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ANALYSIS OF THE EFFECTIVENESS OF SEXED SEMEN IN A SELECTED HERD OF DAIRY COWS

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ABSTRACT

Biotechnological methods can be used in dairy cow reproduction to increase reproductive potential and improve economic outcomes of milk production. Biotechnological methods widely used in reproduction include artificial insemination and embryo transfer, and more recently insemination with sexed semen, which makes it possible to control the sex of the offspring. This study presents an analysis of the effectiveness of the use of sexed semen in a selected herd of dairy cows. The results confirmed the effectiveness of sexed semen at increasing births of female calves. Sexed semen was most effective among heifers. In that group the fewest insemination doses were required for conception (1.54), and pregnancy after the first insemination procedure was noted in 52.2% of cases. The values of selected fertility parameters (calving-to-first-service interval, service period, services per conception, and rate of conception after first service) did not deviate significantly from recommended values in cows inseminated with sexed and unsexed semen. Among the group of cows inseminated with sexed semen, fertility parameters were significantly more favourable than in the group inseminated with conventional semen.

Key words: dairy cows, artificial insemination, sexed semen, reproductive parameters

INTRODUCTION

In order to increase the reproductive potential of dairy cows, biotechnological methods enabling rapid genetic improvement in the herd have been introduced. Reproductive biotechnology is a set of methods, procedures and operations whose main goal is to maximize genetic potential and obtain more offspring in optimal conditions [Pindaru et al. 2016]. The main biotechnological techniques which have earned an indisputable position in breeding practice include artificial insemination [Vishwanath 2003] and embryo transfer [Smorąg 2010], while other methods are described as accompanying reproduction, e.g. methods of in vitro acquisition of embryos and oocytes. Recently there has been growing interest in controlling the sex of offspring in dairy herds [Piech 2010, Gogol 2018]. It is possible to obtain offspring of a specific sex in the next generation owing to the use of sexed semen [Garner 2001, Pindaru et al. 2016]. This method can be used to obtain a larger number of valuable heifers, which are of primary importance in dairy herds, in a fairly short time [Xu 2014, Osada et al. 2019].

Sexed semen can be obtained by various sperm identification methods [Pindaru et al. 2016]. According to literature data, the best technique for sexing of semen is flow cytometry, which exploits the difference in the degree of fluorescence of stained X and Y sperm at a wavelength of 350 nm [Espinosa-Cervantes and Córdova-Izquierdo 2012, Pindaru et al. 2016]. The intensity of fluorescent light is transferred to a computer and converted to an electric signal. Depending on the degree of fluorescence, a positive or electric charge is assigned to the sperm, and an electrostatic field is used to separate them according to their charge. The flow cytometry

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method was first described in 1983 by the team of Duane L. Garner [Espinosa-Cervantes and Córdova-Izquierdo 2012]. In currently used cytometers, at a flow rate of about 40,000 cells per second, up to about 15–20 million sperm with over 90% fraction purity can be obtained within an hour. The standard practice is to freeze this semen in straws, in portions containing 2–2.5 million sperm [Gogol 2018].

The use of sexed semen in cattle breeding has numerous benefits. The most important is that it guarantees that many more heifers will be obtained from the best dairy cows [Xu 2014]. In addition, it enables rapid development of the farm through herd rebuilding using heifers from the farm's own herd, significantly reducing breeding costs [Rakowska 2009]. The use of sorted semen in cow breeding is also of ethical significance, because the heifers obtained meet the expectations of dairy farmers, thereby reducing the number of individuals that must be culled [Melado et al. 2010, Balzani et al. 2021]. The number of unwanted male calves is minimized as well [Holden and Butler 2018].

