

Connection of Reproductive Indices of High-Productive Cows with Duration of their Dead-Wood Period

M.H. BAIMISHEV¹, S.P. EREMIN², K.V. PLEMIASHOV³,
V.V. ZAITSEV^{1*}, H.B. BAIMISHEV¹ and H.A. SAFIULLIN¹

¹Samara State Agricultural Academy, Samara, Russia.

²Nizhny Novgorod State Agricultural Academy Nizhny Novgorod, Russia.

³Branch of Federal state budgetary scientific institution "Federal Research Center Livestock - AUIAB Academician L. K. Ernsta", S.-Petersburg, Russia.

*Correspondent author E-mail: zaitsevkinel@mail.ru

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ABSTRACT

It is possible to raise productivity of cattle only on the basis of continuation of studying the capacities of reproductive system in high-productive cows in interconnection with indices of their physiology. There were formed three groups of cows-analogues (according to age, term of in-calf state, ancestry). After cows' calving on behalf of insemination terms' correction after accouchement, duration of lactation and with the help of non-graded start, there were formed three groups of cows after the first lactation with the level of milk productivity 7000-8000 kg but they had different dead-wood period's indices before the second calving. In the 1st group this index was 60 days, in the 2nd group – 80 days and in the 3rd one – 90 days. There were 30 animals in each group. It was noted that optimization of milk productivity's level in cows was possible on behalf of duration increase of dead-wood period. It could serve as prophylaxis of postnatal complications in animals and decrease involution terms of genitals. It's noted that recovery of cows' reproductive capacities after calving also depends on the duration of dead-wood period. At cows' yield of milk - 7000-8000 kg 80 days should be considered the optimal duration of dead-wood period. Given term promotes increase of reproductive capacities and getting viable litter from high-productive cows of Holstein breed. Only in this case high level of milk productivity is successfully combined with high level of adaptive capacities in animals and full realization of their genetic potential during the whole ontogenesis.


Keywords: High-productive cows, Dead-wood period, Reproductive indices, Reproductive capacity, the level of yields of milk.

INTRODUCTION

Industrial dairy cattle-breeding in Russia is the most dynamic and science-consuming branch which contributes greatly the provision of food safety of the country as the main producer of fine milk. Its

share in daily ration of the Russian people reaches 35% on behalf of consumption of different products which are made with its use¹. The main factor restraining the development of dairy cattle-breeding is low indices of band reproduction^{2,3}.



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It is important to study capacities of high-productive cows' reproductive system in the interaction with indices of their physiology during ontogenesis^{4,5,6} for the rise of cattle productivity. As secretion of milk is impossible without calving in cows, then – normal state of reproductive function is the basis of effective lactation⁷.

Solving of the problem of intensification of animals' reproduction mostly depends on the right organization of their keeping, feeding, veterinary control, diagnostics, treatment and prophylaxis on different stages of the reproductive cycle⁸. This work is many-sided and must bear systematic character. Reproductive capacities mostly depend on conditions of the course of in-calf state, accouchement, postnatal period^{9,10}.

It is necessary to insert some correction into the technology of cattle rehabilitation^{11,12} for rational solving of the problem of reproduction, rise of cows' milk productivity and receiving viable remount cubs. It will provide the increase of the yield of remount heifers with high genetic potential in productivity^{13,14}.

There is some lowering of reproductive function and decrease of calves' yield in the farms of the country on the whole. It economically harms the branch very much. Reproductive capacities of import cattle (Holstein breed) sharply decrease after the first calving what is mostly connected with the technology of intensive dairy production without reference to cows' physiological state¹. That's why, the search of biotechnological ways of cattle reproduction for working with high-productive animals is really necessary^{15,16}.

The aim of the research is to find the ways for the increase of cows' reproductive capacities and their productive macrobiosis in conditions of the intensive technology of milk production.

MATERIALS AND METHODS

The study was conducted in strict accordance with the ethical principles established by the European Convention for the Protection of Vertebrate Animals used for experimental and other scientific purposes (adopted in Strasbourg on March,

18th, 1986, and confirmed in Strasbourg on June, 15th, 2006).

The study used high-productive animals of Holstein breed at dairy complex "Kupinskoe" (Bezenchuk area, Samara region).

