PRELIMINARY TESTS ON THE INDUCTION OF ESTRUS DURING THE NON-BREEDING PERIOD IN TURCANA SHEEP

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Abstract - Reproduction in sheep is a topic of interest, finding an efficient method depending on the breed of sheep, the livestock of the farm and the geographical region is a permanent challenge in zootechnical farms. Inducing and synchronizing oestrus during non-breeding season is an essential technological method of assisted reproduction for sheep. The study proposes a method of inducing and synchronizing estrus during non-breeding season based on vaginal sponges with FGA, the administration of PGF2α and GnRH in sheep of the Turcana breed. Several parameters were analyzed: sponge loss rate, vaginitis onset rate, total percentage of ewes in estrus and gestation rate. Based on the values of the induction rate and the synchronization of estrus during non- the reproductive period in sheep from the Turcana breed of 86.66%, respectively a gestation rate of 88.46% we can conclude that the method used was the efficiency.

Keywords - Sheep, Estrus, Fertility, Gestation.

I. INTRODUCTION

Management of reproduction in sheep involves the use of biotechnological methods aimed at increasing the reproductive potential of the animals. For this, a deep knowledge of the biological reproductive patterns of sheep is important, the application of biotechnological methods should only be performed on healthy animals with optimal physical condition [1]. To optimize the management of the reproductive function of sheep, a series of zootechnical and organizational measures are currently implemented, but biotechnological processes are applied: induction and synchronization of estrus, respectively ovulation, induction of superovulation, artificial insemination or embryo transfer [2].

During the non-breeding season (spring and summer), as well as in animals that do not show signs of estrus (for 20 days or more from the beginning of the breeding season or remain non-pregnant after the first heat/insemination) it is necessary to stimulate sexual behavior and promote pregnancy as soon as possible. Since after calving in some breeds of sheep there is a refractory period, it is established that the stage of sexual arousal manifests itself only with the onset of autumn, when the daylight shortens [3]. As a result, the induction of estrus in sheep during the non-breeding period is a necessity with the aim of increasing the fertility and birth rate.

Synchronization of estrus in sheep is a very important breeding technique as it can effectively improve the reproductive performance of sheep, shorten the estrus interval and increase the gestation rate and birth rate, it can lead to the shortening of the time between generations [4]. In sheep farms where increasing lamb production is the main objective, timing of estrus becomes an important factor as it can minimize the effects of seasonal factors on sheep reproduction, extend the breeding season of sheep, adjust the delivery time of lambs, shorten the lambing cycle calving, can achieve two to three deliveries of lambs in a period of 2 years, which ultimately leads to a low economic cost of reproduction, but increasing the number of lambs and implicitly obtaining economic benefits [5]. So, inducing estrus during the non-breeding season and increasing the fecundity rate in sheep offers the best opportunity to increase the efficiency of lamb production.

In sheep during the breeding season, prostaglandins can be used because a functional corpus luteum must be present in the ovaries. Instead, during the non-breeding season, females should be treated with progesterone-based treatments, accompanied by equine chorionic gonadotrophin (eCG), releasing hormones and other compounds. Induction and timing of estrus during the non-breeding season in sheep was achieved using intravaginal sponges impregnated with synthetic progesterone analogues.

However, the effect of hormonal drugs on the female reproductive system manifests different modes of action depending on the functional state of the reproductive organs, but also on the hormonal state. There may be situations where medicines are administered incorrectly and then the consequences may occur. Also, there is insufficient knowledge about the patterns of change in the reactivity of the sexual nervous centers and the corresponding reactions of the body to the administration of hormones, their effectiveness can be reduced, which limits their

widespread use. In general, the induction and timing of estrus in sheep is currently an important direction of scientific research and a problem of interest for sheep breeding [6].

The aim of the study was to optimize a method for inducing and synchronizing estrus during the non-breeding period in Turcana sheep, respectively to assess the efficiency of the method based on some reproductive parameters.

II. MATERIALS AND METHODS

A. Animals taken in the study

The study was carried out between April 17, 2023 and July 10, 2023, in a sheep farm in the western part of Romania. Thirty healthy sheep (n=30) from the Turcana breed (the oldest and best-known sheep breed in Romania) with a weight of 47.51 ± 3.75 kg represented the experimental group. The ewes were randomly selected from the flock, the ewes are in their second or third lambing.

