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MILK PRODUCTIVITY OF SWISS COWS KEEPERED IN OPEN PASTURES

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This article presents the results of research on the milk production of Swiss cows under year-round grazing conditions in open pastures. The study was conducted at the private enterprise "Agro-Novoselivka 2009" in the Kharkiv District, Kharkiv Region.

It was found that Swiss cows, thanks to their high biological adaptability and good acclimatization capacity in the new environmental conditions of eastern Ukraine, exhibited a gradual increase in live weight with age characteristic of this breed, from 391.4±27.5 kg during the first lactation to 586.2±22.8 kg during the second. The duration of lactation was within acceptable limits and amounted to 332.4 days for the first lactation, which is 2.1% longer than for the second.

It was demonstrated that the milk productivity of Swiss cows was quite high and even exceeded the average indicators for European countries. During the second lactation, milk yield per cow was significantly higher by 7.2% ($P < 0.05$) compared to the first and amounted to 8,810 ± 284.6 kg. However, the milk yield coefficient for cows in their first lactation was, conversely, significantly higher by 39.8% ($P < 0.01$) compared to the second lactation and amounted to 2,101,0.

It has been determined that milk from Swiss cows is the most suitable for processing and cheese production due to its high fat and protein content. In the experimental cows, the first lactation milk was found to have a high fat content (4.55%) and protein content (3.62%), which is 2.4% and 1.1% lower, respectively, compared to the second lactation. The same trend was observed in milk fat and protein production, which amounted to 410.3±16.7 kg and 322.6±13.2 kg during the second lactation, which is significantly higher by 9.6% and 8.4%, respectively, compared to the first lactation.

Analysis of the lactation curves revealed that they met general standards and were characterized by relative stability. The highest monthly milk yield in both the first and second lactations was observed in the third month (998 and 1048 kg), with a sharp decline in the fifth month and a drop of up to 64% from the maximum value by the ninth month.

Year-round housing of Swiss cows in open pastures over two lactations with high productive qualities demonstrates the feasibility of applying this housing method in agricultural enterprises in Eastern Ukraine during the revival of dairy cattle farming.

Keywords: cows, Swiss breed, milk yield, milk quality, housing, open pastures**.**

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МОЛОЧНА ПРОДУКТИВНІСТЬ КОРІВ ШВІЦЬКОЇ ПОРОДИ ЗА УТРИМАННЯ НА ВІДКРИТИХ ВИГУЛЬНИХ МАЙДАНЧИКАХ

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У статті наведено результати досліджень з вивчення молочної продуктивності корів швіцької породи за цілорічного утримання на відкритих вигульних майданчиках. Дослідження проводили у ПП «Агро-Новоселівка 2009» Харківського району Харківської області.

Установлено, що корови швіцької породи завдяки високій біологічній адаптивності і добрій акліматизаційній здатності в нових екологічних умовах Сходу України проявили характерне для цієї породи поступове збільшення живої маси з віком від 391,4±27,5 *кг за першу лактацію до* 586,2±22,8 *кг – за другу. Тривалість лактації худоби знаходилася в допустимих межах і становила за першу лактацію 332,4 доби, що на 2,1 % більше відносно другої.*

Доведено, що молочна продуктивність швіцьких корів була досить високою і навіть вищою за середні показники в європейських країнах. За другу лактацію надій на корову був вірогідно більшим на 7,2 % (P < 0,05), *порівняно з першою і становив 8810±284,6 кг. Проте коефіцієнт молочності корів у першу лактацію, навпаки, був вірогідно більший на 39,8 % (P < 0,01) проти другої лактації і становив 2101,0.*

Визначено, що молоко швіцьких корів є найбільш придатним для переробки та виробництва сиру за високого вмісту масових часток жиру і білка. У дослідних корів за першу лактацію в молоці встановлено високі масові частки жиру (4,55 %) та білка (3,62 %), що на 2,4 і 1,1 % менше, порівняно з другою. Аналогічна тенденція відмічена і за виробництвом молочного жиру та білка, яке становило у другу лактацію відповідно 410,3±16,7 кг і 322,6±13,2 кг, що вірогідно вище на 9,6 і 8,4 % щодо першої лактації.

Аналіз лактаційних кривих виявив, що вони відповідали загальним стандартам і характеризувалися відносною стабільністю. Найбільший місячний надій як у першу, так і в другу лактацію відмічено у третій місяць (998 і 1048 кг), з різким спадом у п'ятому і до 64 % у дев'ятому місяці від максимального їх значення.

Цілорічне утримання корів швіцької породи на відкритих вигульних майданчиках упродовж двох лактацій з високими продуктивними якостями характеризує можливість застосування такого способу утримання у сільськогосподарських підприємствах Сходу України при відродженні молочного скотарства.

Ключові слова: корови, швіцька порода, молочна продуктивність, якість молока, утримання, відкриті вигульні майданчики.

Introduction. Dairy farming is one of Ukraine's strategic livestock sectors, which determines the country's food security and the quality of the population's diet, and has high export potential. The sector in the country faces certain challenges, including a decline in livestock numbers, a lack of a stable feed base, unsatisfactory levels of breeding and genetic improvement efforts and technological support, and insufficient state funding.

The experience of the best dairy farms in Ukraine and abroad shows that achieving a genetic potential for cow productivity of 8,000–10,000 kg of milk per lactation is possible only if farms apply modern technological solutions for the proper, scientifically sound, and intensive management of productive herds.

