Formation of reproductive organs of young livestock depending on paratypic factors

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Abstract. The study was conducted to identify the early use of young animals (gobies and heifers) in cattle for breeding purposes. The condition under which the research was carried out was intensive and traditional rearing of young cattle. In the experimental groups, feeding was intense, and in the control groups – according to the accepted technology in the farm. Young growth was carried out until the age of 15 months. Under such different growing conditions, we have established the features of the formation of reproductive organs in gobies and heifers. The good development of the genitals of the heifers of the experimental group, and especially the ovaries, made it possible to carry out their fruitful insemination in the period from 13 to 14 months of age. For this, two bulls were selected from the experimental group at the age of 12-13 months, which, by manual mating, inseminated 20 heifers for a month. During a rectal examination, they turned out to be all pregnant and in due time, without complications, became hotels, gave normal viable offspring. Calving calves aged 22-23 months during 1 lactation they were in no way inferior in milk production to heifers inseminated at the age of 24-28 months and calving at 33-37 months.

1 Introduction

The profitability of cattle breeding depends on a variety of genetic parameters of livestock and paratypical factors influencing it. Also, success in leading the livestock industry depends on the reproduction of the herd by introducing high-quality young stock into the herd. Therefore, the sooner the heifers reach economic maturity, the faster will be the payback of the costs incurred for reproduction and rearing of young animals [1-9].

In order to identify its early use for breeding purposes, a study was carried out with intensive and traditional rearing of young cattle.

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2 Materials and methods

The selected young red steppe breed was formed into 4 groups - 2 gobies (Ia - experience, Ib - control) and 2 heifers (IIa - experience and IIb - control), was kept indoors in the winter, and with the onset of heat was brought to the feeding grounds. The conditions of young animals ($n = 100$) of all groups were identical. The area for 1 animal in the premises was 1.8 m^2 , in the feed yards - 10 m^2 . The front of feeding is 0.5 m. Watering was carried out from group drinking bowls. Feeding in the winter was carried out indoors, and in the summer - on the feeding grounds.

3 Results and discussion

In the experimental groups, feeding was intense, and in the control groups - according to the accepted technology in the household (table 1).

Table 1. The amount of feed and their nutrition consumed by experimental young animals (per 1 animal).

Stern	Gobies (n = 50)				Heifers (n = 50)			
	Ia		Ib		IIa		IIb	
	kg	feed units	kg	feed units	kg	feed units	kg	feed units
From birth to 8 months of age								
Compound feed	355.8	355.8	205	205	311.7	311.7	205	205
Barley	117.8	142.5	45.9	55.5	98.4	119.1	45.9	55.5
Corn Dirt	-	x	37.8	42.3	28.8	32.3	37.8	42.3
Corn silo	368.4	62.6	393.7	66.9	362.6	61.6	403.0	68.5
Green mass of herbs	577.6	110.6	677.2	129.7	554.1	106.1	686.8	125.8
Alfalfa Hay	40.4	19.8	49.6	24.3	40.4	19.8	49.6	24.3
Total including concentrates	-	896.5	-	639.0	-	816.7	-	636.7
	473.6	498.3	288.7	302.8	438.9	463.1	288.7	302.6
From birth to 15 months of age								
Whole milk	180.5	61.4	180.5	61.4	180.5	61.4	180.5	61.4
Reverse	696.7	90.6	209.0	27.2	622.7	80.9	209.0	27.2
Compound feed	1285.3	1285.3	563.5	563.5	1104.3	1104.3	564.7	564.7
Barley	145.8	176.4	54.3	65.7	120.8	146.2	54.3	65.7
Corn Dirt	-	x	223.8	228.3	28.8	32.2	190.8	195.3
Corn silo	1775.9	301.9	1354.7	230.2	1785.5	303.6	1365.5	232.1
Cabbage	24.0	2.4	52.0	5.2	21.0	2.4	52.0	5.2
Green mass of herbs	877.6	164.0	977.2	183.1	854.1	159.5	957.1	179.1
Alfalfa Hay	151.3	74.1	176.5	86.5	151.3	74.1	176.5	86.5
Sudanese hay	149.2	77.6	175.0	91.0	158.1	82.2	171.7	83.3
Hay winter rye	1.0	0.5	2.0	1.0	1.0	0.5	2.0	1.0
Corn straw	3.2	0.6	617.6	123.5	2.6	0.5	608.6	121.7
Barley straw	33.7	12.1	50.0	18.0	33.7	12.1	45.9	16.5
Total including concentrates	-	2246.9	-	1684.6	-	2059.9	-	1645.7
	1430.1	1461.7	841.6	857.5	1253.9	1282.7	809.8	825.7

