



# Research on high-yielding dairy cow treatment techniques during milking

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**Abstract.** Dairy cattle breeding are one of the leading livestock sectors, the improvement of conservation technology and increasing the period of use and maintenance of high milk yield of cows when introducing domestic and foreign milking equipment being a key factor of its successful development in Ukraine. At the same time, many important issues concerning automatic milking of cows in dairy parlors remain underexplored. To a lesser extent, the influence of various techniques on the milking process of all cow herd has been studied, methodological approaches to determining the level of their influence during the performance of certain standard mechanized processes, the optimal modes of operation of equipment that can clearly take into account the current physiological needs of each animal in the herd have not been developed. Therefore, the purpose of the present research consisted in the substantiation and improvement of certain techniques of automatic milking of high-yielding cows in complexes of industrial type. It has been established that when using traditional and group methods of preparation of high-yielding cows for milking in parlors in comparison with group technique with the use of disinfectants, the average intensity of milk yield decreases respectively by 8.6% and 5.0%, and the duration of milking process, on the contrary, increases by 12.8% ( $P < 0.05$ ) and 8.1%. Along with this, it has been proved that the use of the group technique with the use of disinfectants provides milk of higher grade (quality) with the quantity index of somatic cells within 49–94 thousands/cm<sup>3</sup>. The studies of milk yield indices of high-yielding cows with the 8, 12 and 15 sec delay of removal of the milking apparatus from the udder after the end of the milking process proved that they all had no probable differences.

**Key Words:** high-yielding cows, udder, preparatory operations, final operations, indices of milk yield.

**Introduction.** The milking process is no less complicated than the process of milk production. Regular and proper milking which is accompanied with rational alimentation supports the animal's lactation at a high level, and, on the contrary, a prolonged violation of the milking process, insufficient milking leads to the destruction of the secretory cells of the mammary gland and self-drying of the cow.

The milk yield process, which provides the excretion of milk from the alveolar compartment of the udder into the cisternal one, is caused reflexly by stimulation of the mammary gland receptors as a result of pre-milking preparation, as well as compliance with the operation parameters of the milking machine, the so-called unconditional milk let-down reflex.

Along with this, a conditioned reflex of milk let-down is considered (Kolchev 2018; Neja et al 2017) to be formed as a result of repeated milking in standard conditions, with constant technology when external conditions acquire the signal value and begin to cause milk secretion before the operator's touch to the udder and the irritation of the mammary receptors. One of these conditioned-reflex factors is the observation of the daily routine and the sequence of milking cows, which, in combination with other conditioned-reflex stimuli, fixed in time (switching the vacuum pump on, distribution of feed, etc.), contributes to the formation of the reflex of milk let-down, its intensive manifestation, reduces the time spent on the milking process, increases the completeness of milking (Bruckmaier 2005; Paliy et al 2015).

Determining the factors that inhibit the productive capacity and worsen the physiological state of high-yielding cows remains a topical issue in terms of degree of their effect on the animals (Paliy 2016c; Vtoryj & Vtoryj 2018).

The correct implementation of the technological process of milking is the top priority for the high quality milk production and complete milking (Lefevre et al 2010; Stephen 1989). It depends on many factors, the main of which are: effective stimulation of milk let-down and the complete excretion of milk from the udder without manual supplementation; the effect on the cow's udder similar to the natural actions of the calf during sucking; the ability to regulate air deflation, compression of the teat, the pulsation frequency and the size of the teat cup rubber depending on the physiological state of the cow; milking machines and devices should not cause pathological irritations of teats and udder; eliminating the possibility of the displacement of milk cups on the udder during milking process and the overlapping of the upper mouth of teat canal; automated switching off of milking cups after the complete milking of cows and absolute safety control for animals at occasional keeping of milk cups on the teats too long; the simplicity of the design of the milking plant, the quietness of its operation; an attractive look of milking equipment, high operational reliability and ease of its maintenance (Gibson et al 2008; Ingawa et al 1992; Paliy 2016a).