At the same time, the potential for improving the efficiency of dairy farming in Ukraine is far from exhausted, as the average milk yield per cow on agricultural enterprises does not yet exceed 7,000 kilograms. Considering the corresponding indicators of countries with a developed dairy cattle sector, it is reasonable to discuss the need for further improvement of cow husbandry technologies to increase the efficiency of this type of agricultural activity.

Leading specialists in zootechnical science, such as Ivanov M.F., Bogdanov E.O., Borshch O.O. (2024), Pishchan S.G. (2021), Pishchan I.S. (2017), Ruban S.Yu. (2023), Pidpala T.V. (2021), Piddubna L.M. (2024), Perekrestova G.V. (2018), Silychenko K.A. (2023) and others, who have developed the theoretical foundations and practical methods for improving cow housing systems, raising replacement heifers, and establishing highly productive dairy herds of various breeds under the conditions of Ukrainian farms.

Previous experience and the current situation in the dairy industry are prompting a shift in business strategy at most large enterprises. Thus, the main priorities—which previously focused on 1) environmental safety, 2) product quality, and 3) resource conservation—are now being reevaluated. Under current conditions, and especially in the eastern regions affected by Russian aggression, the latter priority has taken precedence. This is due to rising costs associated with energy, construction, and maintenance of energy-intensive livestock facilities (Ruban S.Yu., 2017).

Research by Pishchan I.S. (2017) has established the high adaptability of Swiss cows, in particular, based on a comprehensive assessment of the organism's homeostasis, technological, somatometric, productive, and reproductive characteristics, as well as the productive qualities of the offspring obtained under intensive production technology at a large industrial complex in the steppe region of Ukraine. In general, Swiss cows adapt quite easily to the new physical parameters of the milking machine. It has been established that Swiss animals possess good adaptive plasticity to intensive production technology in new natural conditions. Imported Swiss animals demonstrate a high level of milk productivity and reproductive function with dynamic growth. It has been proven that adapted Swiss cows produce healthy offspring characterized by a satisfactory balance between the external environment and the organism. In studies by Borshch O. et al. (2024) regarding the impact of temperature and humidity factors on cow productivity, it has been demonstrated that these factors were most pronounced in open feeding areas without shelters. Thus, during periods of stress and danger, the duration of feed intake decreased, energy intake decreased by 4.7 and 9.6 MJ, and productivity decreased by 8.77% and 13.74%..

Kirovich N.O. and Didur L.I. (2025) emphasize that Ukraine's livestock industry requires a comprehensive approach, including the improvement of breeding practices, the modernization of animal husbandry and fattening technologies, as well as the creation of incentives for farmers and investors. Of particular importance in this context is the regional adaptation of livestock farming, taking into account soil and climate, economic, and social conditions.

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In recent decades, dairy cattle breeds such as the Ukrainian Black-and-White, Red Steppe, Holstein, and others have been widely used in Ukraine. However, the Swiss Brown cattle breed has not become as widespread. It is one of the oldest breeds in the world and was developed in Switzerland. Thanks to its high biological adaptability and good ability to acclimate to new environmental conditions, Swiss cattle have been exported from Switzerland to various countries around the world with different natural, climatic, and economic conditions. The Swiss cattle breed has spread not only in Switzerland but also in Austria, Italy, Germany, and North America. Breeders in countries such as Australia, New Zealand, and many others (there are about 14 countries where Swiss cattle are actively used) are also working with this breed (Oblivantsov V. V., 2013).

According to Kruglyak O. V. (2018), the Swiss dual-purpose breed is unique, combining traits of both beef and dairy breeds, and exhibits high productivity. The breed's versatility allows for the breeding of animals of meat-dairy, dairy-meat, or dairy types with substantial body weight, robust health, rapid maturation, productive longevity, the ability to adapt to various environmental factors, and the potential to produce high-quality products. Representatives of this breed consistently pass on their own economically valuable traits. Swiss cows rank second in the world in terms of productivity, behind the Holstein breed, with a milk yield of 7,147–7,242 liters and milk fat and protein content levels of 4.15% and 3.49%, respectively (Bondarchuk L. V., 2015).

It should be noted that modern Swiss dairy cows have a milk yield of 8,000–10,000 kg per lactation. Moreover, the percentage of high-yielding animals in the herd is at least 60%, which is crucial for establishing a commercial herd of cows in industrial, automated production. The milk from these cows is delicious, with a fat content of up to 4.2% and a protein content of up to 3.5%, along with significant levels of other nutrients. It is well-suited for making quite tasty cheeses and thick sour cream (Silychenko K. A., 2022).

From the perspective of the need to revive the dairy cattle industry and ensure stable milk production, it is important to study the productive qualities of cows under energy-efficient conditions of keeping them in open pastures.

Therefore, studying the development of milk productivity in Swiss cows kept in open pastures, particularly in the eastern regions of Ukraine affected by military aggression, holds scientific and practical significance for the further revival and development of the livestock industry in Ukraine.

The purpose of this article was to investigate the dynamics of milk productivity and quality in Swiss cows kept year-round in open pastures in eastern Ukraine.

