

# A New Way to Increase the Fertility of Cows

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## Abstract

Modern cattle breeding in the advanced farms of Russia is characterized by high yield. However, in the physiology of such animals, the lactational dominant is superior, and sometimes suppresses the manifestation of the reproductive functions of cows. This leads to an extension of the service period or to their sterility [1, 4]. According to statistics, at present in some farms of the Krasnodar Territory less than 70 calves per 100 cows are obtained, which adversely affect the increase in the number of livestock, the intensity of breeding and the economic indicators of production. We have developed a new way to increase the fertility of cows when using the "Draminsky" device, which measures the electrical conductivity of the stream during mucus during estrus and allows timely insemination of animals at certain parameters of the device. In the article results of using the proposed method for increasing the fertility of cows in production are given.

**Keywords:** Cow, "Draminsky device", estrus, insemination, "AfiTag", "AfiFarm".

## INTRODUCTION

The high level of production of dairy products adversely affects the reproduction rates. At a milk yield for lactation of more than 8000 kg calves yield was 70%. However, in some farms such indicators are higher, with a milk yield of 12,000 kg; the calves yield was 80%.

It is known that in highly productive animals lactational dominance suppresses the reproductive function [1, 4].

The purpose of our studies was to determine the optimal time for cows' insemination in the estrus according to the indicators of the electrical conductivity of mucus in the genital tract with the help of the "Draminsky" device [2, 3]. To achieve this goal, the following tasks were solved: the organization analysis of sampling cows in estrus with the help of the "AfiTag" sensor and the computer program "AfiFarm"; study of the characteristics, the principle of operation and the results of the use of the "Draminsky" device; assessment of the results of insemination and fertilization of cows; the determination of the duration of the physiological stages of the inter-calving cycle of cows; calculation of indicators of milk productivity of cows and an estimation of economic efficiency of use of a way of increase of fertilization of them.

## MATERIALS AND METHODS

To solve the set tasks, we have formed 3 groups of cows: in 1<sup>st</sup> group included 148 first-calving cows, the 2<sup>nd</sup> - 105 cows in the second lactation and the group 3 - 97 cows in the third and older lactations. Starting from June 28 until August 20, 2016, the experimental cows were sampled in the estrus period using the AfiTag pedometer and the AfiFarm computer program. The detection of estrus is based on the relationship between estrus and increasing the movement activity of cows. AfiTag includes a device that counts the number of steps passed by the cow (Figure 1). These data are automatically transferred to the computer. The AfiMilk system analyzes the information received and identifies cows in estrus [5].

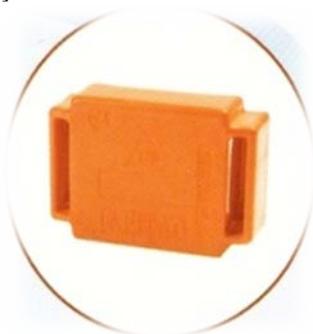


Figure 1 - Identifier and pedometer "AfiTag"

"AfiTag" is an active device (with internal battery), attached to the foot of the cow. It is intended for long-term use (for several years). "AfiTag" can be transferred from one cow to another, which makes it profitable [5].

The numbers of the cows that came to the estrus were automatically recorded in the module of the program "Reproduction of the herd, and then after the morning milking it was transmitted to the reader of the "selection gate" located at the end of the split from the milking parlor.

Upon leaving the milking parlor of the cow selected in the estrus period, after reading its number, the selection gates for entering the building were closed, and additional gates opened and the cow went into a special box for insemination. In each of the morning cows, the cows were subjected to a rectal examination on the detection of the condition of the ovaries, the size of the oocyte and the degree of maturation of the oocyte. After a rectal examination, the probe of the "Draminsky" device was inserted into the vagina [2, 4].

The device "Draminsky" - detector consists of a probe, a measuring-reading unit and a pen with a switch. The measuring-reading unit is equipped with a reading screen with an indicator on the liquid crystals from which information is read. At the end of the measuring probe are located parallel electrodes in the form of rings and employees to measure the resistance of the liquid. The device is completely waterproof, so easy to maintain. The device "Draminsky" is introduced in the vagina, so that the tip of the sensor hit the lower slope. This occurs if you insert the probe approximately up to half of the measuring sensor into the vulva until it stops, then with caution make 2-3 half-turns. After the introduction, the instrument was turned on, and the readings of the displayed constant figures on the screen showing the electrical conductivity of the point mucus were taken. Then, the device was removed, disinfected, and was used again on the next cow. Three months after insemination (in September, October and November), a rectal examination was conducted for all cows inseminated during the summer period.

## RESULTS AND DISCUSSION

It is known that the efficiency of sampling cows in estrus period with visual observation is 45%; the sensors of the pedometer are between 78 and 96%. We daily monitored the change in the cow's behavior against the graphs provided in the cow's activity accounting module (Figure 2).

