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REPRODUCTIVE PERFORMANCE AND INTENSITY OF USE OF PRODUCTIVE POTENTIAL IN COWS

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Abstract

The reproductive performances (SP - service period, CI - calving interval, Insemination index, percentage of fertilization at first insemination) and the intensity of use of milk production potential of Holstein breed (HL) cow population were studied. Change of level of milk productivity cows in the direction of increase or decrease of 1000 kg leads accordingly to decrease or increase the indicators of reproductive function. The reproductive performance indicators of cows in herds with milk productivity from 4000 to ≥ 8000 (SRL "Holstein") and from 6000 to ≥ 10000 kg and more (SRL "Doksancom") revealed two peaks in productivity levels - from 5000 kg milk and from 8000 kg milk. Increasing the service period contributes to increasing the milk yield per normal lactation, but this is not rational because it decreases the average amount of milk per head/day by about 8.1-19.2%, depending on the level of productivity.

Key words*: Holstein breed cows, milk productivity, reproductive performances, use of productive potential.*

INTRODUCTION

The specialized literature has a rich register of data on the study of the relationships between the performance of milk productivity in cows and reproductive indices (Baláš et al., 1994; Moroz et al., 2009; Perfilov et al., 2015; Kuznetsov and Revina, 2017) a single opinion on this subject still does not exist, it still remains in the sights of researchers and specialists of profile.

To confirm or deny this opinion, the purpose of our research was to study the main indicators of reproductive function, their relationship with the level of milk productivity and the intensity of use of the genetic potential of cows.

MATERIALS AND METHODS

In order to achieve the objective, it was experimented with the population of Holstein cows, exploited within the production activity from SRL "Holstein", Roshkani village, Anenii Noi district, SRL "Doksancom", Tomai village, Chiadâr-Lunga district with milk productivity from 4000 to 8000 kg and from 6000 to 10000 kg and more.

To achieve the goal, the following operational objectives were set:

- evaluation of the main reproductive indices: days from calving to the first insemination; days from first insemination to fertilizing insemination; the length of the service period; insemination index; percentage of fertilization at first insemination; the number of inseminations per conception, the number of inseminations per cow;
- reproductive capacity of cows with different milk productivity;
- the relationship between the duration of service period and the intensity of use of the cows productive potential.

For establish the impact of milk productivity on indices of the reproductive function of cows, they were divided into depending on the level of milk yield for normal lactation with a class interval of 1000 kg: <4000; 4001-5000; 5001-6000; 6001-7000; 7001-8000 kg; 8001-9000 kg; 9001-10000 kg; more ≥ 10001 kg. The studies were carried out by comparing groups of animals in terms of reproductive abilities at different levels of productivity.

For insemination, we used frozen sperm of bulls from the Republican Center for Reproduction and Improvement (village Maximovca, Anenii Noi district), conforming to GOST 26030-83 with an activity after thawing not less than 4.0 points, a number of

progressively motile spermatozoa in a dose - 12 million and sperm survival at 38ºC for more than 5 hours.

The material for the research served the data of zootechnical accounting (card form T-2; card form T-10) and the information of data base of the farms.

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. The reliability of the difference between the mean values of the signs was determined by Student's td-test.

RESULTS AND DISCUSSIONS

In Table 1 are presented the mean days from first insemination to conception, number of inseminations per conception, and total number of inseminations, with relation to the length of the interval between insemination.

Table 1. Mean number of days from first insemination to conception, number of inseminations per conception, and number of inseminations as ranged by ten-day periods of the insemination interval of Holstein breed cows

Specification	Length of interval between insemination, days												
	≤50	51-60	61-70	71-80	81-90	91-100	101-110	111-120	121-130	131-140	141-150	≥151	Total
Cows that conceived													
Days from first insemination to conception	72.1	43.29	41.14	35.77	36.35	30.04	31.07	38.96	37,00	41.54	40.00	12.42	36.08
Cows, heads	11	37	64	68	71	58	52	31	20	20	18	26	476
Inseminations per conception	2.52	2.15	2.47	2.25	2.28	2.09	2.16	2.25	1.28	1.95	2.0	1.51	2.08
Conceived on first insemination, %	30.0	38.55	41.2	48.97	46.75	44.88	47.72	40.05	35.44	46.52	44.4	67.6	54.25
Cows that have not conceived, %	7.13	6.68	5.98	5.85	5.80	5.52	4.23	4.70	4.45	4.15	3.00	3.43	5.78
/ heads	2	4	5	7	8	7	5	3	4	2	1	3	51
Totals cows, heads	13	41	69	75	79	65	57	34	24	24	20	29	527
Inseminations per conception	2.93	2.71	2.40	2.38	2.24	2.23	2.28	2.34	2.54	2.20	1.69	1.78	2.27
Per cent conceived on first insemination, %	29.70	38.95	40.18	49.55	43.65	43.50	47.75	37.95	28.15	42.45	40.00	66.50	52.9

The interval between inseminations ranged from ≤50 to ≥151 days. There were only 13 below 50 days and only 129 above 150 days, of which 14 were above 160 days.