Young growth was carried out until the age of 15 months. During this period, the bulls of group Ia consumed more feed at a total nutritional rate of 562.3 feed units. (33.4%), concentrates - 604.2 feed. units (70.5%) than the analogues of group IIb (table. 2). Accordingly, heifers of group IIa for 441.2 food. units (25.2%) and 457 (55.4). The animals of the experimental groups consumed corn silage more, but less than the green mass of corn, hay, corn and barley straw. The calves of group Ia in the structure of the diet of concretes had 14.2% more than the control, and for heifers this difference was 12.2%. Animals of the experimental groups were inferior to control by 2.7-11.7% in terms of the eatability of coarse juicy feed.

Table 2. The proportion of feed consumed by experimental animals on nutrition.

Stern	Gobies				Heifers			
	Ia		Ib		IIa		IIb	
	feed units	%	feed units	%	feed units	%	feed units	%
From birth to 8 months of age								
Dairy	152.0	17.5	88.6	13.9	142.3	17.4	88.6	13.9
Concentrates	498.3	57.5	302.8	47.4	463.1	56.7	302.8	47.6
Rough, total	43.6	5.0	51.0	8.0	43.6	5.3	51.0	8.0
including hay	34.4	3.9	38.9	6.1	34.4	4.2	38.9	6.1
straw	9.2	11	12.1	1.9	9.2	1.1	12.1	1.9
Juicy, total	173.2	20.0	196.6	30.7	167.7	20.6	194.3	30.5
including corn silage	62.6	7.2	66.9	10.5	61.6	7.5	68.5	10.8
Green feed	110.6	12.8	129.7	20.2	106.1	13.1	125.8	19.7
Total	867.1	100	639	100	816.7	100	636.7	100
From birth to 15 months of age								
Dairy	152.0	6.8	88.6	5.4	142.3	6.9	88.6	5.4
Concentrates	1461.7	65.1	857.5	50.9	1282.7	62.3	825.7	50.2
Rough, total	164.9	7.3	320.0	19.0	169.4	8.2	315.0	19.1
including hay	152.2	6.8	178.5	10.6	156.8	7.6	176.8	10.7
straw	12.7	0.5	141.5	8.4	12.6	0.6	138.2	8.4
Juicy, total	468.3	20.8	418.5	24.7	465.5	22.6	416.4	25.3
including corn silage	301.9	13.4	230.2	13.7	303.6	14.7	232.1	14.1
Green feed	164.0	7.3	183.1	10.9	159.5	7.7	179.1	10.9
Total	2246.9	100	1684.6	100	2059.9	100	1645.7	100

Analysis of feeding showed that young experimental groups (Ia and IIa) consumed food in total nutrition in the diet structure about the same amount, and in comparison with analogues of control groups (Ib and IIb), these differences are significant in most cases ($P > 0.95-0.999$). Thus, feeding of young animals with intensive cultivation was more abundant than with the traditional, adopted in most farms of the Rostov region.

Under such different growing conditions, we have established the features of the formation of reproductive organs in gobies and heifers. We conducted a study with intensive and traditional rearing of young animals in order to identify its early use for breeding purposes (table 3-6).

Table 3. The growth dynamics of the reproductive apparatus in gobies, g.