Materials and Methods. The experiments were conducted under production conditions at the agricultural enterprise "Agro-Novoselivka 2009" in the Kharkiv District of the Kharkiv Region during 2023–2025. This enterprise specializes in livestock farming, producing pork, beef through beef cattle breeding with the Aberdeen-Angus breed, and milk using the Swiss breed. Livestock productivity and milk quality were studied in Swiss cows imported from the "Yekaterinoslavsky" industrial complex in the Dniprovsky District of the Dnipropetrovsk Region. The cows' first lactation occurred in 2024, and the second in 2025.

Milking took place three times a day in a specialized milking parlor. The cattle were fed twice daily according to a pre-calculated ration. Traditionally, the feed ration was calculated based on specific indicators and conditions, namely: determining the amount of nutrients required to ensure the health, vitality, and planned productivity of the cows according to feeding standards based on their live weight, productivity, and

physiological condition; and formulating the feed ration in accordance with the total requirement for feed units.

The chemical composition of milk, including the determination of the mass fractions of fat and protein, was analyzed using the AKM-98 and Ekomilk 120 – KAM 98-2A analytical instruments on the basis of composite milk samples. Protein was determined using the refractometric method on an IRF-454B 2M device, and fat content was determined using the Gerber acid method. Control milkings were conducted to record daily milk yields for each month of lactation, in accordance with the "Rules for Evaluating Milk Productivity of Dairy-Beef Breed Cows (SNPplem R-23-97)." The intensity of milk secretion, i.e., the amount of milk per month, and the milk yield coefficient were studied.

Statistical analysis of the study results was performed using MS Excel (2010) software with standard parametric statistical methods under the assumption of normal data distribution, calculating the arithmetic mean (M), the standard deviation of the arithmetic mean (m), and the confidence level (P) of the obtained data.

Research results. To realize the genetic potential of livestock, agricultural enterprises employ modern husbandry and feeding technologies. The primary economic criterion used to evaluate and select cattle is productivity (Pidpala et al., 2018). To achieve effective management of the dairy cattle industry, it is necessary to study all aspects of the breeding and selection process (Pidpala et al., 2021). Therefore, the issue of identifying factors that influence animal productivity is always relevant.

An analysis of the phenotypic characteristics of Swiss cows indicates that Swiss cattle have a fairly robust build; the average live weight of Swiss cows during their first lactation was 391.4 kg, and during the second lactation, it was significantly higher by 49.8% ($P < 0.01$) (table 1). This fully corresponds to the standards of the Swiss breed in Ukrainian breeding. Indeed, similar data were obtained in studies by Pishchan S. G. and Silychenko K. A. (2021). The live weight of Swiss cows during the first lactation was 403.1 kg, and during the second—598.5 kg, which is only 2–3% higher than the figures obtained in this study.

Table 1

Milk production in cows

Performance indicators	First lactation	Second lactation
Live weight of cows, kg	391,4±27,5	586,2*±22,8
Lactation duration, days	332,3±9,9	324,8 ±9,1
Milk yield per lactation, kg	8215,6±283,3	8810,2**±284,6
Milk yield per lactation (3.5% fat), kg	10938±304,3	11730**±296,3
Milk yield coefficient	2101,0*±74,3	1503,4±38,3
Milk fat content, %	4,55±0,07	4,66±0,09
Milk protein content, %	3,62±0,07	3,66±0,08
Milk fat, kg	374,0±13,7	410,3±16,7
Milk protein, kg	297,6±14,1	322,6±13,2
Fat + protein, kg	671,6±26,6	732,9±18,6
Fat-to-protein ratio	*1,26±0,03*	*1,27±0,03*

*Notes: * – P < 0,01, ** – P < 0,05*

The first lactation in Swiss cows lasted longer, at 332.3 days, i.e., approaching the duration of a standardized lactation, but no statistically significant difference in duration

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was found compared to the second lactation (2.1%), which lasted 324.8 days. According to data (Pishchan S. G. and Silychenko K. A. 2021), for Swiss cows, the durations of these lactations were 352 and 329.7 days, respectively, but no statistically significant difference was found; meanwhile, the third and fourth lactations were also shorter than the first by 8 and 14.2 days, respectively.

When evaluating the productive qualities of cattle (Table 1), it should be noted that the average milk yield per cow during the first lactation, despite its longer duration, was 595 kg or 7.2% lower than during the second lactation ($P < 0.05$). According to Pishchan I.S. and Pishchan S.G. (2021), in Swiss cows under industrial livestock complex conditions, milk yield per cow was 8,476 kg for the first lactation, 9,465 kg for the second, 9,507 kg for the third, and 8,995 kg for the fourth. In experiments by Silychenko K.A. (2021) on Swiss cows calving in the spring and summer, similar productivity indicators were obtained: 9,744.9 kg for the first lactation, 10,597.2 kg for the second (significantly higher by 8.2%), and for the third – 1.1% lower than the first and 9.9% lower than the second.

In our experiments, based on 3.5% standardized milk, the milk yield per cow during the second lactation was also 7.2% higher than during the first lactation, amounting to 11,730 kg. In contrast, the milk yield coefficient for cows in their first lactation was significantly higher ($P < 0.05$) than in the second lactation by 39.8% and amounted to 2,101.0. Studies by Pishchan S.G. and Silychenko K.A. (2021) revealed the same trend. Although milk yield was higher in cows during the second lactation, the milk yield coefficient for cows in their first lactation was 2472.7 ± 78.39, and this figure exceeded the figures for the second lactation (1624.9 ± 38.14) by 52.18%, by 61.15% compared to the third (1534.4 ± 25.61), and by 92.77% compared to the fourth lactation (1282.7 ± 29.34).