The obtained results attest that the average length of interval from first insemination to conception in the contingent of cows that were first inseminated within 50 days or less after calving is significantly longer compared to those with the length of longer time intervals of first insemination.

At the same time, there are no significant differences between the means regarding the duration of the interval from the first insemination to conception in the sequence of the length of insemination interval.

In Table 2 are shown the analyses of variance for days from first service to conception, for services per conception, and for all services.

Table 2. Analyses of variance for days from first insemination to conception, services per conception, and all inseminations of Holstein breed cows

Specification	Cows that conceived				All cows	
	Days from first insemination to conception		Inseminations per conception		All inseminations per cows	
	Cows	δ^2	Cows	δ^2	Cows	δ^2
Between ten-days interval of inseminations	13	3.099	13	1.11	13	2.76
Within ten-days interval of inseminations	462	2.098	462	2.28	513	2.95

Analysis of variation for days from first service to conception, inseminations per conception, and all inseminations per cow, demonstrates that in no case is the variation between groups with ten-day insemination intervals significant at a probability as low as 0.05.

In spite of the general lack of significance of the between-group mean squares, one should not conclude that the length of the insemination interval is not associated with the length of the interval from first insemination to conception, with inseminations per conception, or with total number of inseminations per cow. The difference associated with the different lengths of insemination interval could be confounded with differences in management. Such differences are likely to be small in the data, because a concerted effort is exerted to standardize management practices at zootechnical holdings and the field non-return rates were approximately equal.

The following table presents the results of the study of reproductive qualities of cows exploited in SRL "Holstein" with a milk productivity level of 4000 to 8000 kg (Table 3). We have established that with an increase in the level of milk yield, from 4000 to 8000 kg, a significant deterioration in fertility after the first insemination was observed in cows starting with a milk yield of more than 5000 kg. Thus, in animals with a milk yield 8000 kg and more, it was 36.4±9.1%, which is 30.1% lower, of 1.6 times lower ($p \leq 0.01$) than in cows with a productivity of ≤ 4000 kg (66.5±6.5%).

Table 3. Reproductive qualities of Holstein breed cows
(SRL "Holstein" with a milk productivity level of 4000-8000 kg)

Milk yield, kg	Cows, heads	Period from calving to first insemination, days	Service period, days	Insemination Index	Conseived from first insemination, %	Period leght from first to fertile insemination, days
≤ 4000	46	55.8 ± 4.2	95.0 ± 10.9	1.6 ± 0.15	66.5 ± 6.5	30.4 ± 7.6
4001-5000	105	64.7 ± 3.3	113.5 ± 10.9	1.6 ± 0.05	56.3 ± 5.4	37. ± 6.7
5001-6000	129	69.5 ± 2.6	129.8 ± 5.8	1.9 ± 0.05	47.2 ± 5.7	52.7 ± 5.8
6001-7000	102	73.2 ± 3.4	14.2 ± 6.8	1.9 ± 0.1	43.2 ± 4.5	57.1 ± 7.1
7001-8000	75	85.6 ± 4.7	152.0 ± 8.4	2 ± 0.1	38.9 ± 5.6	60.4 ± 9.7
≥ 8001	36	80.6 ± 3.8	141.5 ± 9.8	2.1 ± 0.2	36.4 ± 9.1	55.6 ± 6.8

At the same time, the service period increased by an average of 57.0 days, the period from calving to the first insemination by 29.8 days, and the period from the first to fertile insemination by 27.6 days. The results of the analysis showed that the best fertility results after the first insemination are observed in cows with milk productivity more than 7000 kg, inseminated 85.6 days after calving..

A study of the reproductive capacity of cows in a herd with productivity from 6000 to ≥10 000 kg and more (Table 4) showed that the tendency of a decrease in the reproductive function of dairy cattle with an increase in the level of milk productivity persists. The received data are consistent with the information of other researchers (Gabor, 2008).