Treatment of the udder before milking is an important measure which makes a further successful implementation of the technological process impossible. Due to the improper treatment of the udder before milking the loss of milk yield can raise up to 10–25% (Paliy 2015). For example, a thin film that remains on the udder and teats after the treatment creates an obstacle to passing air into the teat cup over the folds of the skin. Thus, the level of vacuum that compresses the teat increases, which causes the overlapping of the milking canal, the displacement of the teat cup to the udder, injury, the appearance of a red inflammatory ring on its basis, the penetration of bacteria into the udder, loss of milk yield (Foret et al 2005; Grindal & Bramley 1989; McKinnon et al 1990; Rasmussen et al 1992).

Pre-milking stimulation for the reflex response of milk secretion is an important factor in the milking of newly calved cows. In the first 3 days after calving, when the mammary gland has a high sensitivity, 20-second manual preparation of the cow to automated milking with the force 15 N is most optimal. In the next 4–5 days, the force increases to 20 N for 60 seconds and in the next 8–10 days the action on the mammary gland is increased to 25 N for 60 seconds (Besier et al 2016; Kitikov & Romaniuk 2017). In newly calved cows the duration of preparatory operations does not exceed 30–40 sec, in animals of the second half of the lactation it can reach 1 min. Attachment of the teat cups, stimulates the animal, and the milk secretion occurs (Magnusson et al 2006; Tihomirova et al 2017).

The procedure of milk expression before a milking process is of major importance. This stimulates the udder for milk let-down: bacteria and spores are removed from the teat canals with the first spurts of milk. Also, the expression of the first spurts of milk allows the operator to check the degree of milk allowance (Gleeson et al 2009).

Teats and udder should be cleaned and wiped to produce higher quality milk, according to Galton et al (1986), Paliy (2016b) and Vissers et al (2007).

The possibility of contamination with bacteria and spores should be minimized. The teats of the udder should be wiped off with an individual towel to prevent the transmission of pathogenic microbes from cow to the cow which can cause disease such as mastitis. If possible, each teat should be wiped with a separate corner of the towel.

Skin nerve receptors are stimulated through a tactile impact, that is, during the production of the first spurts at the beginning of the milking process, washing of the udder, manual massage, connecting the teat cups, as well as the pulsation of the teat cup rubber during milking. To achieve an optimal stimulation, the duration of a certain combination of previous procedures is required for at least 60 sec. Since all these operations are manual, it is necessary to reduce them in time to achieve high productivity of milking operators for automatic milking processes. The lack of stimulation that occurs in this way can be compensated only by the increased stimulating effect of pulsating teat cup rubber (Paliy 2017).

Final milking operations of high-yielding cows include the processes of complementary milking and removing of the milking machine from the cow's udder.

The milk let-down reflex lasts for a short time and stops regardless of whether the cow is completely milked or not. This feature needs to be taken into account in machine milking, ending milking during the milk let-down reflex, that is, when milk is most intensively fed into milk tanks. The faster a cow is milked, the better and more fully her udder is emptied. In the process of milking, the cistern is first released, then the ducts and, in the last turn, alveoli, and the alveolar milk is the creamiest. Therefore, milking for more than 6–7 minutes negatively affects the productivity in general and the fat content of milk (Meijering et al 2004; O'Brien et al 2012; Rupert 2001).

At the same time, various techniques and means of high-yield cow preparation for machine milking are offered (McKinnon et al 1990; Paliy et al 2018; Ziganshin et al 2016). The effectiveness of these technologies in modern domestic dairy complexes remains insufficiently explored.

Along with this, the issue remains open about the need to justify the substantiation of complementary milking technique application with high-yielding cows with annual milk yield of 6,000–8,000 kg and the establishment of the effect of the delay in removing the milking apparatus from the udder after the end of the milk let-down.