The use of sexed semen has negative aspects as well. First, in comparison to conventional semen, doses of sorted semen are smaller and more expensive. Secondly, the use of such semen may be somewhat less effective, which is associated with the viability of the sperm [Weigel 2004]. During sorting of sperm, exposure to the stain and laser reduces mitochondrial activity, which reduces the motility of sperm, and the sorting speed and length of the entire process can adversely affect the fertilization capacity of the sperm [Carvalho et al. 2010, Mikulska-Pospiszel and Tischner 2010]. According to Norman et al. [2010] higher conception rates in heifers and first-time cows, compared with cows, indicates that using sexed semen for heifer rather than cow breeding is financially preferable. For this reason, the extensive use of sexed semen is limited. However, as noted by Holden and Butler [2018], the decrease in the effectiveness of sexed semen in comparison with conventional semen is compensated for by the numerous economic benefits, improvement in animal welfare, and reduced number of difficult births.

The aim of the study was to analyse the effectiveness of sexed semen in breeding of dairy cows on a private farm in south-eastern Poland.

MATERIAL AND METHODS

The material for analysis consisted of data collected in 2020 on a farm in south-eastern Poland keeping Polish Holstein-Friesian dairy cows of the Black-and-White variety. The data pertained to the period from 2013 to 2019, and their source was the farm's breeding documentation, reports from milk performance evaluations (RW-2, RW-3, and RW-4 reports) and the herd management program 'Stado Online' (Polish Federation of Cattle Breeders and Dairy Farmers).

The cows are kept in a free-stall barn with shallow straw in the stalls. Feed is supplied in a PMR system, and the cows additionally receive concentrate feed during milking. The average daily milk yield in 2019 was 10,061 kg of milk containing 4.60% fat and 3.43% protein. Cows are milked twice a day in a Westfalia 2×3 AutoTandem milking parlour.

The size of the herd on the farm is systematically increasing. In 2019 there were 135 dairy cows, 20 pregnant heifers, 15 heifers above the age of 6 months, 50 calves up to the age of 6 months (heifers are rebuilding material, while most bull calves are sold) and 5 feedlot bulls.

Cattle breeding on the farm is carried out by means of artificial insemination by the owner. The use of sexed semen on the farm was introduced in 2013.

The information sources cited above were used to establish which cows and heifers were inseminated with conventional semen and which were inseminated with sexed semen. Then the dates of the insemination procedures were noted and used to calculate the following:

- number of insemination procedures carried out with conventional semen and sexed semen and the number of inseminated heifers/cows in both groups;
- length of the calving-to-first-service interval – number of days from calving to the first insemination procedure;
- number and percent of cows with different lengths for the calving-to-first-service interval;
- length of service period – number of days from the first insemination to successful insemination;
- number and percent of heifers/cows with different lengths of the service period;
- number and percent of pregnant heifers/cows after each insemination number;
- services per conception (insemination index) – number of insemination procedures per pregnancy;
- sex of calves born to heifers/cows inseminated with sexed semen which calved before the completion of the study.

The data were analysed in Excel software. Standard statistical measures were used (number, percent and mean value), as well as Duncan's test and Yates's non parametric chi-square test [Preacher 2001].

RESULTS AND DISCUSSION

The number of heifers and cows inseminated with conventional semen and sexed semen increased systematically from 2013 (Table 1). This was due to both the annual increase in the size of the herd and the increasing use of sexed semen for insemination. Over the entire study

Table 1. Number of heifers and cows inseminated on the farm during the study period

Year	Inseminated females				
	Total	Conventional semen		Sexed semen	
	Number	Number	%	Number	%
2013	63	60	95.2	3	4.8
2014	66	59	89.4	7	10.6
2015	76	62	81.6	14	18.4
2016	81	67	82.7	14	17.3
2017	86	70	81.4	16	18.6
2018	91	73	80.2	18	19.8
2019	114	84	73.7	30	26.3
Total	577	475	82.3	102	17.7

period (2013–2019), sexed semen was used in 102 heifers and cows, which was nearly 18% of those inseminated during this period. In the first year of use of sorted semen on the farm, it was used in less than 5% of inseminated heifers and cows, but by 2019 the percentage had increased to 26.3%. In effect, the number of heifers and cows inseminated with sexed semen in 2019 was 10 times higher than when it was first used on the farm. These results indicate that the owner of the herd had become convinced that the use of this type of semen was worthwhile and effective in dairy cow breeding.