Table 4. Reproductive qualities of Holstein breed cows SRL "Doksancom"
with a milk productivity level of 6000-10000 kg)

Milk yield, kg	Cows, heads	Period from calving to first insemination, days	Service period, Days	Insemination Index	Period from first to fertile insemination, days	Conseived from first insemination, %
≤6000	58	88.0 ± 5.0	126.3 ± 8.8	1.9 ± 0.16	34.5 ± 7.1	47.8
6001-7000	60	92.6 ± 6.8	132.6 ± 9.9	2.0 ± 0.16	37.6 ± 8.1	43.3
7001-8000	102	82.4 ± 3.0	136.8 ± 5.6	2.2 ± 0.09	52.4 ± 4.9	42.2
8001-9000	148	88.4 ± 4,3	137.4 ± 5.9	2.2 ± 0.10	50.3 ± 4.9	35.8
9001-10000	48	86.5 ± 3,8	153.8 ± 7.9	2.6 ± 0.10	63.8± 7.4	32.4
≥10001	36	88.2 ± 4.8	178.7 ± 11.5	3.0 ± 0.25	71.4 ± 1.4	27.6
Means	452	86.8 ± 1.8	148.4 ± 5.8	2.3 ± 0.06	52.6 ± 2.7	38.1

The obtained data show that, the most pronounced decrease in the conceived insemination of cow is observed with an increase in the level of milk productivity of more than 8000 kg. Other indicators of reproductive function also deteriorate: the insemination index increases (sperm consumption per fertilizing insemination increases by 30% or more), the service period is extended by 11.1-52.4 days.

Thus, with an increase in the level of milk productivity, a decrease in the fertilization rate

of cows, an extension of the service period, and an increase in the insemination index are observed. A change in the level of milk productivity of cows towards an increase or decrease by 1000 kg leads, respectively, to a decrease or increase of indicators of the reproductive function.

The service period is one of the indicators that characterize the efficiency of the reproductive state and an essential component of other indicators as the duration of lactation and also the calving interval. The reproductive function of cows often fails with high productivity and low energy consumption with feed after calving (Dushkin, 2008).

For the deeper disclosure of the particularities of the relationship between the lenght of the service period and intensity of of use of productive potential in cows, we experimented with a herd of 287 Holstein cows, operated under identical technological conditions within SRL "Doksancom" and divided into six classes according to the level milk productivity (Table 5). The analysis of the results obtained regarding the relationship between the legth of service period and the average daily milk production per lactation demonstrates that, in all subclasses, simultaneously with the increase of the first variable, the second one is decreasing. In cows with a milk yield in the range of 7000-8000 kg, simultaneously with the increase in the legth of service period from less than 100 days to 121-160 days, the average daily milk yield decreased by 8.2%. In cows with milk productivity in the range of 8001-9000 kg, in the same service period range, the average daily milk yield decreased by 7.3%. With the further increase of the service period to more than 200 days, the average daily milking decreases by 17.4% compared to the service period lenght of up to 100 days. In the next class (9001-10000 kg), at service period duration of at least 200 days the average daily milking decreased by 12.5% compared to the situation where service period is up to 100 days.

Table 5. The intensity of use of cows according to the duration of the service period (Holstein breed cows, SRL “Doksancom”)

Milk productivity classes (kg)	U.M.	Lenght of service period, days					
		≤ 100	101-120	121-160	161-180	181-200	≥ 201
7000-8000	kg/day	24.3 ± 0.64	23.4 ± 0.39	22.3 ± 0.96	-	-	-
	%	100	96.3	91.8	-	-	-
8001-9000	kg/day	27.7 ± 0.86	26.5 ± 1.02	25.6 ± 1.13	24.5 ± 0.92	23.6 ± 1.05	22.9 ± 1.27
	%	100	95.7	92.7	88.4,0	85,2	82.6
9001-10000	kg/day	31.2 ± 0.85	30.4 ± 0.67	29,6 ± 1,09	29.4 ± 0.56	28.3 ± 0.79	27.3 ± 1.17
	%	100	97.4	94.9	94.2	90,7	87.5
10001-11000	kg/day	34.4 ± 0.41	32.8 ± 0.55	31.6 ± 0.44	30.0 ± 0.74	29.1 ± 0.85	27.8 ± 1.35
	%	100	95.3	91.7	92.6	87.2	80.8
11001-12000	kg/day	-	37.3 ± 1.08	36.2 ± 0.88	33.8 ± 0.42	33.0 ± 0.97	31.4 ± 1.14
	%	-	100	97.1	90.6	88.5	84.2
≥ 12001	kg/day	-	-	41.2 ± 0.84	39.6 ± 0.61	39.4 ± 0.68	34.9 ± 2.64
	%	-	-	100	96.1	95.6	84.7

In cows with the level of milk productivity 10001-11000 kg milk, the daily milk yield at the maximum duration of service pereiod decreased by 19.2%. In the following productivity classes (11001-12000 kg), a decrease in the average daily milking by 15.8% and by 15.3% in the last productivity class (≥ 12001) is attested, compared to the indices established in these variants when the service period lenght was in the range of 101-120 and 121-160 days.

