T.C.
ULUDAĞ ÜNİVERSİTESİ
VETERİNER FAK. DERGİSİ
Sayı: 1-2-3, Cilt: 7, Yıl: 8, 1988

SYNCRONIZATION OF ESTRUS IN THE SHEEP

E. Fatih ÜNAL*

ÖZET

Koyunlarda Östrus Sinkronizasyonu

Koyunların et, süt ve yapağı gibi ekonomik verimlerinin önem kazandığı zamanımızda, istenen özelliklerin kısa zamanda ve en ucuza temini için östrus ve ovulasyonun arzu edilen zamana göre planlanması gereklidir.

Bu derlemede, mevcut fonksiyonel corpus luteumu ortadan kaldırarak follikül aktiviteyi oluşturan, kas içi, ve deri altı enjeksiyon tarzında kullanılabilen prostaglandinler ve analogları ile östrus ve ovulasyonu istenen zaman sürecine göre geciktirebilen, oral, deri altı implant, vaginal sünger veya kas içi enjeksiyonlarla kullanılabilen progestagenlerin araştırıcılara göre değişik kullanım yöntemleri özetlenmeye çalışılmıştır.

SYNCHRONIZATION OF ESTRUS

In the production of domestic animals the control of the date of parturation would be an advance in the husbandry of these animals. For example, careful control of estrus would mean uniformity of age of the new born. Labor associated with breeding or care of the new born could be better programmed and capital could be used more efficiently. Likewise, if estrus can be controlled, one could delay estrus in the female during travel or during livestock shows. Another very important field for synchronization of ewe is in embryo transfer.

Manipulation of ovarian function has depended on the following approaches:

1- Blockage of gonadotrophin output (progestin) and then release following by follicle genesis at a designated time.

2- Induction of luteolysis at a designated time ($PGF_2 \alpha$ or infusion of uterine irritants) followed by follicle genesis.

The basic mechanism by which the ovary is discouraged from growing follicles under natural conditions is by a blockade of FSH output by progesterone and possibly estrogen from the corpus luteum of the cycle, the corpus luteum of pregnancy, or possibly the placenta.

* *Yard. Doç. Dr.; U.Ü. Veteriner Fakültesi, Bursa-TÜRKİYE.*

The artificial control methods of cyclic reproductive activity that are available can be divided into two main groups:

1- Non-hormonal methods

a) Light

The onset of cyclical activity in the ewe is dependent upon changes in the hours of daylight[1,2]. In ewes, the provision of housing with controlled lighting enables the breeding season to change from the autumn and winter to spring and summer. Furthermore, by subjecting the ewes to a lighting regimen which does not have any change in duration it is possible to ensure breeding throughout the year as is the case in equatorial climates[3].

b) Nutrition

The effect of nutrition in initiating reproductive activity in seasonally breeding species is not clear. Improved nutrition can exert a profound effect on ovarian function by increasing the number of follicles which mature and ovulate. This effect is described as "flushing", a practise which has been used in land flocks of sheep for many years. By increasing the dietary intake, particularly that of energy, before ewes are tupped. It is possible to increase the number of lambs that are born[4].

c) Male effect (ram effect)

The presence of a male animal can exert its effect upon the cyclical activity of the female. This is well demonstrated in sheep, where the introduction of a vasectomized tup at the start of the breeding season will stimulate the onset of estrus cycles in the majority of ewes and also bring about some degree of syncronization of cyclical patterns[5]. According to a research, this method is potentially cheap and requires a minimum of labor[6]. Normal estrus behavior is expressed at the following ovulation aproximately 20 to 25 days after the introduction of rams.

2- Hormonal methods

A large number of hormones have been used to manipulate cyclic activity in sheep, but there is no universal technique that will cover all controlled breeding situations. For success it is necessary to recognize that several physiological states exist that are controlled by external and internal factors. For example, seasonal changes will determine whether the ewe is in her natural breeding season or in early, mid or late anestrus; her age will describe whether she is a puberal lamb, maiden ewe or mature ewe; and her lactational state will determine whether she is dry because she has not been pregnant or dry because she is either succled or milked in the postpartum period. Each of the possible combinations must be examined before administrations. From this point of view it is possible to initiate ovulatory activity in the anestrus period.

Aims designed to produce two lamb crops a year have been described. For this reason treatment with progesterone 1 progestogens for 12 to 16 days followed by the administration of PMSG within 24 hours after cessation of progesteron therapy have been used. For example, according to their physiological status have been used Flurogestone acetate (FGA) and PMSG: Treatment procedures for initiating ovulatory activity in the anestrus period:

Physiological status	Dose FGA (mg)	Dose PMSG (IU)
Dry ewe	40	400 - 800
Succling ewe	40	500 - 800
Puberal lamb	40	400 - 600

Poor results have been obtained when the technique is used with that experience very deep anestrus and also the use of PMSG alone to induce estrus[7,8]. In seasonally anestrus early postpartum and lactating ewes it is not very successful, probably due to the influence of prolactin[9].