Research and solution of these issues are both of practical and scientific value.

**Material and Method.** The purpose is to investigate particular techniques of machine milking of high-yielding cows on complexes of industrial type. To achieve this goal, the following tasks have been imposed:

- to evaluate traditional (sequential) and group techniques of preparation of cows for machine milking in automated milking parlors, as well as a group technique with application of disinfectant solutions;
- to determine the effect of the time of delay in removing the milking apparatus from the cow's udder after the milking process is completed on the milk yield rates and the animal health status.

To substantiate the effectiveness of preparation technique of high-yield cows for machine milking the research was performed in three groups of cows-analogues of Ukrainian black-and-white dairy breed, 26 head in each group, on the State Enterprise "Experimental farm "Kutuzivka", NAAS. Analogues were selected taking into account the lactation rate (II–III), daily milk yield (22–25 kg of milk) and the state of cow's udder. The research was carried out by the method of periods during three months.

The scheme of the scientific and economic experiment of the study upon the degree of the impact of the traditional (sequential), group techniques, as well as the group technique with the use of disinfecting solutions for the preparation of cows for machine milking onto the milk let-down reflex, the intensity and completeness of milking, the state of the udder parts, the time spent on production operations is presented in Table 1.

Table 1

The scheme of the first scientific and economic experiment upon the impact degree of the cow's preparation technique for machine milking

<i>Group</i>	<i>Preparatory period (7 days)</i>	<i>Test period (30 days)</i>
<i>Preparation of cows for machine milking</i>		
I (control)	According to the "Rules of machine milking of cows" (Fenenko et al 2004)	Traditional (sequential) technique according to the "Rules of machine milking of cows" (Fenenko et al 2004)
II (test)	According to the "Rules of machine milking of cows" (Fenenko et al 2004)	Group technique
III (test)	According to the "Rules of machine milking of cows" (Fenenko et al 2004)	Group technique with the use of disinfecting solutions

According to the scheme of the experiment with the cows in the groups I, II, III in the preparatory period the same conventional preparation for machine milking, on the farm, was used. The first pipe-line milking operator served the cows on the right and left sides of the panel stall by four cows when admitting to the milking parlor from the pre-milking area, the second operator – by four cows when discharging from panel stall. The sequence of treatment operations of cow preparation to machine milking included washing the udder with a spray gun with pure warm water, heated to 40–45°C (duration 10–15 sec), wiping with a clean towel (10–12 sec), massage of the udder (10–15 sec), pumping the first two or three spurts of milk (5–6 sec) onto the control plate, fixing teat cups onto the cows' teats (10–12 sec). All operations were performed sequentially for each cow individually.

In the experimental period, the cows of the 1<sup>st</sup> group were prepared for machine milking according to the technological mode adopted during the preparatory period.

For the cows of the group II (group technique), a mode was used in which the 1<sup>st</sup> pipe-line milking operator served the cows on the right side of the panel stall and the 2<sup>nd</sup> operator on the left side of it. The sequence of the implementation of technological operations for preparing cows for machine milking involved the successive washing of the cows' udders, wiping, and massage, pumping the first spurts of milk on the control plate and fixing teat cups to the teats of the four cows, in similar time for technological operations.

The cows of the group III (group technique with the use of disinfecting solutions) were treated by the operators, who didn't wash the udders with a spray but treated the teats with disinfecting solutions. In addition to this, with four animals the teats were wiped and massaged and the first spurts of milk were pumped on the control plate and the teat cups were fixed. After the device was dispensed, the operators also treated the teats with a disinfectant solution (from the spray or moistened them with a solution prepared on iodine basis).

To determine the degree of impact of the delay in removing the milking apparatus from the udder of high-yielding cows after the end of machine milking on the milk yield indices and their health status, a scientific and economic experiment was carried out by the period method on 3 groups of analogues of Ukrainian black-and-white dairy breed, by 15 heads in each group. The experiments were carried out on three farms during two months (Table 2).

