

INFLUENCE of GESTAGENIZATION PROCEDURE on the EWE REPRODUCTIVE PERFORMANCE

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The effect of treatment of Ascanian Merino ewe with progesterone (2.5 or 5.0 mg per animal) before beginning of mating period on following display of heat and results of insemination campaign were investigated. Hormone injection improved the ewe ability to conceive at the time of the first showed heat, increased in quantity of animal that displayed heat, fertility and fecundity, but non-significantly reduced in prolificacy. Taking into account the current prices for hormone and the number of additionally received lambs the method is recommended for practical implementation.

Keywords: ewe, reproduction, progesterone

ВПЛИВ ПРОЦЕДУРИ ГЕСТАГЕНІЗАЦІЇ НА ПОКАЗНИКИ ВІДТВОРЕННЯ ОВЕЦЬ

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На вівцях асканійської тонкорунної породи вивчали вплив одноразової обробки прогестероном у дозі 2,5 або 5,0 мг/гол. перед настанням парувального сезону на наступний прояв статевий

охоти та результати кампанії з осіменіння. Ін'єкція гормону покращувала здатність маток завагітніти у першу проявлену статеву охоту, збільшувала частку тварин з проявом охоти, фертильність та плодючість, але невірогідно зменшувала багатоплідність. З урахуванням діючих цін на препарат та кількість додатково отриманих ягнят спосіб рекомендується для практичного впровадження.

Ключові слова: вівця, відтворення, прогестерон

ВЛИЯНИЕ ПРОЦЕДУРЫ ГЕСТАГЕНИЗАЦИИ НА ПОКАЗАТЕЛИ ВОСПРОИЗВОДСТВА ОВЕЦ

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На овцах асканийской тонкорунной породы изучали влияние однократной обработки прогестероном в дозе 2,5 или 5,0 мг/гол. перед наступлением случного сезона на последующее проявление половой охоты и результаты кампании осеменения. Инъекция гормона улучшала способность маток забеременеть в первую проявленную половую охоту, увеличивала долю животных с проявлением охоты, фертильность и плодовитость, но достоверно уменьшала многоплодие. С учетом действующих цен на препарат и количество дополнительно полученных ягнят способ можно рекомендовать к практическому внедрению.

Ключевые слова: овца, воспроизводство, прогестерон

The key to the success of insemination of ewes is their good preparedness. The preparation stage is begun 1–1.5 months before the start of the insemination campaign. It includes improving of feeding, giving animals an active motion, de-worming, etc. However, animal individual characteristics and the impact of negative environmental conditions can counteract the positive effects of these technological measures and

affect the delay in the displaying of sexual heat and the deterioration of ability of ewes to fertilize. Under such conditions, it is advisable to introduce additional measures that reduce the impact of negative factors and improve the reproductive abilities of animals. However, these measures should not be valuable in order not to reduce the profitability of industry, nor should they significantly alter hormonal status of animals.

The sheep of most breeds that hold in high latitudes are characterized by seasonal reproduction. This is manifested by the fact that in certain months the sexual activity of animals is suppressed, which is accompanied by gradual disappearance of functional corpus luteums in ovaries. Natural renewal of displaying of sexual activity begins with the onset of suitable climatic conditions.

Researches have shown that in the beginning of natural breeding season, a significant proportion of ewes has a so-called "quiet heat", during which ovulation occurs, but there are no external signs of heat [15]. The corpus luteum formed on the site of such ovulation does not develop to normal stage and is subjected to rapid lysis. However, even for its inferiority, the formed yellow body produces progesterone. The latter belongs to substances with gestagen activity and is an important link in regulation of hypothalamic-pituitary-gonadal axes, in particular, participates in the modification of frequency and amplitude of secretion of gonadotropin-releasing hormone (GH-Rh) [16] and changes sensitivity of the hypothalamus to action of estrogens [4]. In other animals, corpus luteums with a short longevity before the first in season heat is not detected, but most of them have an increase in concentration of progesterone in the blood [3]. The source of this hormone may be interstitial structures that are not detected sonographically. The fact of a natural "quiet heat" and registered increased concentration of progesterone in the blood prompted an opinion on the importance of previous "progesterone phase" for a full restoration of sexual activity [7, 11]. The practical aspect of this was embodied in assumption of feasibility of artificially making such a phase as the way of improving the reproductive performance of ewes.

Treatment with gestagens (gestagenization) is used as a preparatory procedure before the next stimulation of gonadotropins in many schemes for induction of ovulation and heat in sheep [1, 6, 8, 14]. This approach has a positive effect and when applying the "male effect" [2, 18]. However, in the literature there is little data about use of progestogens to improve the effectiveness of traditional insemination campaign. In this plan we should noted the work of Kovrizhnyh I.D. et al. [10], in which improvement in overall reproductive performance were noted after feeding of oral progestins to sheep shortly before the beginning of

breeding season. Data on the use of progesterone for this purpose were not found.

The purpose of our study was to determine the efficacy of single-dose injection of progesterone before the onset of the estrous season for the next renewal of sexual activity and results of inseminative campaign.

