ADVANCES IN THE CONTROL OF REPRODUCTION IN SHEEP AND GOATS

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Events Of The Estrous Cycle

The use of transrectal ultrasound (US) imaging to monitor ovarian structures (follicles and corpora lutea) in sheep and goats has greatly improved our understanding of the key events of their estrous cycle. Information produced is helping to improve programs for estrus synchronization, artificial insemination and embryo transfer, or, at the very least, helping to explain program failures and inconsistencies. For the past decade researchers have been able to monitor ovarian activity in small ruminants recording temporal events, measuring the effect of drug treatments and comparing between individuals, breeds, seasons and ages.

Using US data we know that (like in cattle) groups of follicles develop to antral size (>2 mm) in consistent wave patterns during diestrus and, to a lesser extent, seasonal anestrus. Follicular waves emerge from the pool of smaller follicles approximately every 4-5 days in sheep and goats producing 3 or 4 waves per cycle. The last wave, generally about day 12 in sheep and day 15 in goats, produces the ovulatory follicles [1]. There is growing evidence that follicular dominance occurs in both sheep and goats as has been shown to occur in cattle. The growth of small follicles that occurs soon after ovulation (the first follicular wave) is suppressed relative to the growth of one or more large follicles. The ovulatory (dominant) follicle(s) ovulates when progesterone levels decrease allowing positive feedback (primarily estrogens) between those ovulatory follicles and the hypothalamic-pituitary axis. Endocrine profiles (LH, FSH, estrogens, inhibin) relate, as in cattle, to the emergence, development and atresia of follicular waves [2]. Research to improve synchronization and superovulation based on this information has still not changed how most of us apply protocols as the difficulty of managing the cycle makes it less than practical in most cases. Still, as evidence mounts to support benefits from follicular management during diestrus I expect we will see changes to how we manage programs.

Timed Breeding

Poor synchrony of ovulations in estrus synchronization programs used for fixed-time insemination in AI and ET programs has been considered as a possible cause of fertilization failure. In sheep, there is a good synchrony in LH surges preovulation and in the time at which ewes began to superovulate in ET programs with a median time from first to last ovulation of 6 h. To help synchronize the time of ovulation an injection of GnRH (100 ug) 30–36 h after sponge removal has been shown to help in sheep [3]. In goats, the benefit remains controversial. In superovulated goats there is a far greater spread in the timing of ovulation and LH surges. In one small-scale experiment, an increase in ovulation rate and in the number of transferable embryos was obtained in goats treated with GnRH 24 and 48 h after progestagen removal. In another trial, authors reported an increase in ovulation rate in GnRH-treated goats, but with a low fertilization

rate. I recommend the use of GnRH at 30 hr post progestagen removal in our programs for AI and ET.

Recent Canadian research [4] showed a difference in the LH response to three commercial GnRH preparations. Cystorelin produced a higher and more prolonged LH release leading to speculation that it increased ovulation rate in the trial. Would practitioners benefit from selecting one form of GnRH over another?

It is well accepted that teaser rams cause LH release and encourage ovulation, very similar to the result of the GnRH injection [5]. They are widely used in many AI programs outside of North America. Rams are introduced about 36 hrs post progestagen removal. Ewes first marked are first bred. Suggestions are that the ram stimulation assists by improving the synchrony of ovulations within the group. Canadian and American programs could likely benefit from including this natural synchronization aid in AI and ET programs.

Cline and coworkers compared eCG (not commercially available in the USA) with PG600 (Intervet, Millsboro, DE) (containing 400 IU of eCG and 200 IU of hCG) widely used in the USA as the gonadotrophin source in progestagen-timed synchronization programs [6]. Using transrectal imaging they found that P.G. 600 resulted in a significant increase in the spread of the timing of ovulation. This suggests that, while not critical for natural breeding programs, P.G. 600 was less suitable than eCG for timed laparoscopic frozen semen AI. Of particular interest was the spread in the occurrence of ovulation – serving to remind us of the difficulties faced in fixed time AI, particularly important with frozen semen, and again suggesting the benefit from the addition of GnRH treatment or the use of a teaser ram to increase LH and ovulation synchrony .

Breed, season and individual animal variation in ovulation rate has been monitored. Ovulation rate can be clearly shown to rise towards mid breeding season – supporting the previously held belief that programs for AI and ET would benefit from delaying until mid season.

Estrus Synchronization

Synchronization programs using eCG stimulation on animals repeatedly over time have now been shown, after years of speculation, to affect the interval to estrus and ovulation and repeat use risks reducing pregnancy rates in fixed-time AI programs. The delay of ovulation was affected by the number of hormonal treatments previously received by the females. [7]. This may proved to be an important consideration in some programs.

The addition of exogenous progestagens for synchronization and superovulation with or without the present of an active CL has been shown to affect follicular development and the response to superovulation programs [8]. Evidence suggests that response is improved when both the CL and progestagen are present though improved suppression of LH/FSH activity. The recommendation is that programs are started, using progestagen devices, early in the luteal phase taking advantage of combined exogenous and endogenous progestational control.

Melengesterol acetate (MGA), as a feed additive, has been tested for use in synchronization protocols for sheep for many years . Farm trials continue to indicate that it is effective, risk free and time saving (as compared with inserting vaginal pessaries, devices or implants) and economical. Still its use is limited. On-farm trials in Ontario (D. Kennedy, Ontario Ministry of Agriculture, Food and Rural Affairs, Guelph, Ontario; unpublished data) showed results comparable to vaginal progestagen and eCG use when MGA was fed at .125 mg BID for 12 days and 500 iu eCG given 5 to 10 hours after last feeding. MGA is now used widely in Canada for low cost estrus synchronization in sheep and meat goats. In the US, MGA is approved for suppressing estrus in feedlot heifers to improve performance in animals intended for slaughter. It does not carry FDA approval as a product to synchronize estrus. It is not approved for use in sheep and goats.

Light Control Programs

Manipulation of environmental light to alter seasonality of sheep and goats has not been widely used in North America. The cost of light-control barns and concerns regarding ventilation are among the reasons. Over the past decade producers in Quebec and Ontario have been experimenting with adding light (16 hr) from mid December to mid to late January, then beginning a period of reduced light (8hr) and breeding, with or without synchronization programs, under natural lighting in March. Years of producer results suggests they are experiencing a positive outcome, even when applied to ewes late-pregnant or lambing under long light in December and being weaned to breed in March. The advantage is low cost and simplicity, using naturally short-day photoperiod of March and thus avoiding the expense and difficulty of managing tightly closed barns. It is a lot easier to add light than to keep it out.

Sheep and goat semen collection centers in North America are generally small in size and usually operate only during the fall breeding season. Goat bucks in particular have been shown to produce less semen out of season. French research of over a decade ago demonstrated that alternating 30 days of long light (16 hr) with 30 days of short light periods (8 hr) greatly reduces seasonal affects on testicular size and semen production and quality. The program is easily managed and would enhance semen production easily in small centers [9].

Drug Availability For Reproductive Management

Almost all reproductive manipulations require the use of exogenous hormones. Estrous synchronization and control of the time of ovulation are the basis for most. Superovulation, particularly if timing with follicular wave emergence, requires drug use and is essential for embryo and oocytes programs. Canadian veterinarians, while not as well off as in some parts of the small ruminant world, generally have access to many of the drugs required. Our American neighbors, on the other hand, still do not. For developments in the Minor Use and Minor Species drug program visit pages http://www.avma.org/scienact/mums/default.asp (Personal communications Dr. David Scarfe, AVMA Office).

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