Table 2

The scheme of the second scientific and economic experiment to determine the impact degree of the delay in removing the milking apparatus from the udder of high-yielding cows after the end of machine milking

<i>Groups</i>	<i>Modes of removal of the milking apparatus from the udder</i>
Test I	Delay after the end of milk flow 200 mL/min + 8 sec
Test II	Delay after the end of milk flow 200 mL/min + 12 sec
Test III	Delay after the end of milk flow 200 mL/min + 15 sec

All the cows during the experimental period were milked with the same type of apparatus with a mode of automatic removal from the udder at the end of the milk let-down of 200 mL/min, but with different time of a delay: the cows of the group I – 8 sec, the cows of the group II – 12 sec, the cows of the group III – 15 sec.

## Results and Discussion

***Substantiation and definition of techniques for the preparation of high-yield cows for machine milking.*** The duration of the technological operation of the preparation of the udder for the manifestation of a full-rate milk let-down reflex depends

on the age, on the stage of the cow's lactation, on the level of productivity, on adherence to the stereotype of milking and on the degree of detection of the conditioned-reflex component of milk secretion. The purpose of this is to call a full-rate let-down reflex and to provide the sanitization of the udder.

The preparation of cow's udder for milking consists of several stages with the use and application of various substances for the treatment of udder, napkins, disinfecting foam, and after milking – treatment with preservative substances.

After making a literary and patent search, the following classification of techniques of cow preparation for milking at milking plants is proposed:

- Traditional (sequential) technique. The sequence of operations involves washing, wiping, massage of the udder, pumping the first spurts of milk, fixing the teat cups. All operations are performed for one animal at once;
- Group technique. The sequence of operations: washing, wiping and massage of the udder, pumping the first spurts of milk, fixing the teat cups. The operations are performed alternately on 4 animals;
- Group technique with the use of disinfectant solutions. The sequence of operations: disinfectant treatment, wiping and massage of the udder, pumping the first spurts of milk, fixing the teat cups, treatment of the udder after milking with disinfectants. The operations are performed alternately for 4 animals.

During the research a comparative analysis was carried out of the application of the techniques proposed above of preparation of high-yield cows for milking directly on the State Enterprise "Experimental farm "Kutuzivka", NAAS, Kharkiv district, Kharkiv region, with their milking twice a day on the milking plant of a herringbone type UDE-8 of domestic production.

During the experiment, it was established that in the group I, when using the traditional (sequential) technique of the preparation of high-yield cows for milking, the manifestation of the milk let-down reflex during the first minute of milking in the amount of  $1.84 \pm 0.24$  kg of milk is ensured, with an average one-time milk yield of  $14.2 \pm 1.81$  kg and the duration of complete milking of  $7.8 \pm 0.33$  min per cow (Table 3).

Table 3

The parameters of milk yield and milk quality with application of various techniques of preparation of cows for milking, ( $X \pm S_{\bar{x}}$ )

Parameters	Techniques of preparation of the cows for milking		
	Traditional (sequential) technique	Group technique	Group technique with of disinfecting solutions use
	Group I	Group II	Group III
Duration of the experiment, days	30	30	30
Number of cows, individuals	26	26	26
Number of indications, n	104	104	104
Intensity of milk let-down, kg/min:			
during the 1-st min of milking	$1.84 \pm 0.24$	$2.25 \pm 0.28$	$2.47 \pm 0.36$
during the 2-nd min of milking	$2.12 \pm 0.43$	$2.78 \pm 0.18$	$2.83 \pm 0.28$
during the 3-d min of milking	$2.45 \pm 0.31$	$2.50 \pm 0.43$	$2.62 \pm 0.34$
Milked with machine, kg/%	$14.15 \pm 1.26$	$13.99 \pm 1.76$	$14.31 \pm 1.34$
	99.2	99.3	99.4
Amount of manually produced milk, kg	$0.09 \pm 0.01$	$0.09 \pm 0.01$	$0.1 \pm 0.08$
Average one-time milk, kg	$14.2 \pm 1.81$	$14.1 \pm 1.76$	$14.4 \pm 1.36$
Duration of machine milking, min	$7.8 \pm 0.33^*$	$7.4 \pm 0.46$	$6.8 \pm 0.28$
Average rate of milk let-down, kg/min	$1.75 \pm 0.28$	$1.81 \pm 0.30$	$1.90 \pm 0.25$
Milk quality according to the DSTU 3662-97 <sup>1)</sup> , grade	First	First	First