This technique was effective in advancing the onset of the breeding season in ewes. Robinson[10], reported that 93 % estrus rate can be expected with PMSG treatment and 73 % without PMSG and lambing rate of 60-70 % can be achieved after two cycles with nutural service. PMSG treatment may not always be necessary if her own natural breeding season is on.

It is possible to use syncronization by progesterone/progestogens combination in different ways:

a) Oral administration

The most commonly used oral progestogens are: MAP (medroxyprogesterone acetate-Provera), CAP (chlormadinone acetate-chlormadinone), FGA (fluorogestone acetate-cronolone), MGA (melengestrol acetate).

The minimum daily dose of CAP and MAP to completely inhibit estrus and ovulation is 1 mg/day. After the applications estrus appears but ovulation does not, and the persentage of conception rates to service at the first overt estrus after progestogen withdrawal has been low ranging from 23 to 38 %[11,12]. Eight mg/day of FGA orally after administrations of PMSG on the last day of treatment are more successful and 83 % are found is estrus after treatment between 48-68 hours. Velle and Helle[13], over a 12 year period subjected ewes to estrus syncronization using a daily dose of 50 mg MAP for 10 days during the breeding season. The experiments covered 378 individual cycles and 89.3 % of the animals came in heat within 6 days of the last day of treatment. The lambing rate at the first estrus after treatment was 74.4 %.

b) Injection

Twelve mg of progesterone injected every 2 days for a total period of 12 days is adequate to provide good syncronization. Application of PMSG (400 IU) on the day following the cessation of progesterone usage significantly advances and improves the precision of time of onset of estrus and ovulation. Fertility has been variable ranging from a 13 to 80 % lambing rate after natural service or AI[14].

c) Intravaginal sponges

Robinson[15] first reported the successful use of intravaginal sponges with a solution of synthetic progestagen in cyclic ewes. According to the workers[16,17], this technique following a 15 day insertion leads to effective suppression of estrus and ovulation. Possible dose rates are shown in the table below:

Physiological status	Dose FGA (mg)	Dose PMSG (IU)
Dry cyclic ewe	30 - 40	0 - 400
Succling ewe	30 - 40	400 - 600
Puberal lamb	30 - 40	250 - 400

It is possible to use also MAP, and the best results have been obtained with sponges containing 20-80 mg MAP[18].

Also Kılıçoğlu at all[19], introduced MAP sponges (60 mg) into the vagina of goats. The pregnancy rates at the first estrus after the syncronization was 60 %.

To syncronize groups of cyclic ewes with the use of progestagen impregnated sponges only, better conception rates have been obtained when PMSG was injected at the time of the withdrawal of the sponges[20].

Fertility may be reduced when ewes are mated at the first syncronized estrus. This may be due to poor absorption of the progestagens from the sponge or to an effect of the abnormal steroid balance on sperm transport and survival. For this reason intravaginal pessaries must be prepared using standardized controlled techniques that ensure equal distrubution of progestagen throughout the sponge and also attention must be given to the nutritional requirements of both ewes and rams in the program, both prior to and during treatment.

d) Subcutaneous implans

The technique is characterized by a more rapid onset of estrus after progestogen withdrawal and ovulation after the commencement of estrus occurs earlier. There is an advantage to use silastic implants for the continuous progesteron administration with a minimum of animal handling[21].

Ainsworth and Walynetz[22], reported that they got better results with S_2 and S_3 implants than after treatment with vaginal sponges. Spitzer and Carpenter[23], reported two groups experiments: Exp. 1- cronolone pessary alone, 96 %, — norgestomet implant + inj. of norgestomet + EV (estradiol valerate), 92 %.

Exp. 2- cronolone pessary + inj. of norgestomet + EV, 84 %,
— norgestomet imp. + inj. of norgestomet + EV, 96 %.

In the first experiment they found 80 % pregnancy rate and in the norgestomet treated 59 %. In the second experiment no significant differences were observed. Pregnancy rate between the two treatment groups were; cronolone 57 %, norgestomet 65 %.

Use of prostaglandins

When $PGF_2\alpha$ or its analoges given to ewes with a sensitive corpus luteum, estrus occurs 36-46 hours after injection. In order to synchronize a group of ewes at randomly different stages of the estrus cycle it is necessary to give two injections 8-9 days apart. Conception rates and prolificacy following natural matings have been comparable to unsyncronized ewes[20].