When analyzing the presented indicators characterizing fat, protein, and fat-to-protein production, the fat-to-protein ratio in the study was also at a sufficiently high level (Table 1). During the first lactation, 374.0 kg of fat and 297.6 kg of protein were obtained from Swiss cows, for a total of 671.6 kg. During the second lactation, these figures were significantly higher by 9.6%, 8.4%, and 9.1%, respectively. However, the ratio of fat to protein produced did not differ significantly and ranged from 1.26 to 1.27. In studies by Pishchan I.S. and Pishchan S.G. (2021) on Swiss cows, similar productivity indicators were obtained. That is, they assert that milk fat production is relatively lowest in first-calf heifers during the first lactation but increases with the cows' age and reaches its maximum value in the third to fourth lactation. Thus, first-calf heifers produced an average of 309.7 kg of milk fat during their first lactation, whereas during their second lactation they produced 349.4 kg of milk fat, which is 11.4% higher ($P<0.05$) compared to the first lactation. Additionally, the lowest protein production was observed in first-calf heifers during their first lactation, who synthesized 285.0 kg of protein during a standard lactation. Already during the second lactation, an average of 326.9 kg of protein was obtained from the cows, which is 11.8% ($P<0.05$) more compared to the indicators of animals in first lactation.

Changes in milk yield over the course of lactation and their graphical representation are commonly referred to as the lactation curve. According to the standards of the lactation curve established by Borisenko E.Y. and Versal Y.V. (2009), milk yield per cow increases during the first 100 days of lactation, gradually decreases over the next 100 days, and drops sharply during the final 100 days – nearly halving compared to the peak yield in the third month.

Milk productivity in cows, according to reports by Polischuk T.V. et al. (2021), develops throughout all months of lactation and largely depends on the nature of lactation establishment in cows, the magnitude of maximum milk yield, and the ability to maintain milk yield at a certain level over an extended period. However, even if these conditions are optimal, productivity during lactation is uneven. The highest milk yield occurs in the first 2-3 months after calving, and then begins to gradually decline until the end of lactation.

An analysis of the lactation curves (Fig. 1) showed that the highest monthly milk yield in both the first and second lactations was observed in the third month after calving. Specifically, during the first lactation, the average monthly milk yield per cow was low in the first month (771 kg); in the second month, it increased by 26.2%, and in the third month, by another 2.6%. Starting from the fourth month, a gradual decline in milk yield began, by 3.0%, and in the fifth month, by 13.9%; after the sixth month, the decline leveled off somewhat, reaching 4.9% in the sixth month, 1.0% in the seventh month, and a sharp decline of 9.5% and 10.1% in the eighth and ninth months, respectively, and 3.9% in the tenth month.

