

MONITORING OF REPRODUCTION INDICES AND THEIR INTERRELATIONSHIPS WITH MILK PRODUCTIVITY AT HOLSTEIN COWS OF DIFFERENT ORIGIN

Vera GRANACI, Valentin FOCSHA, Vasile CURULIUC, Valentina CIUBATCO

Scientific-Practical Institute of Biotechnologies in Animal Husbandry and Veterinary Medicine,
v. Maximovca, District Anenii Noi, Republic of Moldova

Corresponding author email: ms.granaci@mail.ru

Abstract

Breeding indices and their interrelations with milk productivity were studied with the Holstein cow populations, of different origins (Dutch, German and French). The value of the main reproduction indices in the investigated populations significantly exceeds the maximum allowable limits. The shortest SP is at Dutch Holstein cows, the German exceeds the first by 7.1 days, the Holstein-Prim, French cows - by 32.9 days those of Dutch and by 5.8 days the cows of German origin. The longest DL has Holstein-Prim, French cows, exceeding by 66.4 days the Dutch, by 35 days the German, which in their turn exceeds, Holstein, Dutch by 31.4 days. The CI exceeds the maximum allowable value (365 days) forming the following string: Dutch Holstein (+75.7 days) < German Holstein (+99.9 days) < French Holstein-Prim (+136.4 days) and the RCC of cows - Dutch Holstein (0.87) > German Holstein (0.82) > French Holstein-Prim (0.81). Between the RCC and the indices of milk productivity on total lactation were established strong and very strong negative correlations and mostly negative from medium to very weak with the same indices on normal lactation.

Key words: *calving interval, coefficient of reproduction capacity, correlation, dry period, service-period.*

INTRODUCTION

Cattle take a primordial place in providing the products needed for the consumption of the population and in the agricultural economy, that is why the species deserves concern and support for size, performance and competition both now and in the future.

With the radical reshuffles in the ownership structure of livestock in favour of the private sector, there have been a number of shortcomings and differences, such as the practical decrease in livestock, the change of technical actions in the genetic improvement of livestock populations, official control of productions, testing of breeders by the quality of their lineage, etc. that have also been deeply felt in the cattle branch. Research carried out in recent years, on this sector in the Republic of Moldova, shows a slow decline in the herd. At the same time, using advanced growth and exploitation technologies, the productivity of specialized dairy cattle production, increase. The breeding parameters (fecundity, birth rate, calving interval, etc.) significantly influence the rate of breeding of the animals and the rate of genetic progress, the level of production, the

genetic structure of the populations, the state of animal health and the economic efficiency of this branch. For this reason, the maximum use of cow's reproduction capacity is among the most important conditions that determine the high efficiency of specialised cattle for milk production. The genetic potential of productivity can only be achieved under a high level of reproductive function (Hansen, 2002; Baimishev et al., 2007; Azarova et al., 2009; Lobodin, 2010; Gritsenko, 2016).

Optimization of reproductive function is one of the key factors influencing the realization of the genetic potential of high cow's milk productivity. According to data from the literature milk production, but also its quality is influenced by various factors (Laben, 2000; Matsoukas and Fairchild, 2005; Frolova et al., 2014), but not least the value of the breeding indices (Kononov, 2013).

Although the literature has a rich arsenal of data concerning the interrelationships between milk productivity at cows and breeding indices (Mayer, 2006; Maslov, 2007; Firsova et al., 2012), however, so far, there is no single opinion on this problem, remaining in the sights of researchers and practitioners. Since

the genetic material of the Holstein breed introduced into the republic is of different origin (German, Dutch, French), and the capacities to adapt to the pedoclimatic conditions of the Republic of Moldova are different, we present the results of monitoring of breeding indices and the interrelationships between these and the performance of milk production, at the populations of cows of the Holstein breed of different origin.

MATERIALS AND METHODS

It was experimenting with cow populations of Dutch Holstein exploited in the production activity course of Limited Liability Company (LLC) "DokSanCom", district Ceadir-Lunga, two populations of Dutch and German Holstein cow exploited on the course production activity of Joint-Stock Company (JSC) "Aydyn", Comrat and with the French Holstein-Prim population exploited in the production activity course of Limited Liability Company (LLC) "Total Gnatiuc", district Glodeni, during the period 2017-2020 years.

