed in the milk of cows of “Oleksandrivske” SE (3.54–3.67 and 3.54–3.62%), except the first-calf heifers born in 2006–2007 and 2014 and adult cows born in 2013, where this indicator was lower in animals from “Named after Volovikov” LLC.

Considerable attention is paid in cattle breeding to the problem of the optimal season for the birth of calves. This is due to the fact that the season brings together a number of environmental factors that affect mothers and their offspring. Among them are the quality and range of fodder in the diet, climatic changes and the microclimate of the premises, peculiarities of metabolic processes and hormonal activity in the animal's body throughout the year. In dairy farming, despite the revealed advantages of individual seasons, the production of calves is planned relatively evenly throughout the year. This is due to the year-round need for dairy raw materials [10].

According to the results of our research, the highest milk yield and milk fat yield in the “Oleksandrivske” SE

and “Named after Volovikov” LLC were noted for first-calf heifers born in autumn, and in the Research Farm “Askaniiske” SE — for animals born in the summer period (table 3). The lowest values of the above characteristics in the last two farms were observed in first-calf heifers born in winter, and in the first farm — in animals born in spring. It is worth noting that first-calf heifers from the Polissia zone, born in spring, were inferior in terms of milk to peers from the forest steppe and steppe zones by 701 ($P < 0.001$) and 1187 ($P < 0.001$) kg, respectively, while those born in summer — by 488 ($P < 0.001$) and 1051 ($P < 0.001$) kg, in autumn by 387 ($P < 0.01$) and 499 ($P < 0.01$) kg, and in winter by 1212 ($P < 0.001$) and 1337 kg ($P < 0.001$). There was also a difference in this indicator between animals from the forest steppe and Polissia zones. In the above mentioned seasons, the former were inferior to the latter by 486 ($P < 0.001$), 563 ($P < 0.001$), 132 and 125 kg. A similar pattern was observed in relation to the amount of milk fat. The fat content in milk, depending on the seasons, in animals of all farms had a wave-like character.

During the third lactation in all farms, cows born in autumn had the highest yield and yield of milk fat, while the lowest values of these indicators were observed in animals born in winter (table 4). The animals whose birth also occurred in the autumn period turned out to be the most fat-milk animals. The highest values of milk yield, milk fat content, and milk fat yield in cows of all birth seasons were noted in the steppe zone, and the lowest values were in the Polissia zone. Animals from the steppe zone, based on the above characteristics, significantly ($P < 0.05$ – 0.001) outnumbered animals from the Polissia zone by 670–1224, respectively; 0.34–0.39 and 48.7–69.3, and from

Table 3. Milk productivity of first-calf heifer of the Ukrainian Black-and-White dairy breed depending on the season of birth

Sign	Season of birth			
	spring (n=245)	summer (n=137)	autumn (n=111)	winter (n=221)
Sub-division of “Oleksandrivske” SE, forest steppe zone				
Yield, kg	5929± ±71.0	6168± ±89.4	6449± ±97.2	6123± ±73.9
Fat, %	3.61± ±0.005	3.59± ±0.007	3.61± ±0.008	3.60± ±0.004
Milk fat, kg	213.6± ±2.47	220.8± ±3.09	232.2± ±3.33	220.0± ±2.62
“Named after Volovikov” LLC, Polissia zone				
Yield, kg	5228± ±75.1*** 3	5680± ±93.0*** 3	6062± ±76.6** 2	4911± ±70.5*** 3
Fat, %	3.65± ±0.004*** 3	3.64± ±0.005*** 3	3.61± ±0.004 3	3.63± ±0.004*** 3
Milk fat, kg	190.5± ±2.72*** 3	206.6± ±3.34** 3	218.1± ±2.70** 3	178.2± ±2.52*** 3
Research farm «Askaniiske» SE, steppe zone				
Yield, kg	6415± ±77.7***	6731± ±62.8***	6581± ±138.0	6248± ±64.2
Fat, %	4.09± ±0.019***	4.05± ±0.018***	4.07± ±0.017***	4.11± ±0.017***
Milk fat, kg	261.5± ±3.16***	271.6± ±2.54***	267.4± ±2.91***	256.6± ±2.70***

Table 4. Milk productivity of mature cows of the Ukrainian Black-and-White dairy breed depending on the season of birth

Sign	Season of birth			
	spring (n=245)	summer (n=137)	autumn (n=111)	winter (n=221)
“Oleksandrivske” SE, forest steppe zone				
Yield, kg	6837± ±80.0	6987± ±111.2	7117± ±129.1	6802± ±87.1
Fat, %	3.57± ±0.005	3.56± ±0.007	3.59± ±0.009	3.58± ±0.006
Milk fat, kg	243.7± ±2.83	248.9± ±3.94	255.2± ±4.65	243.2± ±3.12
“Named after Volovikov” LLC, Polissia zone				
Yield, kg	5876± ±65.6*** 3	6243± ±91.6*** 3	6635± ±70.5*** 3	5812± ±73.8*** 3
Fat, %	3.64± ±0.005*** 3	3.62± ±0.007*** 3	3.68± ±0.007*** 3	3.65± ±0.005*** 3
Milk fat, kg	213.9± ±2.36*** 3	226.1± ±3.30*** 3	244.4± ±2.65* 3	212.2± ±7.71*** 3
Research farm «Askaniiske» SE, steppe zone				
Yield, kg	7100± ±107.6*	7275± ±90.9*	7305± ±90.4	7007± ±83.3
Fat, %	3.99± ±0.014***	4.02± ±0.015***	4.02± ±0.017***	4.01± ±0.013***
Milk fat, kg	283.2± ±4.30***	291.7± ±3.65***	293.1± ±3.78***	280.3± ±3.21***

the forest steppe zone by 188–288 kg, 0.42–0.45% and 37.1–42.8 kg (the exception was the yield in autumn and winter periods between cows from the steppe and Polissia zones, the difference is not significant).