Mass indicators	Group					
	Ia, age, months			Ib, age, months		
	8	12	15	8	12	15
Genital apparatus	617	1275	1671	347	898	1446
Fat of the reproductive apparatus	-	-	238	-	-	209
Scrotum	130	240	413	65	170	363
Penis	170	375	425	130	235	379
Prepuce	35	45	57	20	40	46
Testis	217	445	488	89	320	394
including right	110	225	247	45	160	199
left	107	220	241	44	160	195
Epididymis	19	55	85	15	50	64
including right	10	29	43	8	26	33
left	9	26	42	7	24	31
Testicular serosa	16	21	59	10	13	45
including right	8	11	31	5	7	23
left	8	10	28	5	6	22
Additional gonads	29.4	87	137	17.6	65	128
including vesicular	9	40	73	4	30	68
prostate	15	20	27	10	15	25
cooper	5.4	27	37	3.6	20	35
Seed tube	0.6	6.7	7.2	0.4	4.7	6.8
The specific weight of the testes, g/cm ³	1.09	1.08	1.04	1.12	1.10	1.04
including right	1.10	1.07	1.03	1.13	1.09	1.03
left	1.07	1.08	1.04	1.10	1.10	1.04

By weight of testes, bulls of group Ia at the age of 8 months exceeded peers of Ib by 128 g (2.4 times), by 12 - 125 g (39.1%) and by 15 - 94 (23.9). Moreover, in calves of group Ia from 8 to 12 months the mass of testes increased by 228 g (2 times), from 8 to 15 - 271 (2.3) and from 12 to 15 - by 43 (9.7%); accordingly, in the bulls of the IB group - 231 (3.6), 305 (4.4) and 74 (23.1%).

Table 4. The dynamics of the linear growth of the genital apparatus in gobies, cm.

Indicator	Group					
	Ia, age, months			Ib, age, months		
	8	12	15	8	12	15
Penis: length	73	80	84	62	72	76
diameter in the middle	0.9	1.8	2.5	0.7	1.7	2.4
Prepuce: length	21	25	27	15	20	22
cut width	5	6	7	3	5	6
Appendage Length: right	9.5	10.5	20.8	8.5	9.5	15.1
left	9.5	10.5	20.8	8.5	9.5	15.0
Right testis: length	10	10.7	12.3	7.5	10.2	11.2
diameter in the middle	4.2	6.0	6.5	2.6	4.7	5.7
Left testis: length	10	10.6	12.0	7	10.1	10.8
diameter in the middle	4.1	5.8	6.2	2.5	4.7	5.6
Gland Length: vesicular	9.5	12.3	12.6	7	10.5	10.6
prostate	13	15.5	18	11.5	13	16
cooper	2.5	3	4	2	2.8	3.8
Gland Width: vesicular	2.5	4	5.1	2	3	3.7
prostate	0.7	0.9	1.2	0.4	0.7	0.8
cooper	1.3	1.9	2.2	1	1.2	1.9

With age, the growth rate of the mass of testes decreases sharply, and already from 12 to 15 months of age it is 4.1-6.3 times lower than in the period from 8 to 12 months. But the growth of the testes at the age of 15 months does not end. In an adult bull, the mass of the testis reaches 300-350 g, and the testes - 600-700 g, i.e. at the age of 15 months, bulls of the experimental group have 75.1% of the mass of adult bulls, and the control - 60.6%. At the same time, the length of the testis in an adult bull is 12-14 cm, and in bulls it is 15 months Ia groups - 12.2 cm, Ib - 11 cm, i.e. the size of the length of the bulls have a smaller difference - 84.6-93.5%.

When analyzing the growth of testes in all age periods, the right testis, as a rule, has a larger mass than the left. But the proportion of the left testis, starting at 12 months of age, is greater than the right. This is probably due to the fact that in the left testis there is still more connective tissue, and in the right - glandular. Therefore, it has a lower specific gravity.

Additional sex glands also in all age periods in bulls of intensive growth have better development, greater mass and linear dimensions. So, the mass of vesicular glands in gobies of group Ia at the age of 8 months exceeds that of peers Ib by 5 g (2.25 times), 12-10 (33.3%), 15-5 (7.4%); respectively, prostate - by 5 (1.5), 5 (33.3), 2 (8), Cooper - by 1.8 (1.5), 4 (35), 2 (5.7). The highest differences are observed at the 8-month-old age of the gobies. Then they decrease by the age of 15 months become minimal (5.7-7.4%). The mass of vesicular glands in the period from 8 to 12 months increased in gobies of the Ia group by 31 g or 4.4 times, and among peers Ib - by 26 g (7.5 times), and from 12 to 15 months - by 33 (1.8) and 38 (2, 3); respectively, the mass of the prostate glands - 5 g (33.3%) and 5 (50), 7 (35) and 10 (66.7), cooper - 21.6 (5 times) and 16.4 (5.6 times), 10 (37%) and 15 (75%). In all analyzed periods, additional sex glands in gobies of the control group have a higher growth rate. However, complete compensation in the growth of the glands in them, in comparison with the experimental one at the age of 15 months, does not occur. A similar thing can be seen in their linear growth.