The study was targeted the assessment of the duration of breast restenosis (BR), service-period (SP), calving interval (CI), duration of lactation (DL), reproductive capacity coefficient (RCC) and interrelationships of reproduction indices depending correlation coefficient between the coefficient of use of reproductive capacity at cows and milk (M) productivity, duration of lactation (DL), milk fat (F) and overall fat (OF) on total lactation (TL) and normal lactation (NL) in the respective animal populations.

Statistical processing of the experimental results was carried out computerized, by mathematical analysis of biological phenomena, according to the program "Microsoft Excel 210".

Interpretation of the value of the correlation coefficient:

- $r = 0 \rightarrow$ there is no correlation;
- $r = +/- 1 \rightarrow$ the correlation is perfect;
- $r > 0.4 \rightarrow$ good correlation;
- $r [0 - 0.2] \rightarrow$ very weak correlation;
- $r [0.2 - 0.4] \rightarrow$ weak correlation;
- $r [0.4 - 0.6] \rightarrow$ reasonable correlation;
- $r [0.6 - 0.8] \rightarrow$ high correlation;
- $r [0.8 - 1] \rightarrow$ very high correlation.

RESULTS AND DISCUSSIONS

The capacity of females for milk secretion is linked with the physiological dominance of the perpetuation of the species and the feeding of progeny. With regard to milk cattle, if the female for some reason is devoid of the ability to procreate, the ability to secretion lactate is also inhibitory.

Therefore, the more offspring a cow produces, the more milk secretion will be stimulated and the more milk it will produce throughout the cow's life. So, the primary task that stands before the breeders is to obtain from each cow during the calendar year a calf.

The breast restenosis is one of the main moments in milk cattle mining technology. Namely, during this period takes place the foundation of well-being health of the mother and the product of conception, the favorable development of parturition and the triggering of successive lactation.

The duration of breast restenosis depends of the duration of lactation and the amount of milk on the previous lactation, age, expected milk productivity, level and quality of nutrition. Theory and practice reveal that the breast restenosis of less than 30 days brings losses of about 20% of milk per lactation.

When its duration is 30 to 40 days the losses will be limited to 10% in the following lactation, compared to its duration of 45 to 60 days (Borisikin et al., 2005; Lavelin, 2009).

In Figure 1 we present the results of the study of the breast restenosis duration at cows of the Holstein breed, different origin.

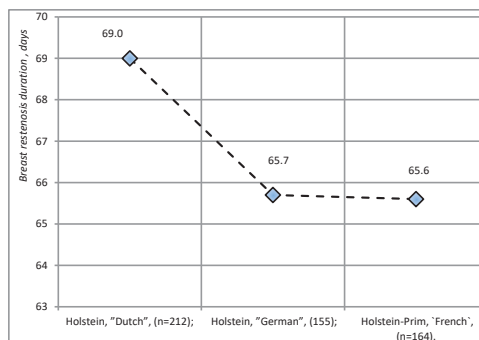


Figure 1. Characteristic of breast restenosis duration at Holstein cow populations, different origin, exploited under the conditions of the Republic of Moldova

The optimal duration of breast restenosis is 60 days, and the deviation in one or another duration has negative consequences, resulting in a decrease in milk productivity.

Analysis of the obtained data attests to the increase in breast restenosis at Holstein cows compared to their optimal value, regardless of origin. Thus, at population of Holstein cows of French and German origin the value of the examined index being similar, exceeds the allowable duration by 5.6 days (+9.2%).

The biggest gap was established in the Holstein population of cows originating in the Netherlands, taking over the optimal value by 9 days (+15.0%). Compared to the populations of french and german origin, the difference is 3.4 and 3.3 days (+5.0 – 5.2%), being non-authentic.