There were formed three groups of cows-analogues (according to age, term of in-calf state, ancestry). After cows' calving on behalf of insemination terms' correction after accouchement, duration of lactation and with the help of non-graded start there were formed three groups of cows after the first lactation with the level of milk productivity 7000-8000 kg but they had different dead-wood period's indices before the second calving. In the 1st group this index was 60 days, in the 2nd group – 80 days and in the 3rd one – 90 days. There were 30 animals in each group.

Biochemical indices of blood were studied according to standard methods for the control of metabolism state. Blood was taken from caudal vein 1.5-2 hours before feeding in 5 cows from every group 15 days before calving. All the applied methods were traditional. The content of common protein in blood serum was determined with the help of refractometer RPL-3 (Russia); separation and quantitative partition of protein fraction's ratio in blood serum were conducted nephelometrically; the content of carotin was determined according to carr-price; the concentration of common calcium in blood serum was determined complex-metrically; the level of non-organic phosphorus, alkaline reserve and glucose concentration in blood were estimated by orthotoluidinic method.

Reproductive capacities of the examined groups of cows were studied according to the following indices: duration of accouchement course, postnatal period and recovery of cows' reproductive capacity after calving (by method of timekeeping, rectal investigations and with the help of USI-apparatus KAIXIN-5200 VET).

Digital material of experimental data was processed by the method of variational statistics on difference reliability of comparable indices with the usage of Student's t-criterion taken in biology and

zootechnics, with application of program complex Microsoft Excel 7. Reliability degree of the processed data are shown by corresponding symbols – $p < 0.05^*$; $p < 0.01^{**}$; $p < 0.001^{***}$.

RESULTS

While conducting our research we established that duration of accouchement was in interaction with duration of service-period and dead-wood period. So, it was respectively less on 1.97 and 2.22 hours in the 2nd and 3rd groups than in the 1st group. It is, evidently, the result of better morpho-functional state of cows' genitals from the 2nd and 3rd

groups of animals (Table 1). The duration of expulsion of afterbirth in the groups was different: in the 1st group – 5.20 ± 1.07 ; in the 2nd group – 2.78 ± 0.45 ; in the 3rd group – 2.05 ± 0.78 hours. Calculating the duration of expulsion of afterbirth in animals from the control group we didn't include cases of delay of afterbirth. The 1st group of animals was registered to have one case of dead birth and one calf died in 1.5 hours after birth. In the first days the most profuse discharge were observed in cows with first calving from the 2nd and 3rd groups in comparison with the control group. It, evidently, points at the increased contractile uterus' capacity in animals from the 2nd and 3rd groups what was promoted by their better

Table 1: The course of calvings and after-calving period of the observed cows' groups

Index	Groups of animals		
	The 1 st group	The 2 nd group	The 3 rd group
Quantity of animals	10	10	10
Duration of accouchement, hours	8.42 ± 1.18	6.45 ± 0.92	6.20 ± 1.04
Duration of the expulsion of afterbirth, hours	5.20 ± 1.07	$2.78 \pm 0.45^*$	$2.05 \pm 0.78^*$
Delay of afterbirth, %	20	-	-
Postnatal complications, %	40	10	-
The ending of uterus' involution, d:			
discharge of lochia	15.2 ± 2.79	12.5 ± 1.80	12.0 ± 1.04
results of rectal investigations	28.0 ± 0.42	$21.6 \pm 1.62^{**}$	$20.8 \pm 1.13^{**}$
Live weight of calves at birth, kg	34.6 ± 2.58	36.3 ± 1.84	36.8 ± 2.12
Received calves	8	10	10

Table 2: Biochemical blood indices of the observed groups of cows

Index	control	Groups of animals	
		1-experimental	2-experimental
		15 days before calving	
Common protein, g/l	71.15 ± 1.91	73.14 ± 2.57	72.12 ± 1.11
Albumins, %	39.45 ± 0.85	43.0 ± 0.74	$43.45 \pm 0.62^*$
Globulins, %	56.30 ± 0.72	55.88 ± 0.83	56.54 ± 0.67
including:			
á-globulins	15.55 ± 0.34	13.91 ± 0.48	13.82 ± 0.52
â-globulins	15.45 ± 0.34	$12.61 \pm 0.98^*$	$13.73 \pm 0.43^*$
ã-globulins	21.22 ± 0.96	$29.36 \pm 1.58^*$	$29.00 \pm 1.13^*$
Common calcium, mmol/l	2.34 ± 0.04	2.32 ± 0.03	2.280.05
Inorganic phosphorus, mmol/g	0.65 ± 0.08	1.43 ± 0.13	1.45 ± 0.11
Alkaline reserve, V%, Ñ_2	44.13 ± 1.96	47.45 ± 2.03	47.91 ± 1.89
Carotin, mg%	0.330 ± 0.04	$0.490 \pm 0.04^{**}$	$0.520 \pm 0.03^{**}$
Glucose, mg%	64.5 ± 0.72	71.3 ± 0.42	79.7 ± 0.26

