

THE REPRODUCTIVE PERFORMANCE OF COWS SPECIALIZED FOR MILK PRODUCTION IN THE PROCESS OF ADAPTATION TO NEW LIFE CONDITIONS

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Abstract

The reproductive performances (SP - service period, CI - calving interval, CCR - Reproductive capacity coefficient) of Jersey (Js), Holstein (HL) cow populations of French, Dutch and local selection were studied, in the period of adaptation to the new operating conditions. It was established that the most significant deviations from the optimal physiological value of SP and CI are found in the Js breed (SRL "Agro-Gogu") (+104.9 and +113.4 days) and in the local selection HL population (SRL "Gomets Efrem") (+78.2 and 88.6 days). In the dynamics of lactation, the duration of SP and CI, regardless of the animal husbandry, but also of the breed, is far above the optimally allowed values. The most favorable results are attested to heifers first calving of the French HL breed. The CCR reached the maximum value in cows HL of local selection, from the second lactation, followed by the Js population. The analyzed data reveal that the adaptive response of the animals to the new conditions is very slow, with breed differences and intrabreed variability.

Key words: adaptation, cows, imported animals, local selection population, reproductive performance.

INTRODUCTION

The revitalization and improvement of herds of cows specialized for milk production is achieved through the import of live animals, semen, embryos etc. When importing animals from abroad, we must strive not only to obtain high productivity from them, but also to ensure their long-term use in order to obtain as many young animals as possible for breeding. Dysregulation of the reproductive abilities of cows leads to lower birth rates and lower milk productivity (Deshevkykh et al., 2016).

Sulyga & Kovaleva (2010) established that in some animals, acclimatization occurs quickly, without special changes in the physiological state, while others require months and even years, as environmental factors affect imported animals differently. Filinskaya et al. (2020) claims that adult animals acclimatize worse than young animals that were raised in new conditions for the breed. According to Evstigneev (2010), the acclimatization of imported animals to new natural and climatic conditions is never complete and occurs only in the first or second generation and, in some cases, may not be observed at all. Therefore, the successful introduction of productive ani-

mals in new conditions is ensured if there is sufficient information about the growth and productive and farrowing status of the animal breeding sector of the exporting country (Shabalina, 2011; Korotkikh et al., 2019) reports that for domestic animals, the distribution area can be expanded due to the creation of maintenance and feeding conditions corresponding to their natural properties. Adaptive reactions in the body can be caused by various factors and can be expressed in changes in growth and development, the level of milk productivity, the morphological and functional properties of the udder and the reproductive abilities of cows (Vostroilov et al., 2019; Amaritii & Maciuc, 2023). Good reproductive qualities in new climatic and economic conditions often indicate the normal course of the acclimatization process in these animals (Usenkov et al., 2011).

Since about 70% of the herd intended for milk production consists of imported animals, and taking into account the pedoclimatic conditions of the Republic of Moldova, which are different from one area to another, in order to develop the strategy of selection and improvement works with these contingencies, the study of the reproductive qualities of the

imported animals in the process of adaptation to the new living conditions and of their offspring is a very urgent and indisputable problem. The reference objective focused on the study of the main reproductive indicators in cattle of different breeds, specialized for milk production in the process of adaptation to new living conditions.

MATERIALS AND METHODS

It was experimented with Holstein breed cow populations of different origin from the zootechnical units: SRL "Doksancom", v. Tomai, Chiadâr-Lunga, the Holstein breed of Dutch origin (HLD); SRL "Gomerts Efrem", Comrat municipality, the local selection Holstein breed (HLLS); SRL "Holstein", v. Roshcani, Anenii Noi district, the Holstein breed of French origin (HLF) and the population of Jersey (Js) cows SRL "Agro-Gogu" v. Ruseni, Anenii Noi district.

To characterize the reproductive capacity of cows, the following indices were evaluated: SP - length of service period, CI - interval between calvings, CCR - coefficient of reproductive capacity.