The figure shows that the activity of cow # 1631 on day 30 in this time period is increased. This may indicate that she came to sexual estrus, so she must be immediately allocated for examination by a technician - inseminator.

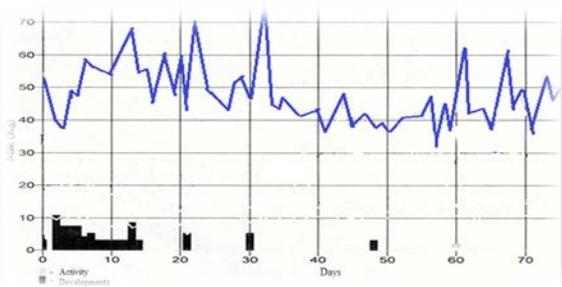


Figure 2- Cow behavior change graph

Observations showed that in the summer, regardless of the temperature of the environment, cows were in estrus and were inseminated every day. The results of estrus detection and insemination are presented in table 1.

Table 1 - Results of estrus detection and insemination of cows in the summer months

Month/ of the year	Duration of detection of cows in estrus, days	Inseminated cows, heads.		Cows were fertilized	
		per month	on average per day	heads	%
June	3	17	5.7	6	35.3
July	31	196	6.3	48	24.5
August	16	137	8.6	44	32.1
Total	50	350	7.0	98	28.0

Daily selection of cows in estrus in the summer months in hot weather allowed to identify and to inseminate 350 cows. An average of 5.7 to 8.6 cows was detected per day. The greatest number of them showed sexual heat in August, when the air temperature was 28 - 32 C during the day and 20 -23 C at night. On average, fertilization in the summer months of the year (June-August) is very low 28%. In August, the fertilization rate was 32.1% of animals. The first reason for the low fertilization rate was the high temperature of their environment. The second reason for the low fertilization of the cows was their single insemination after estrus detection. It is known that the optimum period of fertilization is the period within 5 to 6 hours after ovulation. The time of its release from the oocyte can occur at any time of the day, and then, when insemination does not occur. The farm adopts the technology of reproduction, widely used in Western countries - a single insemination of cows after their detection in estrus. However, abroad, this technology is used for compulsory hormonal stimulation of cows under a special program that causes the maturation of the egg. In the conditions of the traditional method adopted in Russia, it is necessary to inseminate the cows immediately after estrus and secondary after 10-12 hours.

After the rectal examination of the experimental cows, the fertility indexes were calculated depending on the age (Table 2). Of the 148 cows, the first-calving cows inseminated in the state of sexual heat were fertilized with only 46 animals (31.08%), among the cows in second lactation; out of 105 cows, 27 animals were fertilized (25.7%). Of the 97 adult cows in estrus, 25 (25.77%) were fertilized, on average, during the period of observation, the fertilization rate in the herd was 28.0%. The data obtained show that single insemination of the identified cows in estrus in the summer period, according to the technology adopted in the farm, negatively affects fertilization.

The average number of cows on the second, third and older calves was 1.89 and 3.88 spermadosis per 1 fertilized cow, 3.57 on average for all animals. The indices of insemination rates indicate a low efficiency of sperm production expenditure, for the production of calves from cow herds in the summer period of the year. We studied the parameters of the "Draminsky" tester,

consisting of a measuring probe, a measuring-reading unit and a handle with a switch. Inside the handle is usual battery with a voltage of 9V, the measuring-reading unit is equipped with a reader screen with an indicator on liquid crystal (type LCD), from which the measurement results are read (Figure 3).

Table 2 – Cows’ fertility of various ages

Index	Age of cows in lactation			Total
	the first	the second	Third and older	
Revealed in the estrus, heads	148	105	97	350
%	42.3	30.0	27.7	100
Heads fertilized	46	27	25	98
% of total livestock	13.1	7.7	7.2	28.0
Not impregnated, heads	102	78	72	252
%	29.2	22.3	20.5	72.0
Dose consumption: total	148	105	97	350
for 1 head	1	1	1	1
Insemination index (sperm dose expenditure per 1 fertilized cow)	3.22	3.89	3.88	3.57
Fertilized cows of different ages, %	31.08	25.71	25.77	28.0



Figure 3 - Measuring-reading unit with an indicator on liquid crystals

At the end of the probe there are two metal rings parallel to each other - electrodes, which serve to measure resistance. The magnitude of the current flowing between the electrodes and the electric field created by this current are safe for cows and humans. Our experience has established that, on the device "Draminsky", at display of sexual heat at cow indicators of electrical conductivity mucus made from 190 up to 240 units.