The numerical distribution and percentage of heifers and cows inseminated with sexed semen (Table 2) shows that these procedures were performed mainly among heifers (45.1%) and primiparous cows (43.1%). Insemination with sexed semen in multiparous cows was sporadic – from 1 to 4 cows each year during the study period (in 2013 and in 2019 there were no procedures of this type in this group). Among heifers and cows inseminated with sexed semen in 2013–2019, multiparous cows accounted for only 11.8%. The sporadic use of sexed semen in older cows may be explained by the fact that older cows generally achieve poorer reproductive parameters than younger cows, so the use of sexed semen in older cows is not justified economically. Rakowska [2009] reported that the use of sexed semen in younger cows increases the chances of conception, due to their better condition. The steady increase in insemination with sexed semen among all insemination procedures in heifers and primiparous cows since 2013 should be considered a positive development. Among all insemination procedures performed in 2013, procedures with sexed semen accounted for only 1.6% in primiparous cows and 3.2% in heifers, but in 2019 they accounted for 13.2% in both groups. In multiparous cows, insemination was performed primarily with unsexed semen (63.1% of all insemination procedures during the study period). Insemination with sexed semen accounted for 26.4% of all insemination procedures in the final year of the study, and 17.7% for the entire study period.

Table 3 presents the length of the calving-to-first-service interval and the service period in heifers and cows inseminated with sexed semen. According to Juszczak and Hibner [2000] and Wierzbowski and Żukowski [2007], the length of the calving-to-first-service interval should not be less than 60 days. According to Bogucki et al. [2007], the calving-to-first-service interval should become longer as the cows' productivity increases. In their study, the calving-to-first-service interval increased from 68 to 117 days when the production level increased. The increase in the time needed for the reproductive system to return to its normal activity, especially in highly productive cows, may be due to the high metabolic burden caused by high production and the negative energy balance occurring at this time [Borkowska et al. 2012].

The average length of the calving-to-first-service interval was 65 days in cows inseminated with sexed semen and 76 days in cows inseminated with unsexed semen (Table 3). The average difference between groups (11 days) was statistically significant ($P \leq 0.05$). The combined percentage of cows with the two lowest ranges for length of the calving-to-first-service interval (≤ 45 and 46–60 days) was similar in both groups distinguished by type of semen used – 42.8% for insemination with sexed semen and 41.1% for conventional semen. The optimal length of the calving-to-first-service interval for dairy cows (61–90 days) was observed more often (by 1.7 p.p.) in the group of cows inseminated with sexed semen. However, the value of Yates' chi-square test did not indicate a statistically significant relationship between the type of semen used and the number of cows in a given range of lengths of the calving-to-first-service interval ($P > 0.95$).

The average service period in heifers and cows inseminated with sexed semen was 34 days and was significantly ($P \leq 0.05$) shorter (by 14 days) than in the group of heifers and cows inseminated with unsexed semen. This may have been due in part to the fact that heifers and cows inseminated with sexed semen more often (44.1% vs. 35.6%) became pregnant after the first insemination

Table 2. Number and % of heifers/cows (*) inseminated with conventional and sexed semen in different age categories

Year	Conventional semen						Sexed semen					
	Heifers		Primiparous cows		Multiparous cows		Heifers		Primiparous cows		Multiparous cows	
	n	%	n	%	n	%	n	%	n	%	n	%
2013	9	15.0 14.3	10	16.7 15.8	41	68.3 65.1	2	66.7 3.2	1	33.3 1.6	–	– –
2014	9	15.2 13.6	8	13.6 12.1	42	71.2 63.7	4	57.1 6.1	2	28.6 3.0	1	14.3 1.5
2015	10	16.1 13.2	5	8.1 6.6	47	75.8 61.8	5	35.7 6.6	7	50.0 9.2	2	14.3 2.6
2016	11	16.4 13.6	6	9.0 7.4	50	74.6 61.7	5	35.7 6.2	7	50.0 8.6	2	14.3 2.5
2017	9	12.9 10.5	8	11.4 9.3	53	75.7 61.6	8	50.0 9.3	5	31.2 5.8	3	18.8 3.5
2018	11	15.1 12.1	7	9.6 7.7	55	75.3 60.4	7	38.9 7.7	7	38.9 7.7	4	22.2 4.4
2019	5	5.9 4.4	3	3.6 2.6	76	90.5 66.6	15	50.0 13.2	15	50.0 13.2	–	– –
Total	64	13.5 11.1	47	9.9 8.1	364	76.6 63.1	46	45.1 8.0	44	43.1 7.6	12	11.8 2.1