In these sheep, all lambing's took place normally, without dystocia and without dead lambs. Ewes in this study were separated from the rest of the flock and subjected to the estrus induction and timing protocol scheme. Rams belonging to the same breed, healthy, with a weight of 75.21 ± 4.28 kg were introduced into the paddock after the administration of hormonal treatment according to the proposed synchronization scheme.

All the experimental procedures applied in the present study received the approval of the ethics committee of the University of Life Sciences "King Mihai I" from Timisoara.

B. Estrus synchronization protocol

All ewes were treated with FGA (45 mg) vaginal sponge (CHRONOGEST CR-20 Vaginal Sponge, Intervet Production SA, Rue deLyon, F-27460 Igoville, France). Before using FGA vaginal sponges, in order to prevent vaginitis in sheep, all 30 sponges were placed in a container with a solution of 160 IU of penicillin sodium, and the contents of the container were shaken for 5 minutes so that the penicillin sodium to spread evenly on the surface of the sponges.

The sponges were introduced into the vagina with the help of the device vaginal applicator, the day of the introduction of the sponges being day 1 of the estrus synchronization and induction protocol. PGF2α (0.1 mg) was injected intramuscularly on the ninth day. The sponges were removed on day 11. Sheep were given 6 µg of GnRH by intramuscular injection 36 hours after sponge withdrawal.

C. Estrus detection and monitoring

Ewe estrus was detected twice daily using aproned rams. Ewes were determined to be in estrus when they exhibited a standing reflex in response to the sitting ram. The number of ewes in estrus was determined 24, 36, 48, 60 and 72 h after administration of the synchronization treatment. The percentage of ewes in estrus during the different mentioned periods against the total number of ewes in estrus was then calculated.

Likewise, it was followed throughout this period if the loss of the sponge occurred and if vaginitis set in. The onset of vaginitis was also observed when the intravaginal sponge was withdrawn. Sponge placement and removal, evaluation of sponge loss, and identification of vaginitis were always performed by the same person. The foul-smelling state and the purulent discharge from the sheep's vagina would have been the symptom of vaginitis.

After approximately 60 days from mating, the onset of pregnancy was identified using the MiniTube Sonograf (Minitüb GmbH, Germany).

All determinations were centralized: sponge loss rate, vaginitis installation rate, total percentage of ewes in estrus and gestation rate were calculated.

Sponge loss rate (%) = number of ewes that lost sponge/number of ewes treated with intravaginal sponge × 100,
Vaginitis rate (%) = number of ewes showing vaginitis/number of ewes treated with intravaginal sponge × 100,
Percentage of ewes in estrus (%) = number of ewes in heat/number of ewes in heat × 100,
Gestation rate (%) = number of pregnant ewes/number of mated ewes × 100.

III. RESULTS AND DISCUSSIONS

Over time, numerous hormonal treatments have been developed and perfected to influence the sexual cycle of sheep. The choice of a scheme and method of regulation depends on the breeding season, but especially on the time of year. Prostaglandins are known to be used during the breeding season, while other hormones present in estrus stimulation schemes are used during the non-breeding season.

These treatment regimens use: progesterone, gonadotropin-releasing hormones (GnRH), equine chorionic gonadotrophin (eCG), releasing hormones and other compounds. For sheep, intravaginal sponges impregnated with synthetic progesterone analogs are frequently used because they are more active compared to natural hormones in low doses and the administration of progestogens is the method of estrus detection because it causes [7], [8].

Based on the observations and determinations made at

the barn, the values were centralized and the following parameters of interest were determined: sponge loss rate, vaginitis installation rate, total percentage of ewes in estrus and gestation rate. The obtained values were represented graphically Fig. 1-Fig. 2.

Analyzing the dynamics of coming into heat of the flock of sheep in the experimental group, we find that their establishment was mainly achieved in the time interval 24-36h, respectively 36-48h after the injectable administration of GnRH. Out of the total of 30 sheep in the experimental group, 34.61% showed heat in the 24-36h interval, respectively 42.30% in the 36-48h interval (Fig. 1). Estrus induction was achieved in 86.66% of the sheep of the experimental group.

Vaginal sponges impregnated with FGA remained intravaginal throughout the duration of the experiment, none of the sheep lost the vaginal sponge. It should be noted that vaginitis was not detected in any of the sheep as a result of the use of vaginal sponges (Fig. 2).

Regarding the rate of loss of sponges by sheep, the results of previous studies are not conclusive. According to some authors Fonseca et al., [9] and Husein et al., [10] the longer the treatment time of the vaginal sponge in sheep, the more likely it is to lose the sponge, indicating that the treatment time is one of the factors influencing its loss. The results of the study by Yu et al., showed that there was no significant difference in the rate of loss of sponges in ewes between the five estrous timing treatments tested. However, it should be noted that the sponge loss rate showed an increased trend when the sponge was used for 13 days [6].