Single injection techniques have been described with the following results:

- $PGF_2\alpha$ 15 mg on day 9 of cycle, 86 % in estrus 2 to 3 days after treament,
- $PGF_2\alpha$ 16 mg between days 7 and 11 of cycle, 66 % in estrus 2 to 3 days after treatment[24].

Loubser and Niekerk[25], used double injection of $PGF_2\alpha$ at two different dosage levels, 5 mg and 10 mg, eleven days apart, which was compared to a combination of MAP sponges and 5 mg or 10 mg of $PGF_2\alpha$ The combination of MAP sponges plus 10 mg $PGF_2\alpha$ gave the best synchronization results (94.4 %) as well as the best conception rate (84.9 %) when ewes were inseminated on a fixed time basis 68 and 80 hours after treatment.

Also Yutaka and Roberts[26], reported $PGF_2\alpha$ treatment associated with MAP intravaginally for 7 days to be more effective than the treatment with $PGF_2\alpha$ or progestogen alone for the control of estrus in cycling ewes.

Hacket et all[27], examined different times of insemination after $PGF_2\alpha$ treatment for 60-72 hours. Prolificacy was not affected by the time of insemination.

Smith[28], reported that the estrus-ovulation time relationship was examined in Romney ewes with progestogen (intravaginal sponge) and gonadotropins (PMSG-HCG or PMSG alone) prior to January and during April breeding season. There were no significant effects of season, hormon treatment or time of insemination on lambing rate.

Fukui[29], treated i.m. with 16 mg $PGF_2\alpha$ to 232 Australion merino ewes at unknown stages of estrus cycle. One hundred and ninety-five of them showed estrus within 5 days of treatment. Ewes in estrus were inseminated non-surgically once with 0.1 ml. fresh, undiluted semen or 0.3 ml. frozen, thawed, pelleted semen.

The 21-day nonreturn rates were as follows:

48.6 % for normal insemination with fresh undiluted semen
27.0 % for normal insemination with frozen, thawed semen
37.8 % for deep cervical insem. with frozen, thawed semen
54.5 % for intra-uterine insem. with frozen, thawed semen.

CONCLUSIONS

Sheep constitute an important part of the livestock industry in the world. Sheep supply an alternative source of food, fiber and milk. To be of value to the sheep-farmer, controlled breeding applications need to be simple, effective and cheap. Several practical methods are now available for the control of the ewe's estrus cycle.

The intravaginal sponge, impregnated with FGA or MAP, is probably the simplest to apply; actually, this type of treatment is one that can be handled by the farmer himself after a minimum of training. An implantation method (miniature ear implant) may not have this same advantage. Other agents for controlling estrus, such as $PGF_2\alpha$ or analogues, even if it were demonstrated that their efficiency equalled that of intravaginal sponges, would undoubtedly remain a prescribed drug and at current costs would probably be more costly to employ than progestagen sponges.

Finally, we may say that the applications of attempts are numerous but still a lot of work has to be done before the best practical method for estrus syncronization in sheep has been found.

REFERENCES

1. HEANEY, D.P., AINSWORTH, L., BATRA, T.R., FISER, P.S., HACKETT, A.J., LANGFORD, G.A., LEE, A.J.: Research for an intensive total confinement sheep production system. Agric. Can. Anim. Res. Inst. Tech. Bull. No: 2, 56 pp. (1980).
2. VESELY, J.A.: Application of light control to shorten the production cycle in two breeds of sheep. Anim. Prod. 26 (2), 169-176 (1978).
3. AMIR, D., SCHINDLER, H.: Oestrus induction and fertility of ewes at the beginning end of the breeding season. Hassadeh, 57 (9), 1663-1667 (1977).
4. TSAKALOF, P., ULACHOS, N., LATUOSAKIS, D.: Observations on the reproductive performance of ewe lambs syncronized for estrus. Vet. Rec. 100, 380-382 (1977).
5. CAHILL, L.P., BLOCKEY, M.A.B., PARR, R.A.: Effects of mating behaviour and ram libido on the fertilitiy of young ewes. Aust. J. Exp. Agric. Anim. Husb. 15, 337-341 (1975).
6. QUINLIVAN, T.D.: Estrous syncronization and control of the estrous cycle. In: Current therapy in Theriogenology. 950-954 ed. Morrow, D.A., Saunders Comp. Philadelphia (1980).
7. CUNNINGHAM, N.F., SABA, N., BOARER, C.D.H., HATTERSLEY, J.J.P.: Plasma hormone levels and reproductive behaviour in anestrous ewes after treatment with progesterone and PMSG. J. Reprod. Fert. 60, 177-185 (1980).
8. LUNSTRA, D.D., CHRISTENSON, R.K.: Fertilization and embrionic survival in ewes syncronized with exogeneous hormones during the anestrus and estrus seasons. Jour. of Anim. Sci. Vol: 53, No: 2 (1981).
9. KANN, G., CARPENTIER, M.C., MEUSNIER, C., SCHIRAR, A., MARTINAR, J.: Eustrus induction and fertility. Jour. Res. Ovine Caprine. Fr. 272 (1975).
10. ROBINSON, T.C.: The control of the ovarian cycle in the sheep. Sydney Uni. Pres. (1967).
11. BENTHIN, G., ROSTEL, W.: Oestrus induction by means of hormone treatment in the ewe. Tierärtzliche Umschau. 33(3), 174-176 (1978).
12. HINDS, F.C., DZIUK, P.J., LEWIS, J.M.: Control of estrus and lambing performance in cycling ewes fed 6-methyl-17-acetoxy progesterone. J. Anim. Sci. 23, 782-786 (1964).
13. VELLE, W., HELLE, O.: Expriences with estrus syncronization in sheep over a twelve-year period using oral MAP treatment for ten years. Jour. of Anim. Sci. 48 (5), 1015-1019 (1979).
14. LAMOND, D.R., BINDON, B.M.: Oestrus, ovulation and fertility following suppression of ovarian cycles in merino ewes by progesterone. J. Reprod. Fert., 4, 57-66 (1962).
15. ROBINSON, T.J.: Use of progestagen impragneted sponges inserted intravaginally or subcutaneously for the control of the oestrous cycle in the sheep. Nature (London), 206, 39-41 (1965).
16. SCHINDLER, H., AMIR, D., PINTO, O.: Oestrus syncronization and breeding manegement in a sheep flock during the breeding season. Hassadeh, 57, 5, 913-919 (1976).

