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The cows calving in the selection of bull-breeder in Monbeliard, Norwegian Red and Holstine breed

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The purpose of the research was to evaluate the nature of calving in cows of Ukrainian Black-Spotted and Red-Spotted dairy breeds in the selection of bulls of Montbeliard, Norwegian Red, and Holstein breeds. Methods: the research was conducted in four breeding plants of the Cherkasy region, which are engaged in breeding Holstein, Ukrainian Black, and Red-spotted dairy breeds on livestock of 780 cows. The determination of live weight and linear measurements of newborn calves was performed on their birthday for 1-3 hours after calving. The clinical examination results determined cows' clinical and gynecological condition by a veterinarian by the method of rectal examination. Stillbirths were recorded in a binary way as living (1) or dead (0). Twin calves and calves as a result of abortion were excluded from the data. It was found that calving took place without complications when the live mass of calves did not exceed 6-7% of the mother's mass. The lowest calving current score and the lightest calving were obtained in the conditions of FE Lan" using Norwegian Red breed - 1.6 points. Besides, when using Norwegian Red breed bulls, the lowest percentage of offspring stillbirth was obtained - 1.8%. When crossing cows of the Ukrainian Red-Spotted dairy breed with breeders, the offspring of the Montbeliard breed was got, prevailing peers got from Holstein breeders by body measurements: head width (12.7-12.9 cm) by 1.5-2.2 cm, width in the shoulder-scapular joints (19.1-19.7 cm) by 1.2-1.6 cm, width in the hip joints (20.6-21.5 cm) by 1.7-2.2 cm. Even though the average score on the course of calving was higher in cows, inseminated with the semen of bulls of the Montbeliard breed, in fact in these groups, the frequency of heavy calving with the help of 5 or more people, or with the intervention of a veterinarian was lower by 0.2-1.3%. The use of crossbreeding can be effective in reducing the proportion of heavy calving and stillbirth among the offspring; however, we should carefully approach the choice of the breeder (it is desirable to take into account its evaluation by the ease of the calving, especially when using the Montbeliard breed), its breed belonging and the analysis of the breeding stock on which the crossing will be used.
Keywords: Montbeliard, Norwegian Red, crossbreeding, nature of calving, stillbirth.

Introduction

Based on the trends in the development of livestock in the world's leading countries, further intensification of the selection process aimed at increasing the milk productivity of cows determines the need for a systematic evaluation of animals on the main economically valuable features (Kulyaba et al., 2019; Slivinska et al., 2019; 2020; Mazur et al., 2020; Borshch et al., 2020; Roman et al., 2020; Grymak et al., 2020). Intensive use of Holstein semen according to the scheme of absorption crossing has led to several problems with reproduction, productive longevity, health (Boiko et al., 2017). Today in Ukraine, the output of calves per 100 cows is 52-74% and the average duration of use of cows at the level of 1.5-2 lactation. The qualitative content of milk in the best herds reaches 3.6% of fat and about 3.0% of protein. All this has a negative influence on the industry's economy and, as a consequence, leads to a reduction in livestock in farms of various forms of ownership (Bashchenko et al., 2012).

Market conditions in the national economy of Ukraine require a rapid search and justification of more effective breeding programs in livestock. Today, many countries worldwide have joined the program of analytical crossing (Dezetter et al., 2017). According to Clasen J.B., Fogh A., Kargo M. (Clasen et al., 2018) and Hazel A.R., Heins B.J., Seykora A.J., Hansen L.B. (Hazel et al., 2014), the main effect of crossing are observed on the signs of reproduction. After the first calving, the duration of the service period decreased in Holstein-Swedish crossbreeds by 42 days, in Holstein-Montbeliard by 38 days, in Holstein-Jersey by 28 days. All mixtures had a longer duration of economic use by 1.5-3.0 lactations, which increased lifelong income. Fertility after the first insemination was higher in local groups by 9-21%. These cows received a lower percentage of stillborn calves (from 5.1 to 9.9%) and the severity of calving (from 3.7 to 11.6%) (Roschinsky et al., 2015).

A systematic approach in optimizing selection programs and searching for optimal selection options in populations of domestic dairy breeds is a little studied. We supposed that the theoretical substantiation of efficiency of crossing for an increase of the level of reproductive ability, duration of economic use of cows, survival of calves, qualitative signs of dairy productivity (fat content, protein) - measures that do not cause doubt in their relevance.

The purpose of the research was to evaluate the nature of calving in cows of Ukrainian Black-Spotted and Red-Spotted Dairy breeds in the selection of bulls of Montbeliard, Norwegian Red, and Holstein breeds.