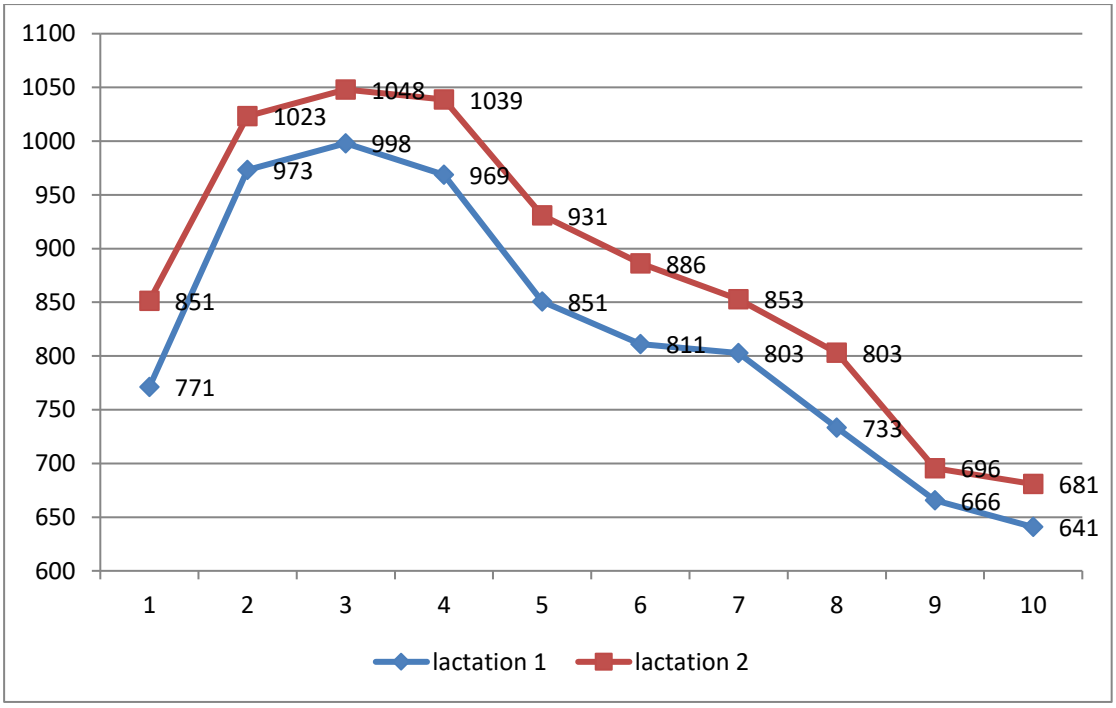

Fig. 1. **Lactation curves for Swiss cows (monthly yield), kg**

It should be noted that the course of the lactation curve from the first month to the last is very similar across the two lactations. However, in the second lactation, the peak in cow productivity was observed in the third and fourth months, after which a sharp decline in milk yield was also observed, followed by a gradual decrease until the end of lactation. This is not surprising, as most authors attribute the decline in milk yield after the third month of lactation to insemination during this period and the redistribution of nutrients and metabolic processes in the animals' bodies in favor of fetal development. Thus, Figure 1 shows that in the second lactation, milk yield in the first month was relatively low at 851 kg, but in the second month it increased by 20.2%, in the third by another 2.4%, and in the fourth it remained almost unchanged, increasing by only 0.8%. Starting from the fifth month, the same trend of a sharp decrease in milk yield by 7.2%

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was observed, in the sixth—by 10.5%, in the seventh—by 3.9%, in the eighth—by 6.2%, in the ninth—a second sharp decrease of 15.4%, and in the tenth—by 2.2%.

It should be noted that in all months of lactation, the difference in average monthly milk yield per cow in the second lactation was significantly greater than that in the first lactation. Thus, in the first month of lactation, this difference was 10.4% ($P<0.05$), in the second month – 5.1% ($P < 0.05$), in the third – 5.0% ($P < 0.05$), in the fourth – 7.2% ($P < 0.05$), in the fifth – 9.4% ($P < 0.05$), in the sixth – 9.2% ($P < 0.05$), in the seventh month – 6.2% ($P < 0.05$), in the eighth month – 9.5% ($P < 0.05$), in the ninth month – 4.5% ($P < 0.05$), and in the tenth month – 6.2% ($P < 0.05$).

The lactation curve of Swiss cows in this study is fully consistent with those of other dairy breeds under various housing conditions. It is characterized by a gradual increase in milk yield until the third to fourth month of lactation, a sharp decline in milk yield by the fifth month, and a gradual decrease until the end of lactation, with a sharp drop in the last two months.

Discussion. The studies established that Swiss cows, which were kept year-round in open pastures, adapted well both to the climatic conditions of eastern Ukraine and to the technological conditions of housing and milking in the milking parlor. The live weight of the cows met the standards of the Swiss breed of Ukrainian selection and amounted to 391 kg in the first lactation and 586 kg in the second. According to a report (Silychenko K. A., 2021), the live weight of Swiss cows was 391.6 kg in the first lactation and 600.2 kg in the second, which fully confirms the results obtained in our experiments. According to data (Pishchan S. G. and Silychenko K. A., 2021), similar patterns of changes in the live weight of Swiss cows were observed, which amounted to 403.1 kg in the first lactation and 598.5 kg in the second, which is only 2–3% higher than our figures. As reported by (Ponko L. P. and Dymchuk A. V., 2024), the average live weight of Ukrainian Black-and-White dairy cows per herd is 567 kg, with 517 kg during the first lactation, 567 kg during the second, and 608 kg during the third. That is, the same pattern of live weight increase with each subsequent lactation has been confirmed.

The productivity of Swiss cows in conditions of keeping without premises was quite high, which confirms the thesis of high adaptability, adaptability of these animals to various climatic and weather conditions. The average yield was 8215 kg for the first lactation, 8810 kg for the second, and in terms of normalized 3.5% milk fat content, 10938 kg and 11730 kg, respectively. In studies (Pishchan I. S. and Pishchan S. G., 2021) similar results were obtained in Swiss cows: yield for the first lactation 8476 kg, the second 9465, the third – 9507 and the fourth – 8995 kg. According to (Pishchan S. G. and Silichenko K. A., 2021), a different trend was obtained in autumn-winter calving Swiss cows, i.e. in the first lactation the yield per cow was 9900 kg, in the second it decreased by 2.1% and amounted to 9707 kg, and in the third it increased again by 1.4% to 10035 kg. As reported (Klymovetsky A. A. and Nosevych D. K., 2020), the same trend was obtained in terms of milk yield dynamics in Ukrainian black-and-white dairy cows. That is, the advantage in milk yield of cows in the second lactation over first-borns was 8.8%, in milk fat yield – 8.5, in milk protein yield – 6.7%.

As reported (Ponko L. P. and Dymchuk A. V., 2024), the milk yield of first-born cows is the lowest and is 6146 kg, in the second lactation 6576 kg or 7.1% more. The highest yield of cows is observed in the third lactation - 6700 kg, which is 3.2% more compared to the average for the herd and 8.3% more compared to the first lactation, the content of mass fractions of fat and protein in milk was the same in all lactations at the level of 3.69 and 3.20%. The production of milk fat and protein increased in the second lactation, compared to the first, by 6.6 and 7.1%, respectively.

Polishchuk T.V., Lotka G.I. et al. (2021) report that there are positive highly probable relationships between milk productivity indicators and live weight of cows: between live weight and milk yield they were within 0.413-0.551, between live weight and fat content in milk – within 0.037-0.113, and between live weight and the amount of milk fat – within 0.414-0.537.