In order to establish the interrelationships between SP, CCR and milk productivity indices, the direction and magnitude of the correlation coefficient (r) was calculated between them and: the amount of milk per total lactation (SP- and CCR-MTL); the amount of milk during normal lactation, kg (SP- and CCR-MNL); overall fat, kg (SP- and CCR-OFNL).

The material for the research served the data of zootechnical accounting (card form T-2) and the information database of the farms.

The coefficient of reproductive capacity (CCR) of cows was calculated according to Eisner (1978) (1).

$$CCR = \frac{365}{CI} \dots \dots \dots (1)$$

The aim was to obtain position estimators: the arithmetic mean - \bar{X} ; the standard deviation of the mean - S_x ; the coefficient of variation - Cv; the correlation coefficient - (r).

The authenticity of the obtained results was verified according to the Student criterion - t_d .

Statistical processing and biometric analysis of the obtained data were carried out according to the generally accepted methods of variation statistics (Grosu, 2005) using the MS Excel-2010 analysis software package.

RESULTS AND DISCUSSIONS

The breeding efficiency of dairy cattle is largely determined by the reproductive intensity of the female herd, which has a direct impact on milk productivity.

Among the factors that determine milk productivity in cows, along with feeding conditions, maintenance, genetic potential an important role is occupied by the reproductive state of the female herd. The main indicators of the state of reproduction of the herd are: the length of the service period, the length of the interval between calvings, the reproductive capacity coefficient of the cows, the determining factor being the service period (Lyashuk & Mikhailova, 2016). In Table 1, we present the results of some reproductive indices (SP - service-period and CI- interval between calvings) in Holstein cows, of different origins, operated in different zootechnical units.

Table 1. The characteristic of the service period and the interval between calvings in the populations of cows specialized for milk production operated in different zootechnical units

Specification	The service period, <i>days</i>			The calving interval, <i>days</i>		
	$\bar{X} \pm S_x$	-with the optimal value allowed (90), days/%	Cv, %	$\bar{X} \pm S_x$	\pm with the optimal value allowed (365), days/%	Cv, %
SRL "Doksancom" (HLD)	129.2±7.20***	+39.2/43.5	52.3	411.3±7.28***	+46.3/12.7	15.3
SRL "Gomerts Efrem" (HLLS)	168.2±16.19	+78.2/86.7	63.1	453.6±16.13	+88.6/24.3	23.3
SRL "Holstein" (HLF)	138.0±12.18***	+48.0/53.3	7.6	422.5±12.10***	+57.5/15.8	7.2
SRL "Agro-Gogu" (Js)	194.9±12.03	+80.8/89.8	59.8	45.5±18.77	92.5/25.3	26.4

***P<0.001.

The obtained results demonstrate that in all cow populations, the duration of the service period

essentially prevails the maximum allowed value (90 days) within the limit of 39.2 days for

HL cows, Dutch origin from SRL "Doksancom" and 104.9 days for Jersey cows, from SRL "Agro-Gogu". Close to the minimum extreme of deviation, from the physiologically optimal value, the French HL population from SRL "Holstein" is placed with a difference of 48.0 days and towards the maximum extreme of deviation is the HL local selection population from SRL "Gomerts Efreem" with a difference of 78.2 days.

The comparative study of the value of the service period according to the origin of the animals and the animal husbandry shows statistically authentic differences lower by 65.7 days ($td=4.7$, $P<0.001$) in the herd of SRL "Doksancom" (Holstein breed of Dutch origin) and by 56.9 days ($td=3.3$, $P<0.001$) in the livestock of SRL "Holstein" (Holstein breed of French origin), compared to the Jersey population exploited in SRL "Agro-Gogu". Based on the analysed data, we mention that the terms of fertile insemination of cows, in all cases, exceed the maximum allowed limit, the latest being found in the herd of cows from SRL "Agro-Gogu".