Regarding the completeness of the growth of the additional sex glands when comparing with the sizes of similar glands in adult bulls, we can state that in bulls of group Ib at the age of 15 months their growth is not yet completed, but for peers Ia - is completed. In adult gobies, the vesiculate glands have a length of 12, a width of 5, a thickness of 3 cm; the prostate gland consists of a weakly expressed body and a scattered part, each cooper gland (two of them) has the size of a large walnut (diameter 3-4 cm).

Gobies of group Ia at the age of 8 months by weight of the penis they exceeded peers Ib by 30.8%, in 12 - by 59.6%, in 15 - 12.1%. At the same time, in bulls of intensive growth, the mass of the penis is from 8 to 12 months increased 2.2 times, length - 9.6%, from 12 to 15 months - 13.3 and 5%, and from 8 to 15 months - 2.5 times and 15.1%; accordingly, the analogues of group I - 1.8 times and 16.1%, 61.3 and 5.6%, 2.9 times and 22.6%. A larger increase in penis mass compared to its length occurs because in the analyzed period the penis thickness increases actively (in gobies of group I from 8 to 12 months, the diameter of the penis increases by 2, from 8 to 15 months - 2.8 times, from 12 to 15 months - 38.9%, respectively, IB - 2.4 and 3.4 times, 41.2%. In adult bulls, the length of the penis reaches 100, and during an erection - 150 cm. In gobies intensive cultivation at 15 months. The length of the penis compared with adults is 84, and the traditional - 76%.

Analysis of the growth of testes and their appendages, vas deferens and accessory genital glands of the penis showed that with intensive growth, it occurs more intensively up to 8 months of age of gobies, and in traditional up to 15 months. At the same time, intensive cultivation contributes to the accelerated formation of the genitals and the earlier completion of their growth and development, which allows the use of gobies effectively at a young age, starting from 12 months of age.

Ovarian mass (table 5) in heifers of group IIa at the age of 8 months higher than IIb by 0.9 g (27.3%), 12 - 5.1 g (2.3 times more), 15 - 4.3 g (62.3%). At the same time, in all age

periods, the right ovary is more developed than the left; in heifers of group IIa at 8 months the mass of the right ovary is 0.2 g (10%) more than the left, in 12 - by 2.1 (60) and in 15 - 0.8 (15.4); respectively, in heifers of group IIb - 0.3 (20), 0.2 (10.5) and 0.3 (9.1). In a cow, the ovaries are relatively small, weighing up to 14-19 g. In heifers of group IIa, the mass of ovaries at the age of 15 months 2.8-7.8 g less than in adult cows, and in IIb, respectively, by 7.1-11.1 g. Heifers of group IIa for ovarian development, their weight is almost close to adult cows, and IIb in 2, 03-2.75 times the mass of the ovaries have less.

Table 5. The growth dynamics of the reproductive apparatus in heifers, g.

Indicators	Group					
	IIa, age, months			IIb, age, months		
	8	12	15	8	12	15
Genital apparatus	137.2	417.1	775.2	99.3	286.0	428.9
Fat of the reproductive apparatus	130	170	620	78	110	310
Labia	15	60	103	15	30	35
Vestibule of the vagina	30	115	155	20	95	105
Vagina	45	100	205	30	75	121
Cervix	8	25	27	5	10	15
Uterine bodies	5	10	43	5	10	38
Uterine horns	25	90	220	16	55	100
Ovary	4.2	9.1	11.2	3.3	4.0	6.9
including right	2.2	5.6	6.0	1.8	2.1	3.6
left	2.0	3.5	5.2	1.5	1.9	3.3
Egg breeders	5	8	11	5	7	8

In heifers IIa of the ovary group and in linear dimensions, length, width and thickness exceed IIb by 16.7-68.4% (table 6).