Material and methods. The experiment was carried out the Askaniya-Nova Research Farm located at 46°27' N. In experiment 336 heads of 1–7-years old ewes of Ascanian Merino breed were involved. Three groups were formed, which were held together in one pen. The first experimental group (EG1) includes 47, the second experimental (EG2) – 43, the control (CG) – 246 animals. The experiment was initiated by a single intramuscular injection of 2.5% progesterone oil solution in the amount of 2.5 mg/head (EG1 group) or 5.0 mg/head (EG2 group). Control animals were not injected.

It is known that the natural renewal of sexual heat in most animals of this breed falls to the last third of August–the first half of September [12]. In view of this, the progesterone was injected to animals on August 16, 2016, and the campaign for insemination was initiated from September 15th.

The insemination campaigns were carried out in two sequential steps: at the first stage after heat detection ewes were inseminated one time in the morning with fresh sperm of tested rams – the period of “controlled insemination”, at the second stage rams were joined with flock to free mating with ewes, which remained infertile, – the period of “uncontrolled mating”. Heat in ewes was detected with use of ram-teasers with the tied aprons. Outside of the inseminative campaign ewes and rams were held in pens remote at a distance of at least 50 meters from each other.

All rams, the sperm of which were used for insemination, were pre-evaluated on the quality of sperm production, ram-teasers – on the displaying of libido.

The effect of gestagenization was determined by the indicators of sexual activity during the inseminative campaign of 2016 and the results of lambing in 2017. The indicators with which sexual activity was assessed were:

- IH_i – *index of heat* – was equated to 1, if ewe showed heat during period of “controlled insemination” or lambing after “uncontrolled mating”, and $IH_i=0$, if both the animal didn't showed heat and didn't lambing after “uncontrolled mating”;

- IHT_i – *index of heat time* – was equated to 1, if ewe showed the first heat during the first 20 days of the insemination campaign; $IHT_i=2$, if ewe showed the first heat after 20 days from beginning of the insemina-

tion campaign; $IHT \neq 3$, if ewe didn't showed heat during period of "controlled insemination" but lambled after "uncontrolled mating"; $IHT \neq 4$, if ewe both didn't showed heat during "controlled insemination" and didn't lambled after "uncontrolled mating";

- ICT_i – *index of conception time* – was equated to 1, if ewe fertilized in the first heat, $ICT \neq 2$, if one fertilized in the second heat, $ICT \neq 3$, if animal fertilized in the third or fourth heat, $ICT \neq 4$, if ewe remained barren;

- IL_i – *index of lambing* – was equated to 1, if ewe lambled single, 2 – lambled twins, 3 – triplets or more lambs, 0 – if ewe did not lambled;

The reproductive performance of sheep was determined by traditional traits:

- $E\%$ – *portion of ewes in oestrus* – was calculated by dividing the number of ewes, which showed heat during period of "controlled insemination", for the total number of animals and multiplying by 100;

- $F\%$ – *fertility* – was calculated by dividing the number of ewes lambled for the total number of animals and multiplying by 100;

- $Fm\%$ – *fecundity* – was calculated by dividing the number of all the received lambs for the total number of animals and multiplying by 100;

- Pf – *prolificacy* – was calculated by dividing the number of all the received lambs for the total number of lambled ewes.

Previously, we found that all of these indices and traits have a non-linear relationship with the age of the animal (data in the printing). Consequently, the different ratio of the number of animals of similar age in groups can subjectively affect the end results. To avoid this, the end indices and traits of experimental and control groups were calculated as follows: the data of each experimental and control group were divided into subgroups, according to how many full years the animal's age was at the time of insemination. For each subgroup, the indices and traits was obtained by averaging the data of animals that were part of this subgroup. End-points of experimental and control groups were calculated by averaging the indices and traits of their subgroups.

Results were statistically calculated with the common accepted ANOVA algorithms with use of the mathematical tools of the program "Excel" of package "Microsoft Office". The probability (p) of differences in the data was determined by calculating the Student's coefficient (t_d).

Results. The treatment of animals with progesterone (gestagenization) in both doses non-significantly increased in the number of animals that showed heat ($E\%$) and fertility ($F\%$) (tabl.) At the same time, a dose of 2.5 mg/head showed a more noticeable effect than injection 5.0 mg per head.

The prolificacy of treated animals was non-significantly diminished, but, due to the increase in E% and F%, the average fecundity (Fm%) of the experimental animals was greater than that of the control animals.

The analysis of indices of renewal showed that all experimental animals had heat – the index IH_i was equal to 1. This suggests that even those animals that did not show heat during the period of "controlled insemination" became pregnant after "uncontrolled mating". Reducing in the ICT_i index in experimental animals showed that progesterone injections improved the quality of the ova that ovulated at the time of the first displayed heat. At the same time, an increase in the IHT_i index in the animals of the EG1 group indicated a certain inhibition of the displaying of the first heat, which could have led to a decrease in the number of ovulated ova (a decrease in Pf), while improving animal fertility (an increase of F%). The dose of progesterone at 5.0 mg/head (group EG2), in contrast to 2.5 mg/head, a few accelerated the displaying of heat (a decrease in IHT_i against the indicator of the control group). This dose also improved the ability of animals to conceive at the first heat (reduction of ICT_i against the control), although not as definitely as in the EG1 group. The IL_i index, which is an individual indicator of the fertility of the individual animal, was the largest in the EG1 group and the lowest in the control.