(*) – values in upper cells were calculated as the % of heifers and cows inseminated with a given type of semen in a given age category; values in lower cells were calculated as the % of heifers and cows inseminated in a given age category in relation to the total number of insemination procedures performed in a given year.

Table 3. Length of the calving-to-first-service interval and service period in cows inseminated with sexed and conventional semen

Semen type	Number of cows, n	Length of period ($\bar{x}$)						
Calving-to-first-service interval[a]				Cows with calving-to-first-service period of length, days				
				≤45	46–60	61–75	76–90	>90
Sexed semen	77	65*	n	15	18	18	12	14
			%	19.4	23.4	23.4	15.6	18.2
Conventional semen	397	76*	n	63	100	81	67	86
			%	15.9	25.2	20.4	16.9	21.6
Service period[b]				Cows with service period of length, days				
				0	≤24	25–60	61–75	>75
Sexed semen	102	34*	n	45	6	26	11	14
			%	44.1	5.9	25.5	10.8	13.7
Conventional semen	475	48*	n	169	23	96	92	94
			%	35.6	4.9	20.3	19.4	19.8

Yates's chi-square – [a] 0.726 ($P > 0.95$), [b] 6.669 ($P > 0.15$); *means significantly different at $P \leq 0.05$.

procedure (service period = 0). For the next two ranges of service period length (< 45 and 46–60 days), the combined percentage of heifers and cows inseminated with sexed semen (31.4%) was higher than in the case of unsexed semen (25.2%). In the group of heifers and cows inseminated with unsexed semen, a substantial percentage (39.2%) had a service period of more than 75 days. The value of Yates' chi-square test may in this case indicate a certain relationship between the type of semen used for insemination and the length of the service period, but it was not statistically significant ($P > 0.15$).

A study by DeJarnette et al. [2008] showed that the effectiveness of sexed semen in heifers was 70–80% that of conventional semen. This is because semen sorting is associated with damage to some of the sperm or impairment of their viability [Arruda et al. 2012]. However, this is not confirmed by the results of the present study. A prolonged service period may be more attributable to a poorly chosen time for the insemination procedure or inadequate preparation of the cows for their next pregnancy. Improvement of outcomes of artificial insemination therefore requires a comprehensive analysis. It

Table 4. Effectiveness of insemination of heifers and cows in different age categories with conventional semen (c) and sexed semen (s)

Year	Age group	Number of cows		Number of insemination procedures		Services per conception	
		c	s	c	s	c	s
2013	Heifers	9	2	12	3	1.33	1.5
	Primiparous cows	10	1	13	1	1.30	1
	Multiparous cows	41	–	87	–	2.12	–
	Total	60	3	112	4	1.97	1.33
2014	Heifers	9	4	15	7	1.67	1.75
	Primiparous cows	8	2	12	3	1.50	1.5
	Multiparous cows	42	1	82	2	1.95	2.0
	Total	59	7	109	12	1.85	1.71
2015	Heifers	10	5	15	7	1.50	1.4
	Primiparous cows	5	7	7	10	1.40	1.43
	Multiparous cows	47	2	101	5	2.15	2.5
	Total	62	14	123	22	1.98*	1.57*
2016	Heifers	11	5	15	8	1.36*	1.6*
	Primiparous cows	6	7	9	12	1.50	1.71
	Multiparous cows	50	2	135	6	2.70	3.0
	Total	67	14	159	26	2.37*	1.86*
2017	Heifers	9	8	15	12	1.67	1.5
	Primiparous cows	8	5	13	9	1.62	1.8
	Multiparous cows	53	3	117	5	2.21*	1.67*
	Total	70	16	145	26	2.07*	1.63*
2018	Heifers	11	7	18	11	1.64	1.57
	Primiparous cows	7	7	13	12	1.86	1.71
	Multiparous cows	55	4	115	7	2.09*	1.75*
	Total	73	18	146	30	2.00	1.67
2019	Heifers	5	15	9	23	1.74	1.53
	Primiparous cows	3	15	5	27	1.81	1.8
	Multiparous cows	76	–	161	–	2.12	–
	Total	84	30	175	50	2.08	1.67
Total	Heifers	64	46	99	71	1.55	1.54
	Primiparous cows	47	44	72	74	1.53	1.68
	Multiparous cows	364	12	798	25	2.19	2.08
	Total	475	102	969	170	2.04*	1.65*