The reproduction of the calf includes two periods: gestation and the period from calving to fecund incemination - defined service-period. Since the duration of gestation at cows is a relatively constant value, equal on average with 285 days, the number of calves obtained from cows, per year and/or the entire period of exploitation, depends on the duration of the service-period. The duration of the service-period influences the milk production of cows, primarily as a factor determining the duration of lactation and the period of instalation of gestation. Once the increase in its duration, correspondingly decreases the birth rate to 100 cows per year, reason why it is recommended that the cows be fertilized in the first 2 to 3 months after calving, this being the main condition of increasing the rate of breeding of the herd in the household and increasing the economic efficiency of the branch (Artyukh et al., 2004; Perfilov, 2009).

Below (Figure 2) we present the results of the monitoring of service-period duration.

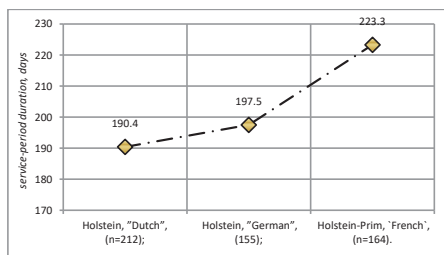


Figure 2. Service-period feature at Holstein cow populations, different origin exploited in RM

The presented results show, that compared both with the maximum allowable duration and between the populations of cows of different origin are attested to higher values of the service-period.

The best results were established in the Dutch Holstein cows. At German Holstein cows population the service-period duration is increasing vis-à-vis premiums with an inauthentic difference of 7.1 days (+3.8%). The results obtained at Holstein-Prim, French origin are the highest, exceeding with an inauthentic difference of 32.9 days (+17.4%) Dutch and 5.8 days (+13.1%) Holstein cows, German origin.

Starting from the known fact that the permissible limits for the duration of the sevice-period, it is recommended to be according to the level of milk production at cows and is considered to be:

- 45 days, for those with low milk production;
- 60 days, for those with average milk production;
- 80 days for those with high yields and
- up to 120 days for cows with record milk production.

Even so, in our case the service-period duration prevails 1.9 times the maximum allowable value for cows with very high milk production. Thus, it is obvious that cows are sown very late after calving.

Investigations with dairy cows confirm that the best results of their use are obtained when the duration of lactation is within 270 to 305 days. In the following figure we present the dynamics of lactation duration in Holstein populations of different origin (Figure 3).

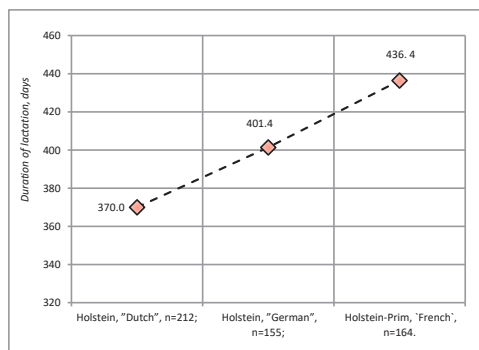


Figure 3. Duration of lactation at Holstein cow populations, different origin, exploited in RM

From the analysed materials it follows that at the delayed sowing of cows after calving, as occurred in the case investigated by us, there is an increase in the duration of lactation. Regardless of the origin of Holstein cows the duration of lactation is well superior the limit of 270-305 days.

Despite the fact that in the Holstein population, originating in the Netherlands, the duration of lactation is 65 days longer (+21.5%), compared to the optimal-accepted duration (305 days) however it was found to be the best result compared to the other two population.

The longest duration of lactation is attested in the population of Holstein-Prim cows French origin, exceeding the maximum permissible limit by 13.4 days (+43.1%) and by 66.4 days (+17.9%) ($td = 2.66; P \leq 0.01$) originating of the Netherlands, vis-à-vis the population of German origin the difference is 35 days (8.7%) in favour of the latter.

The results established at the German Holstein cow population reveal that the duration of lactation is longer, compared with maximum permissible limit by 96.4 days (+31.6%), at the same time, it goes beyond, with a genuine difference, in this respect the Holstein population of Dutch origin by 31.4 days ($td=3,78; P \leq 0,001$).

The increase, in excess of the duration of lactation, although it follows the production of a large quantity of milk, calculated per day lactation, from these cows is obtained a smaller quantity of milk compared to cows having the normal duration of lactation. Too long lactation brings with it 15% loss of milk.