The studies have shown that local vaginitis and changes in the vaginal flora can present manifestations that appear in sheep that have been treated with the intravaginal sponge. Histological and cytological changes have been reported, due to the inflammatory processes of the reproductive tract, changes that may have an unfavorable impact on the fertility of the sheep in which estrus synchronization is performed.

It has also been identified that abnormal vaginal discharge can occur after ewes have been administered intravaginal sponges to synchronize oestrus. Some of the sheep showed purulent and hemorrhagic discharges after long-term administration of intravaginal sponges [11].

After 60 days from mating, the pregnancy rate was determined and it was found that it has an incidence of 88.46% (Fig. 2), a relatively high percentage.

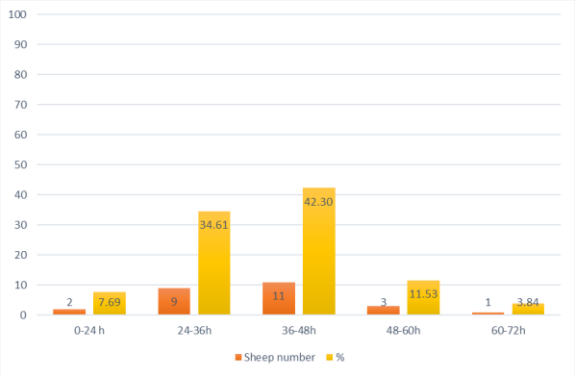


Figure 1. Percentage of estrous ewes in different time periods (%)

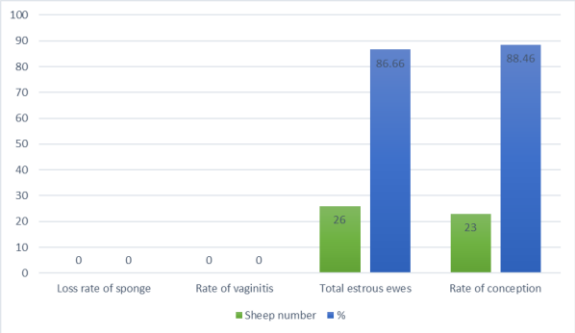


Figure 2. Reproductive performance of Turcana ewes with the estrous synchronization protocol (%)

Regarding the estrus induction rate and the gestation rate, studies have been carried out, the results obtained being different depending on the estrus induction protocol, the breed and the climatic conditions. In this regard, studies were conducted on the effectiveness of using gonadotropin-releasing hormone (GnRH) instead of eCG in Merino sheep involved in a treatment based on intravaginal sponges with medroxyprogesterone acetate. Administration of GnRH at a dose of 100 µg 12 h after sponge removal caused a reduction in the onset of estrus and a higher incidence of heat was observed [6]. Another study recommended the use of surfagon (a GnRH analogue) at a dose of 15 µg (i.m.) in combination with other biologically active substances. The results obtained showed an increase in prolificacy, but also a simultaneous increase in calving weight. The combined use of GnRH and biologically active substances during the breeding season increases fertilization in Merino sheep breeds.

In another study, different methods of stimulating and inducing estrus were taken into account, as well as schemes for introducing complexes of biologically active substances for different breeds of sheep. The general scheme to stimulate the induction of estrus involved the administration of vaginal progesterone sponges for 14 days in combination with vitamin supplements. The authors showed that the use of their improved scheme gives positive results in all studied genotypes and provides a high level of fertilization.

The use of a complex of biologically active substances and a GnRH analogue when the dose of eCG was reduced by 30%, increases the fertility of some sheep breeds [12].

IV. CONCLUSIONS

Estrus synchronization outside the reproductive period in sheep is a valuable management tool, which used successfully can increase reproductive efficiency at the farm level, determining the increase in the pregnancy rate, the increase in the birth rate, the shortness of the period between calvings, the increase in the production of lamb and implicitly an economic increase.

The identification of an experimental protocol to determine an increased rate of induction and synchronization of estrus during non-breeding season in sheep is based on methods and techniques of applied biotechnology.
Combining the administration of vaginal sponges with FGA with the administration of PGF2α and GnRH determined an estrus induction rate during non-breeding the reproductive period in Turcana sheep of 86.66%, respectively a gestation rate of 88.46%.

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