In our opinion, intergroup differentiation based on milk productivity between cows of different years and seasons of birth is caused by the action of a complex of natural (climatic) factors, care, maintenance and feeding (quantity and quality of fodder, nutritional balance of diets, etc.). However, there was no significant intergroup one-way difference in fat content in the milk of cows of different seasons of birth.

The results of our research show that among the studied environmental factors, the year of birth had the most significant effect on fertility and fat content in milk, and it was stronger in firstborns (table 5). It is worth noting that the fat content in cows' milk was also significantly influenced by their breeding zone. At the same time, the last factor had the greatest impact on milk fat output: 61.97% in first-calf heifers and 54.62% in adult cows.

The studied characteristics of milk productivity for both lactations were least affected by the season of the cows' birth. Although it is worth noting that the calculated indicators of the influence of the studied systematic factors of the environment on yield, the fat content in milk and the amount of milk fat in all cases were highly significant. We believe that in order to minimize the reliable influence of the factors "herd", "year" and "season of birth" of animals, it is necessary to create a strong fodder base in each farm, proper maintenance and breeding of heifers, and in the hot season to carry out forced ventilation of the premises.

Table 5. The influence of environmental factors on the formation of milk productivity of cows, %

Indicator	Lactation			
	I		III	
	$\eta_k^2 \pm m_{\eta}$	F	$\eta_k^2 \pm m_{\eta}$	F
The influence of the breeding zone on the milk productivity				
N of degrees of freedom of the factor:				
organized	2		2	
unorganized	3477		3477	
Yield, kg	8.95±0.057***	170.9	8.81±0.057***	168.0
Fat, %	21.91±0.055***	487.7	17.93±0.056***	379.8
Milk fat, kg	61.97±0.035***	2832.8	54.62±0.040***	2092.3
The influence of the year of birth on the milk productivity				
N of degrees of freedom of the factor:				
organized	9		9	
unorganized	3470		3470	
Yield, kg	29.57±0.237***	161.9	19.05±0.250***	90.7
Fat, %	22.77±0.246***	113.7	16.36±0.252***	75.4
Milk fat, kg	4.60±0.259***	18.6	1.51±0.259***	5.9
The influence of the season of birth on the milk productivity				
N of degrees of freedom of the factor:				
organized	3		3	
unorganized	3476		3476	
Yield, kg	4.04±0.086***	48.8	2.13±0.086***	25.2
Fat, %	3.65±0.086***	43.9	2.55±0.086***	30.3
Milk fat, kg	0.89±0.086***	10.4	1.36±0.086***	15.9

Conclusion

Formation of milk productivity of cows of the Ukrainian Black-and-White dairy breed was significantly influenced by their breeding zone. Animals bred in the steppe zone were characterized by the highest milk yield, milk fat content, and amount of milk fat during the first and third lactations, and the lowest by individuals from the Polissia zone. Curvilinear intergroup differentiation based on milk productivity was also noted in animals with different years and seasons of birth. In the forest steppe zone, the highest productivity was noted for first-calf heifers born in 2011, in the Polissia and steppe zones in animals born in 2015. During the third lactation, cows born in 2015 were the most productive in all breeding zones. The highest milk yields in the "Oleksandrivske" SE and the "Named after Volovikov" LLC were obtained from the first-calf heifers born in the autumn period, and in the Research Farm "Askaniiske" SE in summer. During the third lactation, the most productive cows in all farms were cows born in the autumn months. The year of birth and breeding zone of cows had the most significant influence on fertility and milk fat content, and the season of birth had the least effect.

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Прояв ознак молочної продуктивності корів у різних кліматичних зонах розведення залежно від року та сезону їх народження

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Наведено дані щодо впливу чинників довкілля на формування молочної продуктивності корів у різних кліматичних зонах України. Встановлено, що найвищі надої, вміст жиру в молоці та вихід молочного жиру були у тварин, яких розводять у зоні Степу, а найнижчі — в особин із зони Полісся. Між коровами з різних зон розведення також спостерігали міжгрупову диференціацію за ознаками молочної продуктивності залежно від року і сезону їх народження. У зоні Лісостепу найвищою продуктивністю відзначалися первістки, які народилися у 2011 р., у зоні Полісся та Степу — тварини 2015 р. народження, а за третю лактацію у всіх зонах розведення найпродуктивнішими виявилися корови, народжені у 2015 р. Криволінійну міжгрупову диференціацію за ознаками молочної продуктивності відзначили і між тваринами з різними сезонами народження. Найвищі надої у ДП ДГ «Олександрівське» і ТОВ СП «Імені Воловікова» одержано від первісток, які народилися в осінній період, а в ДП «Дослідне господарство «Асканійське» — в особин, народжених влітку. За третю лактацію у всіх зонах розведення найпродуктивнішими були корови, народжені в осінні місяці і перше отелення яких припадало на весняний період у зоні Степу, на осінній — у зоні Лісостепу та Полісся. Найсуттєвіший вплив на надій та вміст жиру в молоці мали рік народження та зона розведення корів, причому сильнішим він був у первісток, а найменше на ознаки молочної продуктивності впливав сезон народження тварин.

Ключові слова: корови, зона розведення, рік і сезон народження, молочна продуктивність, сила впливу