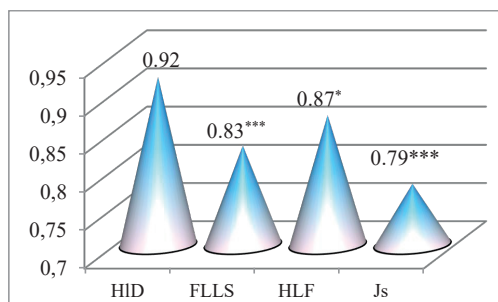
Regardless of the origin of the animals, but also of the animal husbandry, a great degree of heterogeneity is attested within the herds (52.3-64.4%) in terms of the duration of the service period. The highest coefficient of variation is in the population of Jersey cows from SRL "Agro-Gogu". In the Holstein breed, French origin from SRL "Holstein", the herd is much more homogeneous, the coefficient of variation is 7.2%. These data demonstrate that the service period is mainly influenced by external factors (technological, pedoclimatic).

The duration of the interval between calvings (Table 1) in the investigated populations exceeded the optimal term (365 days), depending on the livestock farm, but also on the origin of animals, the differences are within the deviation limit of 46.3-113.4 days, forming the series: Holstein of Dutch origin (46.3 days) < Holstein of French origin (57.5 days) < Holstein of local selection (88.6 days) < Jersey (113.4 days).

The interval between calvings is maximum in the cow population Jersey breed, from SRL "Agro-Gogu" (478.4 days). Compared to the Holstein breed of Dutch origin from SRL "Doksancom", it is higher by 67.1 days ($td=4.7$,

$P<0.001$,) and by 55.9 days ($td=3$, $P<0.001$) to the Holstein population of French origin from SRL "Holstein". In the rest of the cases, both regarding the length of the service period and the intervals between calvings, the discrepancies are statistically inauthentic.

In practice, the coefficient of reproductive capacity of cows is an essential economic index that reflects the state of reproduction of the herd and directly depends on the duration of the interval between calvings, which in turn depends on the service period. The service period also conditions the duration of lactation, but also the birth rate per population, as a whole. In Figure 1 we present the dynamics of the coefficient of reproductive capacity of Holstein cow populations, of different origins.



** $P<0.05$. *** $P<0.001$.

Figure 1. Characteristic of the coefficient of reproductive capacity in cow populations of breeds specialized for milk production

The optimal level of the coefficient of reproductive capacity of cows is equal to one unit and depends on the length of the interval between calvings. The value of the coefficient of reproductive capacity at the cow populations differ both according to breed, origin, and livestock holding, occupying the range 0.92-0.78.

The best result (0.92) is found in the population of Holstein cows, of Dutch origin, from SRL "Doksancom". The most significant difference (0.14) ($td=5.9$, $P<0.001$) was established between the herds of Holstein cows from SRL "Doksancom" (southern pedoclimatic zone) and the population of Jersey cows, SRL "Agro-Gogu". At the same time, in comparison with the Holstein populations of French origin, SRL "Holstein" (central pedoclimatic zone), a

genuine statistical difference of plus 0.05 ($td=2.2$; $P<0.05$) is found in favor of the first. Also, statistically authentic discrepancies were elucidated in the Holstein cow herds of local selection from SRL "Gomerts Efrem", the results being lower by 0.09 ($td=3.9$; $P<0.001$), compared to the Dutch population from SRL "Doksancom", both being exploited in the southern pedoclimatic zone, but in different zootechnical units. At the same time, the value of the coefficient of the reproductive capacity of cows in the herd of SRL "Holstein" in which the Holstein breed of French origin is exploited, is significantly higher by 0.08 ($td=5.2$; $P<0.001$), compared to the population of SRL "Agro-Gogu", both located in the central pedoclimatic zone of the country. In practice, the coefficient of reproductive capacity of cows is an essential economic index that reflects the state of reproduction of the herd and directly depends on the duration of the interval between calvings, which in turn depends on the service period. The latter also conditions the duration of lactation, but also the birth rate per population, as a whole (Table 2).