17. AQILLA, S.D.: Syncronization of oestrus in sheep. Ann. D. Ins. Sper. Per. La. Zootec., 8 (2), 139-146 (1975).
18. WRIGHT, R.W. Jr., BONDIO, I.K., GRAMMER, J., KUZAN, F., MENINO, A. Jr.: FSH-LH superovulation in ewes following estrus Syncronization with MAP pessaries. J. Anim. Sci. Vol.: 52, No: 1, 115-118 (1981).
19. KILIÇOĞLU, Ç., ALAÇAM, E., İZGÜR, H., AŞKIN, N., ARİF, Ş., ÖZSAR, Ş.: Estrus syncronization in dairy goat using dinoprost tromethamine (PG) and medroxyprogesterone acetate (MAP). A.Ü. Vet. Fak. Derg., 32 (1), 187-199 (1985).
20. HARASIGN, W.: Use of progestagens. In: Control of ovulation. Ed. D.B. Crington et all. p. 435, London-Butterworth (1978).
21. DZIUK, P.J.: Comparision between natural service and artificial insemination with fresh or frozen sperm an appointed time in ewe. J. Anim. Sci., 35, 572-575 (1972).
22. AINSWORTH, L., WOLYNETZ, M.S.: Syncronization of estrus and reproductive performance of ewes treated with synthetic progestagens administered by subcutaneous ear implant or intra vaginal sponge pessary. J. of Anim. Sci. Vol: 54, No: 6 (1982).
23. SPITZER, J.C., CARPENTER, R.H.: Estrus and pregnancy rates following syncronization with chronolone intra vaginal sponge norgestomet ear implant in cycling ewes. Theriogenology, Vol: 16, No: 3 (1981).
24. LIGHTFOOT, R.J., CROKER, K.P., MARSHAL, T.: Sheep breedings, Proceedings Int. Cong. Muresk. West. Aust. Inst. Tech., p. 449 (1976).
25. LOUBSER, P.G., NIEKERK, C.H. Van.: Oestrus syncronization in sheep with progesterone-impregnated (MAP) intravaginal sponges on A prostoglandin analogue. Theriogenology, Vol: 15, No: 6 (1981).
26. YUTAKA, F., ROBERTS, E.M.: Comparision of methods for estrus syncronization in sheep. The Jap. J. Anim. Rep., Vol: 25, No: 3 (1979).
27. HACKETT, A.J., ROBERTSON, H.A., PENNER, P., McLAUGHLIN, G.R.: Comparision of two methods of syncronizing estrus and subsequent lambing in a commercial sheep flock. Can. J. Anim. Sci., 61, 67-72 (1981).
28. SMITH, J.F.: Estrus, ovulation and conception following timed insemination in Romney ewes treated with progestagen and gonadotrophins. Theriogenology, Vol: 7, No: 2 (1977).
29. FUKUI, Y.: Effect of non-surgical intra-uterine insemination of fertility at first oestrus syncronized by prostaglandin, Jap. J. Anim. Reprod., 23 (3), 116-120 (1977).