*means in rows differ significantly at $P \leq 0.05$.

should also be emphasized that the service period together with the length of the calving-to-first-service interval determines the length of the calving-to-conception interval. Bogucki et al. [2007] showed that this indicator is prolonged in high-yielding cows. A link between the level of milk production and the length of the calving-to-conception interval is also suggested by research by Jankowska [2002] and Borkowska et al. [2012]. The findings of these authors indicate that cows with low milk yield had the shortest calving-to-conception intervals.

During the entire study period (2013–2019) a total of 577 heifers and cows were inseminated in 1,139 insemination procedures, resulting in a rate of 1.97 insemination procedures per conception (Table 4). Among heifers and cows, nearly 18% were inseminated with sexed semen, and 14.9% of all procedures were performed using this type of semen. The number of insemination procedures with both types of semen systematically increased from year to year. This increase was due in part to the increase in the size of the herd and in part to the increased use of sexed semen for insemination.

Analysis of the insemination index (number of services per conception) reveals higher values in multiparous cows than in heifers and primiparous cows irrespective of the year and the type of semen used. The average values for this parameter calculated for each age group and year do not clearly demonstrate how the use of sexed semen influenced the effectiveness of insemination. Although in 2018 and 2019 fewer semen portions per pregnancy were used in both heifers and cows insem-

inated with sexed semen in comparison with conventional semen, such a clear pattern was not observed in previous years. The average number of services per conception for the whole study period was 2.04 in heifers and cows inseminated with unsexed semen and 1.65 in those inseminated with sexed semen. The average values differed significantly ($P \leq 0.05$).

Comparison of age groups of heifers and cows inseminated in each year of the study showed that the high number of services per conception in the group inseminated with unsexed semen was due to the large proportion of multiparous cows, in which the number of services per conception was generally more than 2. These results correspond to the findings of DeJarnette et al. [2008], who reported much lower effectiveness of artificial insemination of multiparous cows in comparison to heifers and primiparous cows. Miciński [2007] also showed that 1.75 portions were used in the first lactation, 2.32 in the second, 2.35 in the third, and 2.27 in subsequent lactations.

Analysis of conception rates following each consecutive insemination procedure (Table 5) showed that irrespective of the type of semen used, all heifers and primiparous cows were pregnant after the third procedure. In contrast, some of the multiparous cows (8.3% inseminated with sexed semen and 10.7% with unsexed semen) required four procedures to become pregnant. The effectiveness of the first insemination procedure decreased with increasing age, irrespective of the type of semen used, but this association was more pronounced in the group inseminated with sexed semen. In heifers, the first procedure was more than 50% effective in of both groups. The first service was more effective in heifers and cows inseminated with conventional semen in all age categories. In contrast, the second insemination procedure was more effective in the case of insemination with sexed semen, as the proportion of heifers and cows impregnated by the second dose ranged from 41.3% to 50.0%, while in the group inseminated with unsexed semen it was 32.9%. This meant that more than 90% of heifers and cows were pregnant after at most two procedures using sexed semen, compared to less than 70% in the case of unsexed semen. This was mainly because the group inseminated with unsexed semen consisted predominantly of multiparous cows, whose fertility is often lower. Therefore, although the relationship between age and the number of insemination procedures needed for conception was confirmed by Yates's chi-square test (33.19; significance at $P \leq 0.001$), it cannot be definitively concluded that sexed semen was more effective than unsexed semen.