Milk is a multicomponent substance that provides newborn mammals with the necessary nutrients for active growth and development. Being the main source of their nutrition, the mixture of water-soluble components and fats, i.e. proteins (casein and whey proteins), carbohydrates (mainly lactose), minerals and vitamins is quite variable. The quality of milk is influenced by many factors, but the most important of them are full-fledged feeding, the system and methods of keeping dairy cows. However, a constant and well-established metabolism is the main prerequisite for the active functioning of the udder of lactating animals. It is known that with increasing milk productivity, the likelihood of metabolic disorders also increases. That is, this means that the content of the main components of milk can vary within the same species depending on the individual characteristics of animals of the same breed, and here both the level and quality of feeding and the stage of lactation play an important role (O'Callaghan, 2016).

As reported (Pidpala T. V. et al., 2018), the most valuable in milk is dry matter, the basis of which is fat, protein, milk sugar, minerals and other components that are characterized by high biological activity (vitamins, hormones, enzymes, immune bodies, etc.). Milk of Swiss cows is characterized by high taste qualities due to the high content of mass fractions of fat and protein. And a high percentage of mass fraction of fat in milk is also the most attractive for processing and cheese production. In experimental cows, a high mass fraction of fat (4.55%) and protein (3.62%) was found in milk during the first lactation. During the second lactation, they significantly exceeded the corresponding indicators by 2.4% and 1.1%.

Milk from Swiss cows is characterized by high taste qualities, which is confirmed by our studies with a high mass fraction of fat and protein - 4.55–4.66% and 3.62–3.66%, as well as the production of fat and protein for the first lactation of 374.0 and 297.6 kg, for the second - 410.3 and 322.6 kg, respectively. The ratio of fat to protein was 1.26 and 1.27, respectively.

Similar results were obtained in studies (Pishchan S. G. and Pishchan I. S., 2021). Milk protein production during 305 days of lactation of Swiss cows was naturally lower than the fat production indicator, but there was a dynamic increase in the latter with the age of the animals. Thus, the relatively lowest protein production indicator was characteristic of first-born cows in the first lactation at the level of 285.0 kg. While in the second lactation, an average of 326.9 kg of protein production was obtained from cows, which is 11.8% ($P < 0.001$) more than in the first lactation. In the third lactation, the maximum amount of protein production was obtained from cows - an average of 338.1 kg, which is 3.3% more than in the second lactation, and 15.7% more than in the first lactation.

Studies (Perekrestova G. V., 2017) have established that purebred Swiss cows have sufficiently high adaptive properties to harsh operating conditions, therefore, during the 305 days of the first lactation, they secrete 7845.2 kg of milk with a mass fraction of fat at the level of 4.15% and protein - 3.45%. The highest milk fat content is distinguished by purebred Swiss first-born cows, in which the mass fraction of fat was on average 4.15%. The fat-protein ratio in purebred Swiss first-born cows was on average 1.2 units.

Analysis of lactation curves of experimental Swiss cows shows that the highest monthly milk yield in both the first and second lactations was observed in the third month after calving. That is, in the first month of lactation, the average monthly yield per cow

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was low (771 kg and 851 kg), in the second month it increased by 26.2% and 20.2%, respectively, and then sharply decreased after the fourth month. Similar data were obtained in studies (Polishchuk T. V. et al., 2021).

According to reports (Kovalenko V. and Gil M., 2014), the lactation curves of cows of the Ukrainian black-and-white dairy breed, which calved in February-March and were kept in year-round stall and stall-walking systems using pastures, were distinguished by a sharp increase in milk yields in the second month of lactation and a gradual decrease to the fifth, stability until the end of lactation. The lactation curve of cows that were kept in a stall-walking system using feed tables and with a gradual transition to the summer period turned out to be the closest to the optimal lactation curve in terms of daily milk yields. In production conditions, preference is given to cows in which the milk yield curve gradually increases and evenly decreases, i.e. such animals have high lactation activity. Cows with stable lactation are characterized by good health, longevity, better reproductive ability, higher efficiency of feed use with less physiological load. Summarizing the presented research data, it should be emphasized that the rather high indicators of live weight and milk productivity of Swiss breed cows, which were kept in open pastures all year round, indicated that their lactogenic function is adequate and stable, that is, this method of keeping is energy-efficient and meets modern biotechnological requirements for ensuring proper activity of metabolic processes in the body of cattle.

Conclusions:

1. It was established that the milk yield of Swiss cows was at a sufficiently high level and during the first lactation of 332.3±9.9 days, the average yield per cow was 8215±283.3 kg. In the second lactation of 324.8±9.1 days, it was 8810±284.6 kg, which significantly exceeded the first lactation by 7.2% ($P < 0.05$). However, the milk yield coefficient of cows in the first lactation was significantly higher ($P < 0.05$) compared to the second lactation by 39.8% and was 2101.0.

2. The milk of the experimental Swiss cows was distinguished by high quality indicators both in the first and second lactations with a mass fraction of fat in milk at the level of 4.55-4.65% and protein 3.62-3.66%. During the first lactation, 374.0±13.7 kg of fat, 297.6±14.1 kg of protein were obtained from Swiss cows, their total amount was 671.6±26.6 kg, respectively. During the second lactation, these indicators were significantly higher by 9.6%, 8.4%, 9.1%, respectively. However, the ratio of the obtained fat to protein did not differ significantly and was 1.26-1.27.