As we mentioned in the achievement of the objective one calf per cow/year and high milk production per lactation and the entire operating period depends on the duration of the service-period, as this is reflected on the interval between calving (Fedoseeva, 2007; Gabor, 2008).

In order to assess the effectiveness of the exploitation of Holstein milk cows of different origin we determined the duration of the interval between calving in the respective populations (Figure 4).

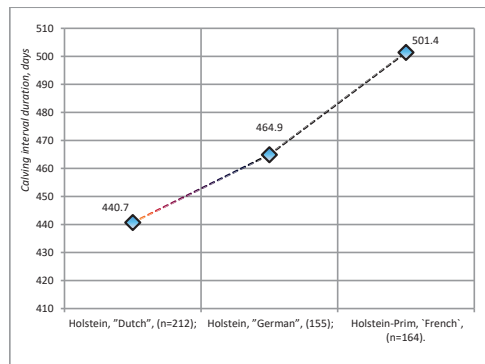


Figure 4. Duration of the interval between calvings at Holstein cows, different origin, exploited in RM

The data obtained on the value of the interval between calvings at Holstein cow populations show that regardless of the origin of the animals it significantly exceeds the maximum allowable value of 365 days, but is differentiated by origin, forming the following string: Holstein Dutch < Holstein German < Holstein-Prim French.

So, but in Holstein cows, Dutch origin the duration of the interval between calvings prevails the maximum allowable value by 75.7 days (+20.6%), being less by 24.9 days (-5.7%) compared to the established result at the Holstein cow population, German origin and by 60.7 days (-13.8%) ($td = 2.22; P \leq 0.05$) to cows of Holstein-Prim, French.

At cows originating from Germany the duration of the period between calvings is greater compared to the maximum accepted value by 99.9 days (+27.4%). The worst results were found to be at the Holstein-Prim cows population of French origin, where the difference is greater, with 136.4 days (+37.4%) to optimal value and with 36.5 days (+8.3%) compared to cows of German origin.

The most relevant result of the coefficient of use of the reproductive capacity of cows is at cows originating in the Netherlands, exceeding those of German origin with a genuine difference of 0.05 ($td = 3.57; P \leq 0.005$) and non-authentic of 0.06 Holstein-Prim cows, French origin (Figure 5).

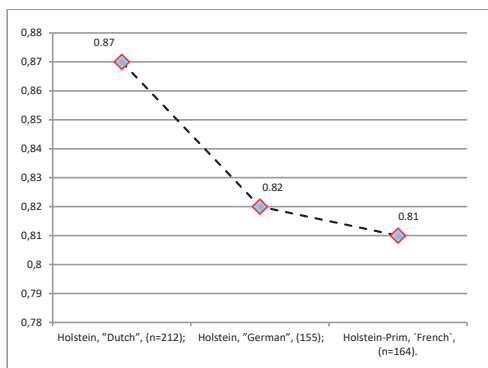


Figure 5. The coefficient of use of reproductive capacity at Holstein cows populations, different origin, exploited under RM conditions

Under the same conditions, at the last two populations the results are similar, the difference being 0.1 in favor of the German population.

In the context of the reports we note that the functionality of the reproductive apparatus is influenced by both genotype and external factors. But starting on the fact that the manifestation of the phenotype represents the

interaction between genotype and environment, defined as the norm of reaction, based only on these data, we are far from determining what is the share of influence of the genotype and to what extent external factors (technological and ambient) participate.

Knowledge of the degree and direction of the correlational links between breeding indices and milk productivity at the studied cow populations is of interest because when selected characters at the cattle for milk production correlate positively, selecting the animals after high milk production, the breeding indices will evolve in the same direction.

If there are negative correlations between the desired characters, the selection work is intertwined, since the increase of one character will contribute to the shrinking of the other. The results of the interrelationships between the duration of the service-period, the interval between calvings and the milk productivity indices of Holstein cows of different origin (Table 1) highlight the presence of correlational links, both positive and negative of very different degree.