Materials and methods

The research was conducted during 2018-2019 in the following conditions: FE "Lan" (280 heads of Ukrainian Black-Spotted Dairy cows)(UBS), three heads of bulls of Holstein breed (H), and three heads of bulls of Norwegian Red breed of Black-Spotted breed (NR) of Chornobayiv district, FE "Progress" (100 heads of cows of the Ukrainian Red-Spotted Dairy breed (URS) 3 heads of bulls of Holstein breed (H) and three heads of bulls of Montbeliard breed (M) of Zolotonisk district, "Mayak-Agro" Ltd. (103 heads of cows of Ukrainian Red-Spotted Dairy breed (URS), three heads of bulls of Holstein breed (H) and three heads of bulls of Montbeliard breed (M), FE "Vidrodzhennja" (300 heads of cows of Ukrainian Red-Spotted Dairy breed (URS) 3 heads of bulls of Holstein breed (H) and three heads of bulls of Montbeliard breed (M) of Shpolyanskyj district. Evaluation in terms of live weight of cows and calves was performed based on primary zootechnical accounting. The determination of live weight and linear measurements of newborn calves was performed on their birthday for 1-3 hours after calving (Khmelnychyi et al., 2016). The clinical examination results determined the clinical and gynecological condition of cows by a veterinarian by rectal examination.

According to the existing methodology in Ukraine (Ibatulin & Zhukorsky, 2017), the course of calving was evaluated on a scale: 1 point - normal parturition, independent calving without human intervention.

2 points - easy calving with the help of 1-2 people.

3 points - difficult calving, when 3-4 people provided maternity care.

4 points - severe calving with the help of 5 or more people or with the intervention of a veterinarian (medical care).

5 points - pathological calving - the use of fetotomy or cesarean section.

Stillbirths were recorded in a binary way as living (1) or dead (0). A calf was considered stillborn if it died in the first 24 hours after birth. Twin calves and calves as a result of abortion were excluded from the data. Biometric processing of experimental data - statistical, correlation, and dispersive analysis was performed according to N.A. Plokhynskyj (1969) on a computer type IBM PC/AT (Plohinskii, 1969).

Results and discussion

One of the disappointing realities of modern dairy farming is the low level of reproduction in farms of all forms of ownership. This, according to most analysts, is the main reason for the reduction of the breeding stock of cattle in Ukraine.

The main link in the whole process of reproduction in cattle breeding is calving. The duration after the calving period and the subsequent fertilization of cows depend on its course. According to research, calving took place without complications when the live weight of calves did not exceed 6-7% of the mother's weight. In all groups, the percentage of offspring weight to mother weight did not exceed 6.2%. It should be noted that at relatively the same live weight of cows (on farms from 643 kg to 656 kg), calves received the same live weight from 37.3 kg to 40.8 kg. The live weight of the offspring got by using bulls of the Montbeliard breed was higher than the weight of calves got from Holstein breeders (Table 1).

Table 1. Indicators of the calving course in cows in the selection of offspring of different breeds (age three lactation and older) for 2018-2019.

Breed ♀x♂	n calving	Live weight of cows, kg	Weight of a calf at birth, kg	Percentage relation of calf weight to cow weight,%	The course of calving points
			PJSC "Progress"		
URSxH	50	652±4.7	37.9±1.58	5.8±0.66	1.69±0.170
URSxM	50	655±6.3	39.2±0.64[1]	6.0±0.97	1.99±0.361
			Software Ltd. "Mayak-Agro"		
URSxH	50	655±8.2	37.8±1.39	5.6±1.88	1.67±0.284
URSxM	50	654±7.7	40.8±1.22[2]	6.2±0.96	2.01±0.765
			SE FE "Renaissance"		
URSxH	150	651±9.1	38.3±0.71	5.9±0.88	1.75±0.933
URSxM	150	656±10.3	39.6±1.28[1]	6.0±0.95	1.98±1.011
			Software Ltd. "Lan"		
UBS xH	140	643±10.0	37.3±1.24	5.8±0.75	1.71±0.18
UBSxNR	140	648±6.3	37.7±0.74	5.8±0.93	1.60±0.08

Note: [1]- P<0.5; [2]- P<0.01; [3] -P<0.001 compared to the live weight of calves got from Holstein breeders

Local calves got by crossing cows of the Ukrainian Black-Spotted Dairy breed with bulls of the Norwegian Red breed did not have a potential difference in live weight compared with the breeders' offspring Holstein breed.