In the process of swelling of the follicle, the instrument readings increased sharply to 300-360 units, when the ovulation of the egg was completed, the indices dropped sharply to 120-140 units. With such indicators, the cow was inseminated immediately. As a result of analyzing the indications of the device for single insemination revealed in cows' estrus, it was established that the first-calving cows had a pregnancy when inseminated if the instrument's indicators were around 116 or 320 units; about 156 or 303 units for cows in the second lactation and about 176 or 323 units for cows in the third and older lactation, (Table 3).

Table 3 - Indices of the electrical conductivity of the current mucus of cow’s fruitful insemination

Index	Age of lactation cows		
	the first	the second	the third and older
Number of cows	46	27	25
Limit of indicators of the device "Draminsky" electrical conductivity, units	116 and 320	156 and 303	146 and 323
The average figure of the device "Draminsky", electrical conductivity, units	227.1	227.7	233.2

Analysis of the electrical conductivity of fertilized cows indicates that at the beginning of the swelling of the follicles on the device appear lower values - from 116 to 176 units; then in the process of intensive swelling of follicles, the electrical conductivity rises from 200 to 290 units, and during the ovulation of the egg, the indicator sharply increases to 300-323 units. Our data indicate that with indications of minimal average and high electrical conductivity units, first-calving, second calving and adults cows can be fertilized. The individual biological characteristics of cows may influence the amount of electrical conductivity during the ovulation of eggs after the onset of sexual heat.

The data obtained as a result of our studies allow us to conclude that in order to accurately determine the time of fruitful insemination of the cow, it is necessary to record from the first lactation the indicators of the conductivity of sexual mucus and to fix for each cow when; at what indicators is the swelling or ovulation of the egg, and then the next sample of the cows in these cows take into account the previous indicators and, accordingly, inseminate at the required time of day. Indicators of milk yield and reproduction of cows are significantly influenced by the duration of the stages of the intermittent cycle (Table 4)

Table 4 - Stages of the inter-calving cycle of cows of different ages, days ( $M \pm m$ )

Periods	The duration of the stages of the interstitial cycle, days in cows at the age of lactations		
	the first	Second	third and older
	n = 46 heads	n = 27 heads	n = 25 heads
Service period	151.8 ± 10.9	157.7 ± 13.7	120.9 ± 16.9
Dry period:	62 ± 0.78	67 ± 0.96	61 ± 0.72
Duration of full lactation	376.8 ± 10.9	382.7 ± 13.8	345.9 ± 16.9
Duration of the inter-calving cycle	438.8 ± 11.7	449.7 ± 14.7	406.9 ± 17.6

Based on computer program data, we analyzed the duration of physiological stages in cows of different ages. It turned out that in cows of all ages the inter-calving cycle exceeds the optimal (more than 365 days) indicator. The maximum duration of the incubation cycle was in cows at the age of 2 lactations, 449.7 days, which is 10.2 days higher than in the first-lactation animals; in comparison with adult cows - by 42.8. Lactation was also more prolonged for cows in the second lactation. With an optimal duration of the dry period (61 - 67 days), the service period exceeded the standard indicator in experimental cows by an average of 30.9 - 67.7 days. The economic feasibility of introducing a new method into production was shown by calculation of the costs of cows' insemination. Only 350 sperm-dosages were used, including 148 for first-calving, 105 for second lactation cows and 97 for adult cows.

The total cost of 350 sperm-dosages was 420,000 rubles. On fertilized cows semen was used to the amount of 117,600 rubles. Over expenditure of cash spent on seed 302,400 rubles (table 5).

In addition to the extra costs for semen, losses are incurred by the farm at the expense of lengthening the service period of the inter-calving cycle by an average of 21 days for each unfertilized cow due to a shortage of calves and milk from the stock after the new calving. The money spent on the semen can be partly used to pay labor to the inseminators, two or three inseminations of cows during the day. In addition, an additional 252 calves will be received. The cost of buying the device "Draminsky" will be 35,000 rubles. The average cost of one sperm dose is 1,200 rubles.

Table 5 - Sperm production expenditure for insemination of cows

Indicators	Age of cows, lactation			total	
	the first	the second	third or older		
Cows identified in estrus, heads	148	105	97	350	
Semen consumption, doses	148	105	97	350	
Total cost of semen, rub.	177,600	126,000	77,600	420,000	
Fertilized cows, identified by the device, units	116 - 120	18	7	6	31
	300 - 320	28	20	19	67
	Total	46	27th	25	98
Total cost of semen, fertilized cows, rub. identified by the device	116 - 120	21,600	8,400	7,200	37200
	300 - 320	33,600	24,000	22,800	80,400
	Total	55,200	32,400	30,000	117,600
Losses from expenses for semen, rub.	122,400	93,600	47,600	302,400	

## CONCLUSIONS

Based on the obtained research results, it can be concluded that: in order to increase the fertilization rate of the cows, to increase the number of calves and the efficiency of selection, and to increase the dairy productivity of cows due to the effective expansion after calving, it is advisable to introduce the proposed method for increasing the fertilization of the cows.

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