Table 1. Dynamics and direction of correlation coefficient between breeding indices and milk productivity at the Holstein cow population, different origin

Specification	Holstein, Dutch, n = 212		Holstein, German, n = 155		Holstein-Prim, French, n = 164	
	SP	CI	SP	CI	SP	CI
Duration of lactation (DL)	0.59±0.04	0.97±0.004	0.96±0.01	0.99±0.001	0.72±0.04	0.99±0.004
Milk on total lactation (MTL)	0.44±0.06	0.74±0.03	0.92±0.01	0.91±0.01	0.64±0.05	0.64±0.05
Overall fat on total lactation (OTL)	0.40±0.06	0.69±0.04	0.92±0.01	0.91±0.01	0.63±0.05	0.60±0.05
Milk on normal lactation (MNL)	0.19±0.07	0.23±0.07	0.58±0.05	0.54±0.06	0.10±0.08	0.05±0.08
Fat on normal lactation, (FNL)	-0.05±0.07	0.04±0.06	0.30±0.07	0.31±0.07	-0.04±0.08	-0.29±0.07
Overall fat on normal lactation (OFNL)	-0.02±0.07	0.17±0.07	0.58±0.05	0.54±0.06	0.12±0.08	0.04±0.08

Thus, between the duration of lactation and the breeding indices (SP, CI) there is evidence of a very high positive correlation at the population of Holstein cows of German origin, high and very high at Holstein-Prim French cows, reasonable and very high at Dutch Holstein cows.

Between the duration of the breeding indices (SP, CI) and the milk productivity indices on total lactation (milk and overall fat) there remain very high positive correlation links to Holstein, German, high to those of French

origin and reasonable to high at the Dutch Holstein population.

Analyzing the results obtained on the correlation between the main indices of milk productivity on normal lactation with the duration of the SP and CI, we mention the drastic decrease in the size of the correlation coefficient.

Here we attested the presence of the reasonable positive correlation between the duration of the service-period and the interval between calving

with the quantity of milk at German Holstein cows, in the other two populations - the weak and very weak correlational links.

Regarding the interrelationships studied between the breeding indices and the average milk fat on normal lactation the size of the correlation coefficient is constantly descending, being weak positive at German Holstein population and very weak and weak reversing its direction to the Dutch Holstein cows and the French Holstein-Prim cows. The similar trend is also observed in the sky regarding the

interrelationship with the overall fat on normal lactation, the links with it and the duration of the service-period and the interval between calving are reasonable positive in German Holstein cows, and very weak positive in the other two populations. T

he results obtained in the study show (Figure 6) that the coefficient of use of the reproductive capacity of cows and the indices of milk productivity (duration of lactation, milk, mean fat and overall fat) on total lactation are attested to the high and very high negative correlation.

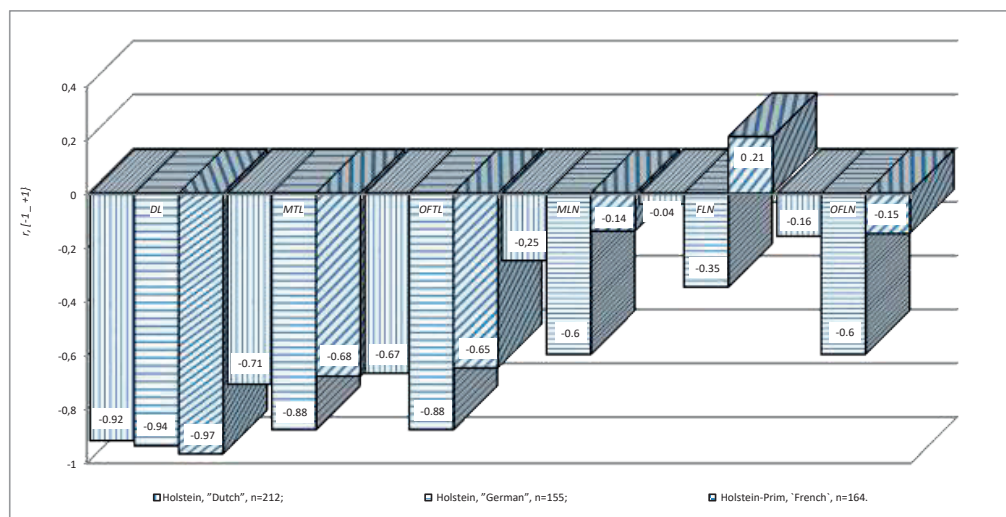


Figure 6. Interrelationships between the coefficient of use of reproductive capacity and the index of milk productivity at Holstein cow populations, different origin, exploited under the conditions of the Republic of Moldova