Table 3: Reproductive capacities of the examined groups of cows

Index	Groups of animals		
	control n = 28	1-experimental n =30	2-experimental n =30
Manifestation of the 1 st sexual cycle after calving, days	40.6±4.26	26.5±2.18*	23.0±2.24**
Impregnation capacity according to ruts, including %:	39.3	66.6	70.0
In the first In the second In the third In	17.8	23.4	20.0
all the consequent	4.2	6.6	6.6
	7.1	-	-
Conceived altogether, %	85.6	96.6	96.6
Interval between sexual cycles, days	29.7±3.76	22.1±2.14	21.8±3.08
Service-period, days	146.6±14.2	114.4±3.50*	113.9±2.18*

preparedness to calving. On the 4-5th day after accouchement lochia acquired dark-cherry color, on the 10-12th day after accouchement lochia of animals from the 2nd and 3rd groups became mucous and lighten. We observed the same changes in 80% of animals from the 1st group on 3-4 days later (Table 1).

The duration of lochia discharge in different groups was as follows: in the 1st group – 15.2±2.79 days; in the 2nd group – 12.5±1.80 days; in the 3rd group – 12.0±1.04 days. We determined the ending of the uterus' involution in the observed groups of animals with the help of rectal investigation of ovaries and uterus (the state of the uterus' neck, consistency of uterine horns, their sizes, absence of discharge at uterus' massage, absence of yellow body in ovaries). At the same time, it turned out that duration of uterus' involution mostly depends on the duration of the dead-wood period. It also correlates with the duration of the accouchement which mostly depends on the preparedness of animals to calving.

Duration of the ending of uterus involution in different groups was as follows: in the 1st group – 28.0±4.2; in the 2nd group – 21.6±1.62; in the 3rd group – 20.8±1.13 days. We also note that the increase of duration of dead-wood period reduces the duration of accouchement course and postnatal period. It, evidently, influences positively the intrauterine development of newborn calves. Live weight of calves at birth differed in different groups. So, body mass of calves in the 1st group was equal

to 34.6±5.8 kg, what is less on 3.7 and 4.2 kg, respectively, than in the 2nd and 3rd groups.

Considering postnatal complications as one of the main causes of metabolic processes' disturbance in cows' bodies, we should note that studying parameters of hemodynamic changes in the observed animals is rather interesting. In order to determine the connection between postnatal complications and metabolic processes in bodies of cows with different duration of dead-wood period, we studied biochemical blood analysis of the observed groups of animals 15 days before calving (Table 2).

The content of common protein before calving: in cows from the control group this index was lower on 1.99 g/l and on 0.97 g/l, respectively, than in animals from the 1st and 2nd experimental groups.

Cows from the control group were noted to have lowering of albumins' content at the increased level of $\hat{\alpha}$ -globulins.

The content of albumins in cows with durable lactation and service-period was less on 3.55% and 4.0%, respectively, than in the 1st and 2nd experimental groups of cows. The difference was statistically reliable ($p < 0.05$). The quantity of $\hat{\alpha}$ -globulins before calving was more in cows from the control group than in cows from the 1st and 2nd experimental groups on 2.84% and 1.72%, respectively ($p < 0.05$). The content of $\hat{\alpha}$ -globulins' quantity before calving was less in cows from the

control group in comparison with the cows from the 1st and 2nd experimental groups on 8.14% and 7.78% ($p < 0.01$).

The cows with prolonged service-period and durable lactation before calving were noted to have acidotic state what was certified by low alkaline reserve. The difference in comparison with the 1st and 2nd experimental groups of animals was equal to 3.32 V%, CO₂ and 3.78 V%, CO₂ ($p < 0.05$).