This analysis convincingly demonstrates that under similar housing, feeding and operating conditions of cows lenght of sarvices period affects milk production differently in cows. If the average daily milk production of cows per lactation under the conditions of a service eriod of up to 100 days is considered 100%, when increasing it to at least 201 days the average daily milk production decreased by up to 19.2%. However, milk losses caused by the increase in the service period due to late fertile insemination in cows will cause significant damage to the farm, because the maintenance and nutrition costs of cows with a low reproductive level are the same as for cows with optimal reproductive indices.

Similar results were reported by researchers (Fariniuk and Abylkasymov, 2016).

Increasing the duration of the service period and the interval between calvings negatively

influences the reproductive capacity of cows (Figure 1).

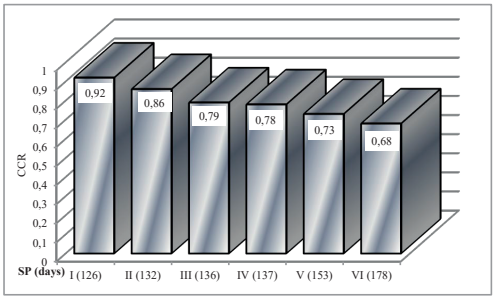

Figure 1. The relationship between the length of service-period and the coefficient of utilization of the reproductive capacity of the female herd (Holstein breed cows, SRL "Doksancom")

Analyzing the obtained data, it is obvious that the coefficient of utilization of the reproductive capacity of cows is in decline as the length of the service period increases, the established differences are statistically inauthentic. The best result was obtained in animals from the first variant, in which the lenght of the service period is statistic authentically higher compared to the variant with the longest service period.

In addition, the increase in the lenght of the service period and the interval between calving negatively influences the reproductive capacity of the cows which is on the dicrease as the milk productivity increases, a fact that even in the current year will decrease the birth rate per herd (Granaci et al., 2023).

Both a small number of inseminations per conception and a short interval from first service to conception are important items and are to be desired by a dairy farms, but are not the only items to be considered in recommending optimunl iuterval from calving to first insemination.

It should be remembered that at present under practical conditions artificial reeding organizations would be interested in a low number of inseminations per conception, as this would be less expensive to the organizations where second and third services are given free of charge, when the first or the first and second inseminations fail to get the cow non-conceived.

Thus, it is likely that artificial breeding organizations would recommend a relatively long service interval. On the other hand, a shorter service interval might result in more first inseminations per cow, since the calving intervals would be shorter, thus producing more income for artificial breeding organizations. Artificial breeding associations would probably be more interested in total number of services as related to insemination interval rather than services per coneption because, at the time of first insemination, no one really knows which cows will conceive and which will not. As shown Moroz et al. (2009), 0.56 less inseminations can be expected for each 100 days of increase in the length of the service period.

The interval from calving to conception defined as service period, should definitely be considered, as it and the length of the gestation period determine the length of the calving interval. Most of the variation in calving interval is brought about by variation in the sevice period, because the variation in the length of the gestation period is relatively small.

The researches (Ulimbashev & Khuranov, 2017; Gorelik et al., 2023) have presented data which indicate that high-producing cows require a considerably increased number of services per conception. These data could be biased, in that there would be a tendency to be more patient with high-producing cows and allow them more chance to conceive than would be the case with low-producing cows. It is also possible that differences in sperm fertilizing ability are confounded with production levels. In addition, it is probable that thos cows requiring more inseminations have a longer period from calving to conception and, thus, less effect of pregnancy on lactations.

Starting from the known fact that the permissible limits for the duration of the service period, it is recommended to be according to the level of milk production in cows

CONCLUSIONS

The relationship between the insemination interval and the interval from the first insemination to conception, as well as between the number of inseminations required for conception and the interval from the first insemination to conception has not been established.

Change of level of milk productivity cows in the direction of increase or decrease by 1000 kg leads accordingly to decrease or increase the indicators of reproductive function.

The reproductive performance indicators of cows in herds with milk productivity from 4000 to ≥ 8000 and from 6000 to ≥10000 kg and more revealed two peaks in productivity levels - from 5000 kg milk and from 8000 kg milk.

Increasing the service period contributes to increasing the milk yield per normal lactation, but this is not rational because it decreases the average amount of milk per head/day by about 8.1-19.2%, depending on the level of productivity, what negatively influences the intensity of realization of the genetic potential of cows.

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