Table. Influence of the gestagenization procedure of ewes before the start of the breeding season on the indexes of sexual activity and reproductive traits

Group	N/n*	Reproductive traits and indices of renewal			
		E%	F%	Fm%	Pf
EG1	7/47	90.0±4.1 ^a	94.3±6.2 ^a	108.9±7.1 ^a	1.17±0.06 ^a
EG2	7/43	89.7±5.3 ^a	89.7±7.9 ^a	106.6±10.8 ^a	1.19±0.06 ^a
CG	7/246	85.4±1.9 ^a	85.9±2.5 ^a	105.1±4.3 ^a	1.23±0.06 ^a
		IH_i	IHT_i	ICT_i	IL_i
EG1	7/47	1.00±0.00 ^b	1.50±0.06 ^a	1.44±0.23 ^a	1.09±0.07 ^a
EG2	7/43	1.00±0.00 ^b	1.42±0.13 ^a	1.51±0.11 ^a	1.07±0.11 ^a
CG	7/246	0.93±0.02 ^a	1.45±0.09 ^a	1.65±0.08 ^a	1.05±0.04 ^a

Note. * N - number of age subgroups, n - total number of animals in a group (head). Data in same column with different subscripts differ with $p>0.05$.

The calculation of the results of the experiment without division into age groups showed that the fecundity in the group EG1 was 112.8%, EG2 – 104.7%, in the control – 102.0%. Thus, treatment of ewes with a progesterone promoted the obtaining of 2–10 added lambs per 100

ewes. Corresponding parameters of prolificacy were 1.18 ± 0.06 , 1.18 ± 0.06 , and 1.20 ± 0.03 lamb/ewe. The analysis showed that injections of progesterone had a more negative effect on the prolificacy of 7-year-old ewes.

Taking into account the current prices (7 UAH per 1 ml of 2.5% progesterone, 150–200 UAH per 3–4-day old lamb), the calculation showed that the implementation of a single treatment of ewes with a progesterone in dose of 2.5 mg/head before the start of the breeding season helped to receive additionally 800–1300 UAH per 100 ewes.

The transition of sheep to an intensive type of development requires an increase in the efficiency and predictability of animal insemination. In order to achieve this, it is necessary to use complexes of measures to improve the sexual activity and increase in the fertility of ewes. Experience has shown that traditional approaches that include improving quality and increasing volumes of feeding are not always effective. The results of this experiment showed that one of the auxiliary ways may be a single treatment of animals with progesterone.

We associate the revealed positive effect of progesterone with the time of carrying out of experiment. As already noted, the beginning of the restoration of sexual activity in sheep of the Ascanian Merino breed falls to the second half of August–the first half of September [12]. Theoretically, the time of injection of progesterone in our experiment was synchronized with period when animals naturally initiate a “quiet heat”. Artificial gestagenization at this time could simulate the “progesterone phase” in those animals, which for some reason could not do this naturally. An additional injected progesterone could also improve the quality of the first ovulation in animals in which “quiet heat” has no place, but in the meantime the first in season ovulation is accompanied by a displaying of heat, since it is known that such ewes have a deteriorated ability to conceive in the first heat against the similar performance of animals with “quiet heat” [15].

The biologically positive effect of progesterone may explain by its stimulating action on specific structures of as well as ovaries and the hypothalamus [17]. So, in the experiments of McLeod B.J. et al. previous 15-day progesterone treatment prior to the injection of LH-Rh stimulated both ovulation and heat in anestrus sheep, whereas injection only LH-Rh initiated ovulation without displaying of heat [13]. This indicates the role of progesterone in the preparation of certain hypothalamic sites, which are responsible for the manifestation of oestrous behavior, to action of estrogens. Positive influence of gestagenization on ovarian structures is proved by analysis of substances synthesis and genes expression. In particular, IGF-1 content in antral follicles of all sizes after injection of LH-Rh was significantly higher in sheep pre-injected with proges-

terone [9]. Treatment of anestrus sheep with progesterone before multiple injections LH-Rh significantly increased in the synthesis of mRNA of vascular endothelial growth factor (VEGF), its receptor (VEGF-R2), angiopoietin-1 and -2, TIE-2 in large follicles, indicating improvement of blood supply of the last [5].

Conclusions. Single treatment of ewes with progesterone, which preceded the start of inseminative campaign, improves the reproduction traits of sheep. Improvement is reflected in the improvement of the ability of ewes to conceive.

2. The dose of progesterone 2.5 mg/head is more effective than 5.0 mg/head.

3. Method of preliminary gestagenization of ewes, which precedes the beginning of the natural breeding season, can be recommended as a practical way to improve the efficiency and consolidation of the inseminative campaign.

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