The same regularity was established for the content of carotin in blood. The concentration of carotin in blood of cows from the control group was less in comparison with the animals from the 1st and 2nd experimental groups on 0.16 mg% and 0.19 mg% ($p < 0.01$), respectively, 15 days before calving.

The cows with durable lactation and service-period at 60.9 days' dead-wood period were noted to have a downward trend of inorganic phosphorus' level in blood, on average on 0.78; 0.80 mmol/l ($p < 0.05$) in comparison with the animals from the 1st and 2nd experimental groups which had less durable lactation and service-period but, at the same time, the duration of dead-wood period in them was on 19.6; 29.3 days longer, respectively, than in cows from the control group (Table 3).

Effectiveness of insemination differed in different groups of animals. So, impregnation of cows in the first insemination was equal to 39.3% in the control group, in the 1st experimental group – 66.6%, in the 2nd experimental group – 70.0%. In the control group 78.4% of animals conceived after the 4th insemination (6th-7th sexual cycle after accouchement), 7.2% of cows – after 5th-6th insemination. The animals from the 1st and 2nd experimental groups (96.6%) conceived after 3 inseminations. The interval between sexual cycles was equal in the control group to 29.7±3.76 days what pointed at cacorhythmic state of sexual cycles in comparison with the animals from the 1st and 2nd experimental groups where just single cases of cacorhythmic state of sexual cycles were noted.

The interval between sexual cycles composed in the 1st experimental group 22.1±2.14 days, in the 2nd experimental group – 21.8±3.08 days, what is less than in animals from the

control group on 7.6; 7.9 days. The duration of service-period composed in the control group of animals 146.6±14.2 days, what was on 22.2; 22.7 days longer, respectively, than in the 1st and 2nd experimental groups.

DISCUSSION

Reproductive capacity of cows in conditions of intensive technology of milk production depends on dead-wood period's duration. The duration of dead-wood period in 80 days provides curtailment of duration of accouchement course on 1.97 hours in comparison with the control group of cows what, evidently, is the result of better morpho-functional genitals' state in the given group of cows before accouchement.

The authors agree with the opinion³ that the level of feeding is not always the cause of low indices of cows' reproductive function. High dairy productivity and prolonged duration of lactation influence much more. The duration of accouchement and the course of postnatal period are interconnected with the duration of dead-wood period. The dead-wood period in 60 days doesn't, evidently, provide preparedness of animals to calving what influences negatively the recovery of cows' reproductive capacities.

At the level of cows' dairy productivity in 7000-8000 kg and more the recovery of reproductive capacity depends on the duration of dead-wood period. The increase of dead-wood period on 20 days raises recovery indices of cows' reproductive capacity, the term of animals' fruitful insemination shortens on 23 days, impregnation capacity in the first rut increases on 27.3% what co-ordinates with the opinion⁹ that the increase of cows' impregnation capacity in the first rut points at their preparedness in the course of dead-wood period.

Lowered content of alkaline reserve, low level of albumins with increased content of α -globulins at 60 days of dead-wood period in high-productive cows testify to lowered resistance of a body and are predisposing pathology factors of accouchement and postnatal period. Lowering of cows' reproductive capacity after accouchement at disturbance of metabolism was pointed at long ago^{17,18}.

Received results of investigations and analysis of literature^{19,20} indicate that in conditions of intensive technology of milk production in high-productive cows the duration of dead-wood period must depend on the level of dairy productivity.

CONCLUSION

Optimization of cows' reproductive capacity and the level of their dairy productivity on behalf of the dead-wood period's duration provides the increase of animals' reproductive capacities, prophylaxis of postnatal complications and decrease of genitals' involution terms in comparison with the control values. The course of accouchement in these groups

of animals was quicker and without complications. Recovery of cows' reproductive capacities after calving in animals from experimental groups also depends on the duration of dead-wood period. We found out that at yield of milk 7000-8000 kg the optimal index of dead-wood period is 80 days what promotes the increase of reproductive capacities and also getting of viable litter from high-productive import cows of Holstein breed. Optimization of dairy productivity level and dead-wood period's duration provide the increase of adaptive properties in animals and high vitality of calves at birth will provide fuller realization of their genetic potential in periods of raising and exploitation.

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