3. Analysis of the formation of milk yield of cows by months of lactation shows that in both lactations, lactation curves met general standards and were characterized by relative stability. Thus, the highest monthly yield in both the first and second lactations was observed in the third month after calving. From the fourth month, a gradual decline in the yield level was noted, after the sixth month the decline was somewhat smoothed out, and in the eighth and ninth months a sharp decline was again noted. It should be noted that in all months of lactation, the difference in the average monthly yield per cow in the second lactation significantly exceeded the similar indicators in the first lactation.

4. Based on the obtained high results of milk productivity of Swiss breed cows kept in open pastures, this energy-efficient method of keeping can be recommended in the conditions of Eastern Ukraine, as it meets modern biotechnological requirements.

References

Bondarchuk, L.V. (2015). Brown shrews in the world. History and modernity. Tavria scientific bulletin. [Buri shvitsy u sviti. Istoriya i suchasnist]. *Tavria Scientific*

Bulletin. Issue 90. P. 67-79. available at**:** https://repo.snau.edu.ua/bitstream/123456789/4396/1.pdf (in Ukrainian)

Borshch, O., Prudnikov, V., Ruban, S., Matvieiev, M. (2024). Cow behaviour and milk yield during different categories temperature-humidity indices. Revista de Investigaciones Veterinarias del Perú. 35(1): article number: e25305. (Scopus). available at**:** http://www.scielo.org.pe/scielo.php?script=sci_arttext&pid=S1609-91172024000100012

Vedmedenko, O.V. (2021). Milk productivity of cows depending on various factors. [Molochna produktyvnist′ koriv zalezhno vid riznykh faktoriv]. *Tavria Scientific Bulletin.* No.107. P. 199-205. https://doi.org/10.32851/2226-0099.2019.107.27 (in Ukrainian)

Versal, Yu. V. (2009). Assessment of influence factors for diagnosing the physiological state of animals. [Otsinka faktoriv vplyvu dlya diahnostyky fiziolohichnoho stanu tvaryn.]. *Measuring and computing equipment in technological processes*. No. 2. P. 128-134. https:// doi.org/ 10.31891/2219-9365 (in Ukrainian)

Gladiy, M.R., Prosovych O.P. (2022). Current state and prospects for the development of the dairy industry of Ukraine. *Bulletin of the National University "Lviv Polytechnic*". No. 2 (10). P. 22-33. https://science.lpnu.ua/sites/default/files/journal-paper/2022/oct/28838/vse-22-33.pdf (in Ukrainian)

Kirovych, N.O., Didur L.I. (2025).Current state of the meat cattle industry in Ukraine [Suchasnyy stan haluzi m″yasnoho skotarstva v Ukrayini.]. *Tavria Scientific Bulletin*. No. 143. Part 1. P. 241-248. https://doi.org/10.32782/2226-0099.2025.143.1.29 (in Ukrainian)

Klymovetsky, A.A., Nosevych, D.K. (2020). Formation of milk productivity of lifelong use of cows of the Ukrainian black-and-white dairy breed in the conditions of farms of the Kyiv region [Formuvannya molochnoyi produktyvnosti dovichnoho vykorystannya koriv ukrayins′koyi chorno-ryaboyi molochnoyi porody v umovakh hospodarstv Kyyivs′koyi oblas]. *Animal science and food technology*. Vol. 11. No.1. P. 33-42. https:://doi.org/10.31548/animal2020.01.033 (in Ukrainian)

Kovalenko, V., Gyl, M. (2014). Lactation curves in cows with different intensities of organism formation. [Laktatsiyni kryvi u koriv z riznoyu intensyvnistyu formuvannya orhanizmu]. *Livestock of Ukraine*. No. 1 (53). P. 18-21. available at**:** https://www.google.com/search?.pdf (in Ukrainian)

Kruglyak, O.V. (2018). Genetic resources of dairy cattle breeding in Ukraine [Henetychni resursy molochnoho skotarstva Ukrayiny]. *Economics of the Agricultural Industry*. No. 1. P. 33-40. https://eapk.com.ua/web/uploads/pdf/eapk_2018_01_p_5_99-33-39.pdf (in Ukrainian)

Oblyvantsov, V.V. (2013). Economic and biological characteristics of Swiss cattle of different breeding affiliations in Ukraine [Khozyaystvennyye i i biologicheskiye priznaki shvitskogo skota razlichnoy selektsionnoy prinadlezhnosti v Ukraine]. *Biology in agriculture*. No. 1. P.14-24. available at**:** https://istina.msu.ru/publications/article/7019795/(in Ukrainian)

O'Callaghan, F. T., Hennessy, D., McAuliffe, S., Kilcawley, K. N., O'Donovan, M., Dillon, P., Ross, R. P., Stanton, C. (2016). Effect of Pasture Versus Indoor Feeding Systems on Raw Milk Composition and Quality over an Entire Lactation. J. Dairy Science. 99. P. 9424-9440. https://doi.org/10.3168/jds.2016-10985

Piddubna, L.M., Zakharchuk, D.V. (2024). Milk productivity of cows depending on breed and origin by father [Molochna produktyvnist′ koriv zalezhno vid porody ta pokhodzhennya za bat′kom]. *Tavria Scientific Bulletin.* No. 135. P. 177-187. https://doi.org/10.32782/2226-0099.2024.135.2.22 (in Ukrainian)