When crossing cows of the Ukrainian Red-Spotted Dairy breed with bulls of the Montbeliard breed, the offspring with a higher live weight of 1.3 - 3.0 kg (P<0.5-0.01) were got. Accordingly, among this group of animals, the percentage of offspring weight and cow weight was the highest 6.0-6.2%, which influenced the course of calving. The lowest calving score and the lightest calving were got in the conditions of the software of FE "Lan" when using the Norwegian Red breed - 1.6 points.

When using bulls of the Holstein breed in the conditions of PJSC FE "Progress" the nature of the course of calving is estimated at 1.69 points, in conditions of Ltd. "Mayak-Agro" - 1.67 points, SE FE "Vidrodzhennja" - 1.75 points. That is, calving was without significant obstetric aid. When calving groups of cows, for insemination of which bulls sperm of the Montbeliard breed was used, the indicator of the nature of the course of calving had a higher score: PJSC FE "Progress" - 1.99 points, Ltd. "Mayak-Agro" - 2.01 points, SE FE "Vidrodzhennja" 1.98 points.

Independently and with the help of 1-2 people, 37 cows were calved (74.0%) in the conditions of PJSC FE "Progress", 39 heads (73.6%) in the conditions of Ltd. "Mayak-Agro", 112 heads (74.6%)) in the conditions of SE FE "Vidrodzhennja" (table 2).

Table 2. Percentage of complex calving and stillborn calves in cows in the selection of offspring of different breeds belonging (age 3 lactation and older) for 2018-2019.

Breed ♀x♂	n	Frequency of calving, %			The proportion of dead-born calves, %
		light (1-2 points)	Medium (3 points)	Heavy (4-5 points)	
			PJSC FE "Progress"		
URSxH	50	79.4	18.4	2.2	6.1
URSxM	50	74.0	24.0	2.0	4.1
			Ltd. "Beacon-Agro"		
URSxH	50	78.6	18.3	3.1	6.9
URSxM	50	73.6	24.6	1.8	3.8
			SE FE "Vidrodzhennya"		
URSxH	150	78.5	19.2	2.3	6.7
URSxM	150	74.6	23.4	2.0	4.0
			FE "Lan"		
UBS xH	140	78.6	18.1	3.3	5.2
UBSxNR	140	90.7	8.1	1.2	1.8

In these farms, cows of the Ukrainian Red-Spotted Dairy breed were crossed with bulls of the Montbeliard breed: Floreal FR 7120080123 and Fanfanni FR 2126773675 in 2017-2018. Data collection continues on use in these herds of bull Freshciss FR 2541883676 - insemination 2019. In these groups of cows, heavy calving had two heads (2.0%) in the conditions of PJSC FE "Progress", and 1 head (1.8%) in terms of the Ltd. "Mayak-Agro", three heads (2.0%) in the conditions of SE FE "Vidrodzhennja".

When using Holstein bulls, pathological calving was observed in one cow in PJSC FE "Progress" conditions. Such a phenomenon as litter delay was observed in 10 cows (20.0%) in the conditions of PJSC FE "Progress", and 11 heads (20.8%) in terms of the software of Ltd. "Mayak-Agro", 21 heads (14.0%) in the conditions of SE FE "Vidrodzhennja".

When using bulls of Montbeliard and Norwegian Red breeds, pathological calving was not noted. The litter delay had two cows (4.0%) in the conditions of PJSC FE "Progress", one cow (1.9%) in the conditions of the Ltd. "Mayak-Agro", six heads (4.0%) in the conditions of SE FE "Vidrodzhennja".

Even though the average score on the course of calving was higher in cows that were inseminated with the semen of bulls of breeders of Montbeliard breed, in fact in these groups, the frequency of heavy calving with the help of 5 or more people, or with the intervention of a veterinarian was lower by 0.2-1.3% compared with the cow's group of analog where for reproduction the sperm of Holstein breeders was used. Independently and with the help of 1-2 people, 127 cows (90.7%) of the Ukrainian Black-Spotted Dairy breed were calved, which were crossed with bulls of the Norwegian Red Black-Spotted breed: Sormarka NO 10462 and Rud NO 10624 in 2018-2019. On this farm, we received offspring with the lowest live weight of 37.3-37.7 kg. Besides, when using bulls of the Norwegian Red breed, the lowest percentage of stillbirth offspring was received - 1.8%.

An unfavorable factor for calving in cows is that the fetus's skull at birth is entirely ossified, whereas the shoulder girdle narrows due to the mobility of the chest and the axial displacement between the shoulder joints the pelvic girdle narrows due to not ossified pelvic sutures. If the animals of the Holstein and Norwegian Red breeds belong to the narrow forehead type, then the exponent of the Montbeliard breed has a broad forehead and a relatively massive head. That is why we studied the measurements of the width in the macula and sciatic humps of cows before calving and the width of the head and torso of the newborn offspring (Table 3).