Table 2. Duration of lactation and the birth rate, in cow populations of breeds specialized for milk production

Specification	Duration of lactation, days	The birth rate, calves
SRL "Doksancom" (HLD)	356.2±7.14***	90.3±1.53***
SRL "Gomerts Efrem" (HLLS)	381.9±16.36*	81.2±2.15
SRL "Holstein" (HLF)	362.9±2.41***	86.4±0.43**
SRL "Agro-Gogu" (Js)	425.9±12.7	78.7±2.01

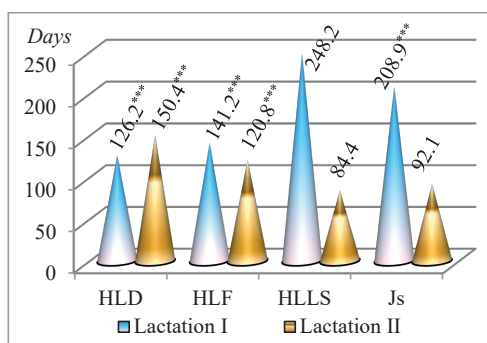
* $P<0.001$. ** $P<0.001$. *** $P<0.001$.

Lactation duration in all cow populations exceeds the physiologically optimal value (305 days). The closest to the allowed duration was found in the population of the Holstein breed of Dutch origin, the gap being 51.2 days, 57.9 days in the population Holstein of French origin, 76.9 days in the Holstein local selection population and 129.9 days in the Jersey breed cows.

Depending on the origin of the animals, in the Holstein population of Dutch origin, vis-à-vis the Jersey breed population, the difference is - 69.7 days ($td=4.6$; $P<0.001$), - 63 days ($td=4.9$;

$P<0.001$) in French Holstein and - 44 days in the local selection population ($td=2.1$; $P<0.05$). Based on the analysed data, the number of calves obtained at 100 cows per year is statistically genuine differences, compared with Jersey population. The best results in Dutch Holstein cows ($td=4$; $P<0.001$). A genuine statistical difference was also evident in the Holstein population of French origin ($td=2.6$; $P<0.001$).

In connection with the data from the profile literature according to which the adaptation process can occur in the first or subsequent generations, we studied reproduction indices in the dynamics of lactations. In Figure 2 we show the characteristic of the service period in the dynamics of lactations.



*** $P<0.001$.

Figure 2. The characteristic of the service period in the dynamics of lactation in cow populations from different breeds specialized for milk production

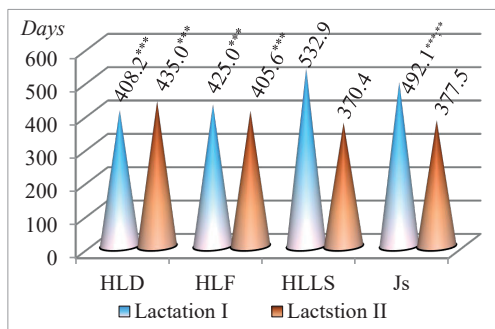
The duration of the service period, regardless of the order number of the lactation, essentially exceeds the optimal value allowed (90 days) except for the herd of cows, the second lactation, Holstein breed local selection from SRL "Gomerts Efrem" located in the southern pedoclimatic zone.

Comparing the results established for cows in the first lactation, extreme values of the service period are found in Holstein cows of local selection, being higher by 122 days ($P<0.001$, $td=6.1$), compared to the Dutch HL herd from SRL "Doksancom", the same southern pedoclimatic zone and with 107 days ($td=5.6$, $P<0.001$) with the result established in the Holstein, French population exploited in the central areas of the country.

The dynamics of the service period in the Holstein contingent of local selection from second lactation, the result is diametrically opposite to that established at the first lactation, the duration being the shortest. The differences are statistically significant lower by 66 days ($td=4.5$; $P<0.001$) vis-à-vis the result recorded in the Dutch Holstein population and by 36.4 days ($td=4.4$; $P<0.001$) in the French Holstein population.

The duration of the service period in different breeds shows that in Jersey cows it is statistically significantly higher by 81.7 days ($td=5.5$; $P<0.001$) and by 67.7 days ($td=3.6$; $P<0.001$) compared to Dutch and French Holstein populations, respectively.

Significantly greater differences were established in the Dutch Holstein herd by 58.3 days ($td=3.3$; $P<0.001$) and in the French Holstein population by 28.7 days ($d=3.4$; $P<0.001$), compared to Jersey cows. The duration of the interval between calvings in the dynamics of lactations, in all the populations included in our investigations, are higher compared to the physiologically optimal value (Figure 3).