With regard to the main indices of milk productivity on normal lactation (milk, mean fat and overall fat) and the coefficient of use of the reproductive capacity of cows, the presence of very weak and weak negative correlation is attested, with the exception of the average fat content in milk at cows of French origin, at which the coefficient of correlation between the studied indices is positive.

The strongest negative correlation altogether link is attested between the duration of the coefficient of use of the reproductive capacity of cows and the duration of lactation, regardless of the animal's origin.

The data obtained during 3 years of monitoring of the breeding indices and their interrelationship with the milk productivity at cows of Holstein breed of different origin, now and exploited in different areas of the Republic

of Moldova, once more prove, that the breeding of cows with high milk production remains problematic and needs more rigorous work to select individuals who have both characters with high values.

CONCLUSIONS

The value of the main breeding indices at Holstein cow populations, different origin exploited under the conditions of the Republic of Moldova, in the average per population, significantly exceed the maximum permitted limits.

In the Population of Holstein-Prim cows of French and German origin, the duration of dry period exceeds the maximum allowable value (60 days) by 5.6 and 5.7 days (+9.2%).

The largest gap was established at Holstein population of cows originating in the Netherlands, with the optimal value of 9 days (+15.0%), compared to populations of French and German origin the difference is, respectively 3.4 days and 3.3 days (+5.0% and +5.2%), being non-authentic.

The duration of the service-period, regardless the origin of the cows, is significantly higher compared to the maximum allowable value even for cows with very high milk production.

The best results were established at Dutch Holstein cows. At the Holstein, German cow population the service-period duration is increasing vis-à-vis premiums with an inauthentic difference of 7.1 days (+3.8%). The results obtained at Holstein-Prim, French origin, are the highest, exceeding the Holstein Dutch with an inauthentic difference of 32.9 days (+17.4%) and with 5.8 days (+13.1%) Holstein cows, German origin.

The duration of lactation in the population of Holstein cows of Dutch origin is the best result compared to the other two populations. At Holstein-Prim cows, French origin is attested the longest duration of lactation, exceeding the maximum allowable value by 131.4 days (+43.1%), by 66.4 days (+17.9%) ($td = 2.66$; $P \leq 0.01$) originating in the Netherlands, vis-à-vis the population of German origin, difference is 35 days (8.7%) in favour of the latter.

The results established at the German Holstein cow population the duration of lactation is higher, with a maximum permissible limit of 96.4 days (+31.6%), at the same time, exceeds, with a genuine difference, in this respect the Holstein population of Dutch origin by 31.4 days (+8.5%) ($td = 3.78$; $P \leq 0.001$)

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The duration of the interval between calving, regardless of the origin of the animals, significantly exceeds the maximum allowable value, but differentiated by origin, forming the following string: Dutch Holstein (75.7 days) < Holstein, German (99.9 days) < Holstein-Prim French (136.4 days).

The most relevant results of the cow's reproductive capacity use were achieved at cows originating in the Netherlands, exceeding those of German origin with a genuine difference of 0.05 ($td = 3.57$; $P \leq 0.005$) and non-authentic of 0.06 Holstein-Prim cows of French origin.

Between the coefficient of use of the reproductive capacity of cows at the investigated populations and the indices of milk productivity (milk, mean fat and overall fat) on total lactation was established the presence of high and very high negative correlational links and, on the other hand, negative from reasonable to weak with milk productivity indices on normal lactation (milk, mean fat and overall fat).

The highest negative correlational link (-0.94 – -1.0) is attested between the duration of lactation and the coefficient of use of the reproductive capacity of cows.

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