In heifers and cows inseminated with sexed semen, among deliveries resulting in a female calf, 45 (72.6%) were single deliveries, and one (1.6%) was a twin delivery which resulted in the birth of two female calves (Table 6). In 62 deliveries a total of 52 female calves were born (82.5% of all calves), of which 5 were stillborn. Deliveries resulting in the birth of a bull calf accounted for 15.9%, including 3.2% stillbirths. In a study by Diers et al. [2020], the percentage of heifers born following insemination with conventional semen was 52.7%, compared to 87.0% in the case of sexed semen. Lower ef-

Table 5. Number of pregnant heifers and cows following successive insemination procedures with sexed and unsexed semen

Age category	Number of insemination procedures	Number (upper cell) and % (lower cell) of impregnated cows				
		Total	After 1 procedure	After 2 procedures	After 3 procedures	After 4 procedures
Insemination with sexed semen						
Heifers	71	46	24	19	3	–
			52.2	41.3	6.5	–
Primiparous cows	74	44	18	22	4	–
			40.9	50.0	9.1	–
Multiparous cows	25	12	3	6	2	1
			25.0	50.0	16.7	8.3
Total	170	102	45	47	9	1
			44.1	46.1	8.8	1
Insemination with unsexed semen						
Heifers	99	64	35	23	6	–
			54.7	35.9	9.4	–
Primiparous cows	72	46	24	18	4	–
			52.2	39.1	8.7	–
Multiparous cows	798	364	110	115	98	41
			30.2	33.3	25.8	10.7
Total	969	474	169	156	108	41
			35.6	32.9	22.8	8.7

Yates' chi-square = 33.19 ($P \leq 0.001$).

Table 6. Sex distribution of calves born to heifers and cows inseminated with sexed semen

Age category	Number		Number and % of calves of each sex											
			Live births					Stillbirths						
	Births	Calves	Σ	♀		♂		Σ	♀		♂		Undetermined sex	
				n	%	n	%		n	%	n	%	n	%
Heifers	28	28	26	23	82.1	3	10.7	2	1	3.6	1	3.6	–	–
Primiparous cows	25	25	23	20	80.0	3	12.0	2	2	8.0	–	–	–	–
Older cows	9*	10	6	4**	40.0	2	20.0	4	2	20.0	1	10.0	1	10.0
Total	62*	63	55	47**	74.6	8	12.7	8	5	7.9	2	3.2	1	1.6

*including one twin birth; **including ♀+♀ twins.

fectiveness for sexed semen was obtained in a study by Osada et al. [2019], in which the percentage of deliveries resulting in the birth of a heifer was 73.8%.

Among stillborn calves, 5 were female (7.9%), 2 were male (3.2%) and one was of undetermined sex (1.6%). In total 12.7% of births were stillbirths. This was higher than the percentage obtained by Atashi [2011], who reported that the frequency of stillbirths depended on parity; it was 7.97% in the case of primiparous cows, and 4.61%, 4.0% and 4.93% in cows at second, third and fourth or subsequent parity, respectively. That study, however, was conducted in cows inseminated with unsexed semen. Norman et al. [2010] estimated that the frequency of stillbirths at first calving was 10.4% in the case of conventional semen and 11.3% for sexed semen, while the corresponding frequencies for subsequent births were 3.6% and 2.7%.

Only one twin delivery was recorded in the study population. According to Wielgosz-Groth et al. [1999], pregnancies in cows are usually single. Multiple pregnancy is rare, and its frequency depends on factors such as breed, herd, year, or parity. In the study cited, multiple pregnancies accounted for 0.41%. Max [2011] demonstrated an association between high yield and the occurrence of double ovulation, which results in multiple pregnancy. Multiple pregnancies are undesirable, especially in dairy cows, as they are associated with metabolic disorders, complications in parturition, and especially postpartum pathology. Twin births increase susceptibility to endometritis and retention of foetal membranes [Max 2011]. A study by Norman et al. [2010] in a group of 1.3 million American Holstein heifers and 10.8 million cows showed that twin births were associated with a higher frequency of stillbirths.