Table 3. Body measurements of cows before calving and calves after birth.

Breed ♀x♂	n	Measurements of cows		Measurements of calves				
		width in maklok, cm	width in gluteal humps, cm	width in head, cm	width in the shoulder scapular joints, cm	chest depth, cm	width in hip joints, cm	torso length, cm
				PJSC FE "Progress"				
URSxH	50	52.3±0.32	33.6±0.97	10.8±1.84	17.7±1.12	13.5±0.91	19.5±0.67	65.7±0.93
URSxM	50	51.8±0.65	32.4±1.11	12.8±0.97	19.3±0.96	13.8±0.74	21.2±1.03	58.2±1.14
				Ltd. "Mayak-Agro"				
URSxH	50	49.2±1.01	29.7±1.01	10.7±1.24	18.1±0.85	13.7±0.88	19.3±0.97	66.1±1.52
URSxM	50	48.9±1.21	28.8±0.89	12.9±0.64	19.7±1.02	13.9±1.11	21.5±1.04	60.3±1.26
				SE FE" Vidrodzhennja"				
URSxH	150	51.3±1.10	31.5±1.01	11.2±1.01	17.9±0.76	13.6±1.10	18.9±1.17	67.1±1.03
URSxM	150	50.6±0.96	31.3±1.09	12.7±0.95	19.1±1.01	13.8±0.69	20.6±1.36	61.3±0.99
				FE "Lan"				
UBS xH	140	52.7±1.22	34.5±0.92	11.1±0.89	18.2±0.87	13.5±0.91	19.2±1.24	65.4±1.18
UBSxNR	140	51.9±0.87	33.9±1.12	10.9±1.01	18.1±1.11	13.4±0.64	20.2±1.20	64.8±1.08

When crossing cows of the Ukrainian Red-Spotted Dairy breed with breeders of the Montbeliard breed, the offspring was got, which was dominated by peers got from Holstein breeders by body measurements: by the width of the head (12.7-12.9 cm) by 1.5-2.2 cm, width in the shoulder-scapular joints (19.1-19.7 cm) by 1.2-1.6 cm, width in the hip joints (20.6-21.5 cm) by 1.7-2.2 cm.

According to linear measurements (width of the head - 10.9-11.1 cm; width in the shoulder of the shoulder blades - 18.1-18.2 cm; width in the hip joints - 19.2-20.2 cm), calves got by cows crossing of Ukrainian Black-Spotted Dairy breed with bulls of Norwegian Red breed of Black-Spotted species and Holstein breed almost did not differ.

It is considered that there may be two ways to reduce heavy calving: reducing the live weight of the newborn calf and increasing the width of the pelvis in cows. However, these ways are problematic. With an increase in live weight of the cow by 1%, the size of its pelvic hole increases by 0.099%, and the live weight of the newborn calf - by 0.292%, which in turn will influence the lightness of the calves (Table 4).

Table 4. Correlation between calving weight and measurements of offspring and body of cows before calving.

Measurements	r
The width of the head of the offspring	0.189
Depth of the offspring breast	0.022
Breast width of the offspring	0.196
Huckle bone width of offspring	0.043
Length of offspring	-0.201
Width of the mother's huckle bone	-0.228
Width in the buttocks humps of the mother	-0.215
The duration of the recovery period	0.362

The highest correlation coefficients were found between heavy calvings and the width of the head and chest of newborn calves (0.189 and 0.196). The inverse relationship exists between heavy calvings on one side and the pelvis's width in the huckle bone and buttocks humps, the length of the offspring. A positive correlation between the nature of the course of calving and the duration of the recovery period (r=0.362) is defined.

When crossing with the Montbeliard breed, only adult cows with a live weight of at least 650 kg and pelvic measurements of at least 5-6 points according to the linear valuation of the exterior type. Taking into account the characteristics of the reproductive capacity of animals that determine the ease of passing calving, selection of breeder, for which it is not typical by the birth of large offspring - the main ways to increase the reproductive functions of the uterus stock and, accordingly, increase the output of breeding young.

Conclusions

The use of crossbreeding can be effective in reducing the proportion of heavy calves and stillbirth among the offspring, which in turn will reduce the associated costs of treating the effects of difficult calving, eliminate the risk of reduced milk productivity and increase the duration of the service period due to complications during parturition. However, we should carefully approach the choice of breed, breeder (it is desirable to consider its valuation of the lightness of the calving, especially when using Montbeliard), and analysis of the breeding stock on which the crossbreed will be used.

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