\* -  $P < 0.05$ , <sup>1)</sup> DSTU (Ukrainian National Standardization System) 3662-97 "Whole cow milk. Requirements for acquisition".

With the use of group technique of cow preparation for machine milking (group II), the implementation of the milk let-down reflex for the first minute of milking was  $2.25 \pm 0.28$  kg, with an average one-time yield of  $14.1 \pm 1.76$  kg of milk. The average duration of milking of one cow was 7.4 min.

When applying a group technique with the use of disinfectant solutions (group III), the milk let-down reflex of during the first minute of milking was at the level of  $2.47 \pm 0.36$  kg, with an average one-time yield of  $14.4 \pm 1.36$  kg. The duration of milking process was 6.8 min, which is 12.8 ( $P < 0.05$ ) and 8.1% less than traditional (sequential) and group techniques (I and II groups, respectively). The average intensity of milk-let down increased accordingly by 8.6 and 5.0%. This is due to the fact that the cows were better and more efficiently prepared for machine milking with the use of advanced techniques reception.

Therefore, it should be noted that the introduction of a group technique with the use of disinfectant solutions provided the least prolonged complete milking process, and this difference in comparison with the use of traditional (sequential) technique turned out to be probable ( $P < 0.05$ ).

Compared to cows of the group I, the intensity of milk let-down in animals of the groups II and III was higher on average by 17.3 and 23.4% respectively. At the same time, the completeness of milking cows of all experimental groups remained at almost the same level of 99.2–99.4%.

The application of traditional and sequential techniques of preparation of the cows for machine milking provided an average of 428–567 thousands/cm<sup>3</sup> of somatic cells in milk, which is lower than the higher grade milk index of 28–167 thousands/cm<sup>3</sup>. Preparing the cows for milking with the disinfectant solutions and treating the teats with disinfectant (prepared on iodine basis) after milking, for the treatment of 4 animals allows receiving higher grade milk with an index of somatic cells in the range of 49–94 thousands/cm<sup>3</sup>.

As a conclusion, in order to provide a constant normative indicator of time expenditures for milking of high-yielding cows at the herringbone type plant it is expedient that the milking operator applies a group preparation technique with the use of disinfectant solutions, which provides for the successive execution of technological operations for 4 cows. This ensures the duration of machine milking at the level of 6.8 min and higher milk quality.

***Technological features of the completion of machine milking on milking machines with various duration of delay in removing milking apparatus.*** Modern milking plants vary by the rate of their equipment with the devices for the automation of technological operations of complementary machine milking, because the amount of milk received from this operation is 300–500 g on average, and the absence of an automated system of complementary machine milking involves significant labor costs. Particular attention is paid to the implementation of the final operations – complementary machine milking and removal of milking apparatus from the cow's teats at the end of milking with a decrease in milk flow (up to 200–800 g/min).

A scientific and economic experiment were carried out on modern milking plants of the "Parallel" type, on which the final operations of complementary machine milking and removal of teat cups are carried out using a pneumatic machine and a manipulator.

It has been established that the delay of removal of the milking apparatus from the udder of high-yielding cows after the end of milk let-down on the milking plant of the "Parallel" type at the first farm was 15 sec, on the milking plants of the "Parallel" type on the second farm was 12 sec, and on the milking plant of the "Parallel" type on the third farm was 8 sec.