Table 6. The dynamics of the linear growth of the reproductive apparatus in heifers, cm.

Indicator	Group					
	IIa, age, months			IIa, age, months		
	8	12	15	8	12	15
Floor gap length	7	10	11	6	7.5	8
The vestibule of the vagina: length	8	12	13	8	10	12
sectional width	7	9	11	6	7	10
Vagina: length	16	22	25	14	17	19
sectional width	10	14	15	7	12	14
Length: cervix	4	4	6	3	3	5
uterine bodies	4	5	8	3	4	6
uterine horns	18	30	37	13	19	23
Horn Diameter: cranially	-	-	1.8	-	-	1.1
the middle	-	-	6.4	-	-	3.1
caudally	-	-	3.3	-	-	1.9
Horn Length: before horny separation	8	13	17	5	8	11
after separation	10	17	20	8	11	13
Sectional Width: cervix	4	7	8	3	4	5
uterine bodies	4	5	7	3	5	7
Horns: cranially	1.3	3	3	1	2	3
the middle	4	6	11	3	4	7
caudally	3	5	7	2		6
Ovaries: length	2.2	2.9	2.9	1.7	1.8	2.8
width	1.3	1.7	2.2	1.2	1.2	2.0
thickness	0.7	1.1	1.6	0.6	0.7	1.1
Oviduct Length	16	22	24	13	15	19

Note: the average development indicators are shown for the right and left uterine horns, ovaries and oviducts (diameter, length, width, thickness)

Thus, according to the mass of ovaries, heifers of group IIb at the age of 15 months have lower indicators of ovarian development compared to analogues of IIa at the age of 12 months by 31.9%. Similar is noted in linear dimensions. This suggests that intensive growth of heifers contributes to the growth of not only their live weight, but also the reproductive organs. The general development of the reproductive apparatus in them is better than in heifers of group IIb in all growing periods.

In adult cows, the length of the egg ducts is 21-28, the inseparable caudal part of the uterus is 5-6, the cervix is – 7-11, the vagina is 22-28, and the vestibule is 10-14 cm. Heifers of intensive cultivation at the age of 15 months the size of the genitals is not much different and has almost the same development as adult cows. At the age of 12 months they had an increase in the mass of the reproductive apparatus compared with the age of 8 months 3.4 times, and heifers of group IIb only 2.9 times; respectively in 15 months compared with 8 months - 5.7 and 4.3 times, and 15 months from 12 months - 61.9 and 84.9%. Although the growth rate of the genital organs from 12 to 15 months of age in heifers of group IIb is 23% higher than that of the experimental one, but this did not allow them to fully compensate for the lag in the growth of the genital apparatus. Heifers of group IIa in terms of mass of the sexual apparatus exceeded analogues of IIb at the age of 8 months by 38.2, in 12 - by 45.8, and in 15 - 57.4%.

The good development of the genital organs of heifers of group IIa, and especially the ovaries, made it possible to carry out their fruitful insemination in the period from 13 to 14 months of age. For this, two calves from group Ia were selected at the age of 12-13 months, who inseminated 20 heifers for a month by manual mating. During a rectal examination, they turned out to be all pregnant and in due time, without complications, became hotels, gave normal viable offspring. Calving calves aged 22-23 months during 1 lactation they were in no way inferior in milk production to heifers inseminated at the age of 24-28 months and calving at 33-37 months.

4 Conclusion

Thus, the intensive cultivation of red steppe young growth positively affects the formation of genital organs and allows the use of bulls to reproduce when they reach 12, and heifers 13-14 months of age. After calving without complications, the heifers showed high milk productivity (for at least 5800 kg of milk after 300 days of lactation) in a timely manner, during the first two months they came to hunting and inseminated fruitfully. This made it possible to introduce young stock into the turnover of the herd for more than a year compared with the traditional cultivation technology, thereby increasing the breeding efficiency and significantly reducing feed consumption for growing young stock.

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