Pidpala, T. V. (2019). Assessment of the features of intensive milk production technology [Otsinka osoblyvostey intensyvnoyi tekhnolohiyi vyrobnytstva moloka]. *Tavria Scientific Bulletin*. No 106. P. 87-93. http://www.tnv-agro.ksauniv.ks.ua/archives/106_2019/30.pdf (in Ukrainian)

Pidpala, T. V., Ostapenko O. M., Yasevin S. E. (2018). Intensive technologies in dairy cattle breeding: monograph. [Intensyvni tekhnolohiyi u molochnomu skotarstvi : monohrafiya]. Edited by Prof. T. V. Pidpala. Mykolaiv. 250 p. available at**:** https://dspace.mnau.edu.ua/jspui/bitstream/123456789/5472/1/Pidpala%20mono.pdf (in Ukrainian)

Pidpala, T. V., Yasevin S. E. (2021). Intensive technology of milk production [Intensyvna tekhnolohiya vyrobnytstva moloka]. *Livestock farming today*. No. 7. P. 18–24. available at**:** https://www.google.com/search? (in Ukrainian)

Pishchan, I.S. (2016). Genotypic and paratypic factors of milk productivity formation of Swiss breed cows in the Austrian ecological zone of origin [Henotypovi ta paratypovi faktory formuvannya molochnoyi produktyvnosti koriv shvits′koyi porody v avstriys′kiy ekolohichniy zoni pokhodzhennya]. *Scientific Bulletin of the S.Z. Gzhytskyi LNUVMBT*. Vol. 18. No 2(67). P. 187-194. http://nbuv.gov.ua/UJRN/nvlnuvmbcgn_2016_18_2_44. (in Ukrainian)

Pishchan, I.S., Pishchan, S.G., Litvinenko, L.O., Gonchar, A.O., Silichenko, K.A. (2021). Peculiarities of the implementation of productive qualities of Swiss breed cows in the conditions of a large industrial livestock complex [Osoblyvosti realizatsiyi produktyvnykh yakostey koriv shvits′koyi porody v umovakh velykoho promyslovoho tvarynnyts′koho kompleksu]. *Grain crops.* Vol. 5. No. 1. P. 167–179. https://doi.org/10.31867/2523-4544/0174 (in Ukrainian)

Pishchan, S.G., Silichenko, K.A. (2021). Characteristics of milk productivity and feeding of Swiss breed cows of autumn-winter calving [Kharakterystyka molochnoyi produktyvnosti ta hodivli koriv shvits′koyi porody osinn′o-zymovoho otelennya]. *Tavria Scientific Bulletin*. No 120. P. 221-237. https://doi.org/10.32851/2226-0099.2021.120.29 (in Ukrainian)

Polishchuk, T.V., Lyotka, G.I., Ushakov, V.M. (2021). Technology of preparing cows for summer keeping: Monograph [Tekhnolohiya pidhotovky koriv do litn′oho utrymannya: Monohrafiya]. LLC "Druk". VNAU. 236 p. available at**:** https://repository.vsau.org/card.php?lang=en&id=28639 (in Ukrainian)

Ponko, L.P., Dymchuk, A.V. (2024). Milk productivity of cows of different origins [Molochna produktyvnist′ koriv riznoho pokhodzhennya]. *Podolskyi visnyk: agriculture, technology, economics*.. No. 43. P. 68-76. https://doi.org/10.37406/2706-9052-2024-2.13 (in Ukrainian)

Ruban, S. Yu., Borshch, O. V., Borshch, O. O., [et al.] (2017). Modern technologies of milk production (features of operation, technological solutions, draft projects) [Suchasni tekhnolohiyi vyrobnytstva moloka (osoblyvosti ekspluatatsiyi, tekhnolohichni rishennya, eskizni proekty)]. Kharkiv. Stil-Izdat. 168 p. available at**:** https://rep.btsau.edu.ua/bitstream/BNAU/1951/1/Suchasni_tekhnolohii.pdf (in Ukrainian)

Ruban, S.Yu., Borshch, O.O., V.O., Borshch, O.V. (2023). Modern technologies of effective dairy cattle breeding [Suchasni tekhnolohiyi efektyvnoho molochnoho

skotarstva]. Development of the livestock industry: innovations, problems, prospects: abstracts of reports of the All-Ukrainian scientific and practical conference of scientists, teachers and postgraduates, July 4-6. *State Biotechnological University. Kharkiv,* P. 11-15. https://biotechuniv.edu.ua/wp-content/uploads/2023/08/materialy-conf-4-6-07-23.pdf (in Ukrainian)

Silichenko, K.A. (2021). Milk productivity of Swiss breed cows of spring-summer calving taking into account the peculiarities of their daily diet [Molochna produktyvnist′ koriv shvits′koyi porody vesnyano-litn′oho otelennya z urakhuvannyam osoblyvostey yikh dobovoho ratsionu]. *Tavria Scientific Bulletin*. No. 121. P. 204-226. https://doi.org/10.32851/2226-0099.2021.121.29 (in Ukrainian)

Tsvihun, I., Tsvihun, A. (2023). Problems of dairy cattle breeding development in the regions of Ukraine [Problemy rozvytku molochnoho skotarstva v rehionakh Ukrayiny]. Economy and Society. No 57. P. 67-73 https://doi.org/10.32782/2524-0072/2023-57-18 (in Ukrainian)