Indices of milk yield and the condition of cow's udder with varying duration of delay in removal of milking apparatus from the udders are presented in Table 4.

Table 4

Indices of milk yield with varying duration of delay in removal of milking apparatus from the udder, ( $X \pm S_{\bar{x}}$ )

Parameters	Duration of delay, sec			
	8	12	15	
	<i>I group</i>	<i>II group</i>	<i>III group</i>	
Amount of cows, individuals	15	15	15	
Duration of the experiment, days	65	65	65	
Number of indications, n	45	45	45	
Milk yielded, kg/min	during the 1 <sup>st</sup> min	2.57 ± 0.45	2.68 ± 0.28	2.65 ± 0.36
	during the 2 <sup>nd</sup> min	2.82 ± 0.45	2.77 ± 0.43	2.85 ± 0.37
	during the 3 <sup>rd</sup> min	2.65 ± 0.31	2.70 ± 0.26	2.78 ± 0.38
Milked with a machine, kg/%	13.95 ± 1.22	14.26 ± 1.35	14.35 ± 1.26	
	98.9	99.2	99.2	
Duration of machine milking, min	5.9 ± 0.32	6.2 ± 0.42	6.3 ± 0.28	
Amount of manually produced milk, kg	0.10 ± 0.01	0.07 ± 0.02	0.09 ± 0.03	
Average intensity of milk let-down, kg/min	1.93 ± 0.37	1.92 ± 0.43	1.92 ± 0.24	
Positive reaction to the hidden form of mastitis	not found	not found	not found	

According to the results of the analysis of the indicators of the milk yield of high-yielding cows with a delay in removal of milking apparatus from the udder after the milking process was stopped, the time of which was 8, 12 and 15 sec, it was found that they did not have any probable differences. At the same time, there was a slight increase in the time spent by the operator on milking cows with a delay of 15 sec, but the amount of milk yielded for the first minute of milking tended to decrease in cows at a delay of 8 sec compared to the value of manual supplementary milking of 0.10 kg against 0.07–0.09 kg, with the delay of removing the apparatus for 12 and 15 sec, respectively.

It should be noted that during the experimental period there was no positive reaction to the latent form of mastitis found.

The application of delays of different duration of removing milking apparatus from the cows' udder after the milk let-down process was over did not have a negative effect on animal health.

Consequently, in the course of the research carried out, no advantage was found regarding the application of any duration delay of removal of the milking apparatus from the udder of high-yielding cows after the termination of the milk let-down process, as all the studied parameters were almost at the same level.

During the machine milking of cows it is necessary to take into account the process of milk let-down, which is regulated by the nervous and humoral systems of the animal, and its conditional and unconditioned reflexes.

Researches conducted by Paliy (2016b) and Watters et al (2012) confirms the importance of the preparatory operations during machine milking, which stimulate the intensity of milk let-down reflex and improve the hygienic quality of milk. The observance of all the rules of preparation of cows for milking, according to the authors, allows to increase the rate of milk yield by 0.14–0.36 L/min.

Mein & Thompson (1993) carried out studies to determine the effects of washing, massaging the udder, and extracting the first spurts of milk. As a result, the cows which were prepared for milking yielded by 12% more milk than the cows which were left without preparation.

It is important to start milking cows immediately after washing the udder and to milk them dry as soon as possible, in 5–6 min, to make full use of the milk let-down reflex (at this time, the alveolar apparatus is periodically compressed, and ducts and cisterns are relaxed). The techniques which are sometimes used in the milking parlors when, first, all cows' udders are consistently washed up and, then, teat cups are put on the teats do not contribute to the complete milking of cows. Experience shows that if washing and massage of the udder are carried out 20 min before milking process, the

milk yield of the cows is reduced due to incomplete milk let-down (Galton et al 1986; Savinyh 2018). However, milking should start only when the udder is full of milk. The same reasons should be taken into consideration when planning the number of milking operations per day.