*** $P<0.001$.

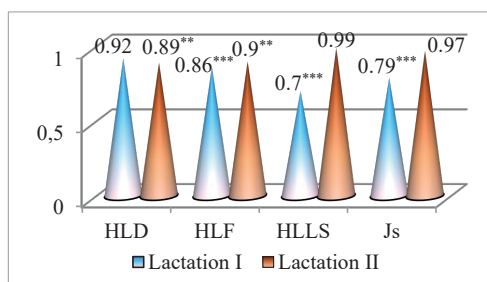
Figure 3. The characteristic of the calving interval in the dynamics of lactation in cow populations of different breeds specialized for milk production

In first lactation cows, the largest gap was established in the population of local selection cows, exceeding with statistically genuine differences of 124.5 days ($td= 6.9$; $P<0.001$) (SRL "Doksancom") and 107.9 days ($td=6.5$; $P<0.001$) (SRL "Holstein"). Statistically greater genuine differences in these populations were also established compared to the Jersey breed population from SRL "Agro-Gogu" 83.9 days

($td=5.7$; $P<0.001$) and 67.1 days ($td=5.0$; $P<0.001$).

The second lactation contingents show a similar trend to the situation in the case of the service period. The best result was demonstrated by the local selection of the Holstein population. In relation to the Dutch Holstein and French Holstein herds, differences of 64.6 days ($td=4.4$; $P<0.001$) and 35.2 days ($td=4.2$; $P<0.001$.) are found, respectively. Statistically smaller true differences of 57.1 days ($td=2.8$; $P<0.01$) and 86.5 days ($td=5.4$; $P<0.001$) in these latter two populations are also attested compared to the result established in the Jersey breed population.

Next, we present the dynamics of the coefficient of utilization of the reproductive capacity of herds of cows from specialized breeds for milk production, corresponding to the order number of the lactation (Figure 4).



** $P<0.001$. *** $P<0.001$.

Figure 4. Characteristic of the coefficient of reproductive capacity, in the dynamics of lactation, in cow populations of breeds specialized for milk production

From the analysed data, it is evident the influence of the service period on the duration of the interval between calvings, which in turn is directly reflected on the coefficient of utilization of the cows' reproductive capacity. Comparing the results obtained in the first lactation, the best coefficient of utilization of the reproductive capacity of the female herd is found in the Holstein breed population of Dutch origin exploited in the southern pedoclimatic zone (SRL "Doksancom"), while among the herds in the second lactation, the superiority is held by the Holstein cows of local selection, from SRL "Gomerts Efrem", located in the south of the country, followed by the contemporaries of the Jersey breed exploited in the central area.

Based on the results recorded on two normal lactations (305 days), we note that the reproductive capacity coefficient of the female population, regardless of breed, provenance or pedoclimatic zone, is better in cows from the second lactation.

In the following we present the interrelationships between SP, CCR and milk productivity indices in the cow populations included in the study (Figure 5).

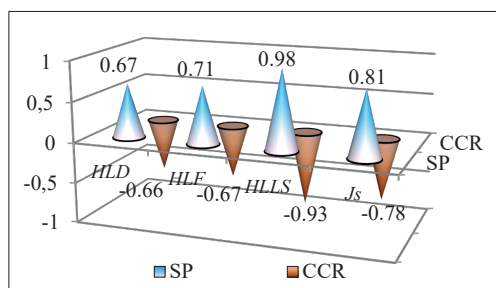


Figure 5. Relationship between SP, CCR and milk productivity for total lactation, in cow populations of breeds specialized for milk production

The analysed results attest to the presence of a high and very high positive correlation between service period and milk productivity on total lactation. Under the same maintenance and exploitation conditions, the magnitude of the correlation coefficient between reproductive capacity and milk productivity on total lactation remains strong and very strong, over time which direction changes diametrically opposite - negative, regardless of the animal husbandry or the origin of the animals.

Similar results can be seen in the case of milk productivity in normal lactation (Figure 6), only changing the magnitude of the correlation coefficient from very weak to weak.