The effectiveness of insemination with sexed semen was similar among heifers and primiparous cows, as parturition resulted in the birth of a female calf in 89.3% and 88.0% of cases, respectively. The frequency of stillbirths in the two groups was also similar (7.2% and 8.0%, respectively). Mikulska-Pospiszel and Tischner [2010] report that the frequency of births of female calves was higher in heifers inseminated with sexed semen, at 91%. In the present study, the much lower effectiveness of the use of sexed semen in multiparous cows (only 60% female calves and 30% stillbirths) cannot be reliably assessed due to the small number of insemination procedures in this age group.

CONCLUSIONS

The results of the study confirm that sexed semen is effective at increasing the frequency of births of female calves, which is of importance for conducting breeding work in the herd, as it enables more rigorous selection among heifers. The use of sexed semen was shown to be most effective among heifers. In this group the number of semen portions per conception was lowest (1.54), and pregnancy following the first insemination was noted in 52.2% of cases. In the case of primiparous and older cows conception rates after first insemination with sexed semen were only 40.9% and 25.0%, respectively. The values for selected fertility parameters (calving-to-first-service interval, service period, services per conception, and conception after the first insemination) in heifers and cows inseminated with unsexed and sexed semen did not deviate significantly from standards. Significantly better values for fertility parameters were obtained in the group inseminated with sexed semen in comparison with the group inseminated with unsexed semen, especially in the subgroups of younger animals (heifers and primiparous cows). In the case of multiparous cows, due to the small number of insemination procedures using sexed semen, it is difficult to draw definitive conclusions. It would be worthwhile to systematically introduce sexed semen in dairy cow breeding to increase its efficiency.

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ANALIZA EFEKTYWNOŚCI WYKORZYSTANIA NASIENIA SEKSOWANEGO U KRÓW MLECZNYCH W WYBRANYM STADZIE

STRESZCZENIE

Wykorzystanie metod biotechnologicznych w rozrodzie krów mlecznych pozwala na zwiększenie ich potencjału reprodukcyjnego oraz poprawia wskaźniki ekonomiczne produkcji mlecznej. Do powszechnie stosowanych obecnie biotechnik w rozrodzie należą sztuczna inseminacja oraz embriotransfer, a w ostatnim okresie dołączyła do nich inseminacja nasieniem seksowanym, która pozwala na kontrolę płci potomstwa. W pracy przedstawiono analizę skuteczności wykorzystania nasienia seksowanego w wybranym stadzie krów mlecznych. Uzyskane wyniki potwierdziły efektywność stosowania seksowanego nasienia na zwiększenie urodzeń jałóweczek. Największą efektywność stosowania nasienia seksowanego uzyskano w grupie jałówek. W tej grupie zużywano najmniej porcji nasienia na zapłodnienie (1,54), a ciążę po pierwszym zabiegu unasieniania stwierdzono w 52,2% przypadków. W grupie pierwiastek i krów starszych po pierwszej inseminacji nasieniem seksowanym cielnych było odpowiednio tylko 40,9 i 25,0% samic. Wartości wybranych wskaźników płodności (okres spoczynku poporodowego, okres usługi, indeks unasienień oraz wskaźnik zapłodnienia po pierwszym unasienianiu) nie odbiegały znacząco od zalecanych norm w grupie samic inseminowanych nasieniem nieseksowanym i seksowanym. W grupie zwierząt inseminowanych nasieniem seksowanym uzyskano istotnie lepsze wartości wybranych wskaźników płodności w porównaniu do grupy inseminowanych nasieniem konwencjonalnym.

Słowa kluczowe: krowy mleczne, inseminacja, nasienie seksowane, wskaźniki rozrodu

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