The scientific and economic experiments we carried out proved that it is expedient that the operator uses a group technique of preparation of cows for milking with the use of disinfectant solutions which involves performing technological operations for 4 cows alternately to provide of a constant normative indicator of time spent on the cows held in free-stall barns and milking on automated milking plants of a "Parallel" and "Herringbone" type. This ensures the prolongation of machine milking at the level of 6.8 min/head, a high intensity of milk let-down (2.47 kg of milk during the 1<sup>st</sup> minute of milking, 2.83 kg of milk during the 2<sup>nd</sup> minute and 2.62 kg of milk during the 3<sup>rd</sup> minute). The application of this method ensures the production of a higher grade milk (according to DSTU 3662-97).

Milking the cows dry is an important factor for success in dairy cattle breeding. Since the product of the complementary milking has the highest fat content, it is a crucial factor for the quality of milk in general and high profits (Sycheva 2014; Tsiupko & Tsiupko 2012).

The scientists (Chen et al 2014) consider that it is necessary to use the equipment for complementary milking on every modern dairy complex, as the experiments with the application of a milk flow meter show that, even with the most advanced milking machines without the equipment for complementary milking, over 200 g of milk remains in the udder of a significant number of cows. Other researchers (O'Brien et al 2012) also support this idea.

Thus, it is possible to obtain some increase in milk yield when the mechanical complementary milking mode is used. But, at the same time, many academicians and practitioners express the idea that it is possible to give up complementary milking without losing a significant amount of milk and without compromising animal health if all the previous operations were carried out qualitatively. These authors believe that the total labor inputs for the complementary milking are economically unprofitable and, with the observations of certain requirements such as stimulation, flawless functioning of the milking machine, good and qualitative rubber, trained cows and skilled milking machine operators, can be abandoned (Hvatova 2016; Savinyh 2018). At the same time, the world market of milking equipment offers milking plants in which, after reaching a certain minimum amount of milk flow, milking apparatus is automatically removed from the cow's udder without any complementary milking.

The experience of many foreign dairy farms testifies to the possibility of excluding the operation of machine complementary milking from the list of mandatory final operations (Svennersten-Sjaunja & Pettersson 2008).

Along with this, Burvenich et al (2003) believe that machine complementary milking can cause more problems with regard to animal health than refusing it.

Our scientific and economic study found that the delay in removing the milking apparatus from the udder after the end of milking by 8, 12 and 15 sec did not negatively affect the health of animals, and the rates of milk yield did not have any probable differences.

As a way of resolving the issue associated with the implementation of final operations, automation (robotics) is an alternative both in terms of labor costs and control of the state of dairy cows.

Along with this, taking into account the tendencies of dairy cattle breeding in the world, dairy automation is an important indicator of its technical development. By providing technological and economic benefits that can not be achieved through the traditional organization of production, it is the basis for the perspective development of the modern dairy industry of the country (Nanka et al 2018; Nikiforov et al 2018). The rise of the level of automation in the dairy industry is of paramount importance, which is manifested through the improvement of labor efficiency, the improvement of the dairy product quality, the optimal use of productive resources, etc.; and the creation of "an

intellectual farm”, where, in addition to milking, a number of other, most difficult operations would be automated, is the further path of progress in this direction.

**Conclusions.** The application of group method in preparation of high-yielding cows for milking process with the use of disinfectants in comparison with traditional and group techniques causes the reduction of the automatic milking process duration by 12.8% and 8.1% respectively and increases the average intensity of milk yield by 8.6% and 5.0% which goes along with production of milk of higher grade (according to Ukrainian national standardization system 3662–97).

It has been proved that 8, 12 and 15 sec delay in removal of the milking apparatus from the udder of high-yielding cows after the end of the milking process does significantly affect milk yield indices, health status of the animals and incidence of mastitis.

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