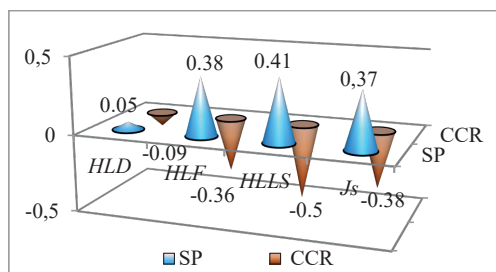


Figure 6. Relationship between SP, CCR and milk productivity for normal lactation, in cow populations of breeds specialized for milk production

Figure 7 reflects the direction and magnitude of the correlation between reproductive and overall fat on normal lactation.

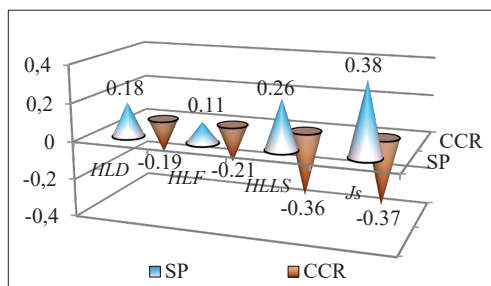


Figure 7. Relationship between SP, CCR and overall fat for normal lactation, in cow populations of breeds specialized for milk production

Between the overall fat and reproductive indices (SP and CCR) the presence of the correlative link was established, predominantly weak in magnitude, as a positive in the case of the service period and negative to the coefficient of use of the reproductive capacity of the mother herd.

The results obtained in our study have an ambiguous character. On the one hand, it confirms the results reported by Usenkov (2013), who, studying the economic, biological peculiarities and the acclimatization capacity of heifers imported from Germany, found that heifers of the Holstein breed had difficulties acclimatizing in the local conditions.

On the other hand, it rejects the view that even after the first calving they had high rates for all the basic economically valuable characteristics and practically all fell within the requirements of the target standards for native animals, which in our case, was not observed in none of the investigated populations, in the first lactation.

At the end of the analysis of the experimental results, we generalize that the indices that reflect the functionality of the reproductive system in cow populations imported from abroad, but also in the local selection population, did not fall within the requirements of the target standards. According to the value of the reproduction indices in the local selection population, as a whole in the population, compared to the imported animals, no adaptive reactions are attested for now. These being significantly higher with the result

established for the population of Holstein cows of Dutch origin exploited in the same southern pedoclimatic zone, and also lower results are attested for them and compared to the result established for Holstein cows of French origin, located in the central pedoclimatic zone of the country.

Thus, in dairy cattle breeding of the Republic of Moldova, when solving problems related to reproduction, it is necessary to apply an integrated approach, using modern genetic material, advanced technologies, including improving the conditions of feeding and keeping dairy cows.

CONCLUSIONS

The functionality of the reproductive system in cow populations imported from abroad, for now, does not fall within the requirements of the target standard, showing variations depending on the breed and their origin, but also of the technological and pedoclimatic conditions in which the animals are exploited.

The most significant deviations from the optimal physiological value of SP and CI can be seen in the Js breed (SRL "Agro-Gogu") (+104.9 and +113.4 days) and the local selection HL population, (SRL "Gomerts Efrem") (+78.2 and 88.6 days).

In the dynamics of lactation, the duration of SP and CI, regardless of the zootechnical unit, breed and its origin, are far above the optimally allowed values. The most favorable results are attested to primiparas (I-st lactation) of the French and Dutch Holstein breed. For cows in the second lactation we mention the HL breed population of local selection. CCR reached the maximum value in cows HL of local selection. The adaptive response of animals to the new conditions is very slow, with breed differences and intrabreed variability.

The successful introduction of productive animals in new conditions is ensured if there is sufficient information about breeding technology, productive status and also the level of selection and improvement of the animal breeding sector of the exporting country.

ACKNOWLEDGEMENTS

The research was carried out within the project 20.800009.5107.20 "Management of the genetic potential and productions of breed animals reproduced and exploited in the pedoclimatic conditions of the Republic of Moldova".

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