Manipulating Sheep Fertility: Why, how and getting the best results?

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Manipulating sheep fertility is a common point of interaction between the vet and shepherd irrespective of flock size. From advancing the breeding season to split lambing shed usage, to facilitating artificial insemination (AI) programmes or embryo transfer (ET), to facilitating the smallholder condense their lambing, the applications can facilitate profitability and in some cases even animal welfare on farm.

When considering manipulating fertility we mean either (a) advancing or (b) condensing lambing or (c) both. Common reasons why flocks might wish to advance the breeding season include: facilitating marketing of early lambs for the premium Easter market; older lambs by autumn enabling breeding of ewe lambs or more forward ram lambs for sale; to spread large flock traffic through restricted lambing shed space. We may wish to synchronise a lambing period to: facilitate AI and ET programmes; in small flocks with limited workforce or who have to hire a ram for small numbers; to increase ease of batching lambs as all of the same age; to condense labour inputs. Either strategy may be aimed at increasing lamb numbers either through manipulating of fertility or by optimising management.

Condensing or advancing the breeding season may simply accelerate, condense or exacerbate clinical disease within a flock. It is essential that flocks considering such strategies have high levels of pre-existing management. For example, suboptimal body condition score, infectious abortion, high stocking density, inadequate staff numbers, poor trace element status etc. will only be exacerbated by having a synchronised lambing window or by asking ewes to lamb at a time of year where the post-lambing metabolic challenge may be significant. These systems are largely higher cost and commercial lambs must reach a premium. Therefore high loss levels and endemic disease cannot be tolerated. This suits best a flock invested in preventative health management. However, we must also recognise that for the part lamb shepherd or the smallholder, condensing lambing and moving, may facilitate much higher levels of attention in the lambing window, higher levels of supervision and attention to detail when managing neonates. There is also potential to reduce costs in these systems i.e. a one week sponged lambing vs a six week lambing.

Tup fertility is also central to any breeding strategy- artificial or otherwise. Ram fertility accounts for 50% of the genetic potential as well as reproductive capability of the flock. With a spermatogenic cycle of 45 days and taking over 6 weeks to improve a body condition score by 1, preparedness is essential and ram health must be at a priority well in advance of mating. Trace element status, body condition score, infectious disease status must be checked prior to mating. With evidence that 12.9% of tups fail ram MOTs pre-mating (Lovatt et al., 2016), assessing ram status in advance is crucial. Whilst the rhetoric has largely changed on the routine use of electro-ejaculation (EEJ) to assess tup fertility in the absence of abnormalities on physical examination, tups for use in manipulated mating could be considered an important exception. These tups are often in high pressure situations and single sire mating groups- indications for routine EEJ.

When considering basic descriptors of ovine reproductive physiology:

- Ewes are seasonally polyoestrus and short day breeders
- Normal oestrous cycle 16-18 days (average 17 days) and oestrus lasts 24 hours (12-36) in adult ewes. Oestrus can be as short as 30 minutes in ewe lambs (Sargison, 2007)
- Ovulation towards the end of oestrus
- Higher altitude > variation

The length of the breeding season varies between breeds with “all year round” lambing breeds having extended breeding windows. Onset in cyclicity in most breeds is triggered by shortening day length, to some extent temperature (Delgadillo et al., 2009) and may be advanced by pheromonal exposure to sexually active rams.

Melatonin facilitates increases in LH pulsatility enabling growth and ovulation of follicles.

**The ram effect**

The sexual activity of male i.e. behavioural, auditory, and pheromone cues trigger cycling in ewes and LH surges can occur within 30 minutes of ram introduction. Ideally isolation from rams facilitates the effect ideally >2 week isolation (>24 hours isolation), 1km, sight, sound and smell. Intermittent exposure can achieve similar results to permanent exposure and even reintroduction increased LH pulses. One study demonstrated that short term exposure less effective vs. 17 days (Kenyon 2008).

40-60% of ewes have a short cycle after introduction of rams i.e. a prematurely regressing CL approximately 3-4 days post introduction. The normal CL generated regresses after a normal cycle and we see behavioural oestrus at approximately 23 days. The further 40-60% after a silent heat at ram introduction generate a CL capable of triggering normal oestrus and therefore cycle at 18-20 days. The ram effect is capable of advancing the breeding season by 2 weeks and is commonly achieved using teaser rams at a ratio of 1:100 ewes in commercial flocks. 84.7% mated in 16 days (Smith 1996)

**Melatonin**

Melatonin implants are used as part of a protocol to advance the breeding season by up to 2 months. The melatonin implant mimics the natural change in photoperiod. The protocol begins 30 weeks pre-lambing, with isolation of ewes from rams, and implantation at 29 weeks pre-lambing.

Regulin has been shown to improve pregnancy rate by 10-30% (Abecia et al., 2015, Lopez Sebastian 1990) by improve embryonic survival (Abecia et al., 2008). Furthermore there is evidence of increased lamb numbers by 0.08-0.25 lambs per ewe (Paladin et al.). Poor results have been demonstrated when the protocol was in for too short a window or ewes were already cycling (Williams, 1992). Ewes BCS 3.5-4 had afaster response (Abecia et al., 2008). Regulin implants in rams have been shown to improve sperm motility and influence acrosome function.

**Prostaglandin**

For use in breeding season only (Henderson, 1985) and needs a receptive corpus luteum to be effective at synchronising the mating window. As a consequence protocols based on two injections 9-10 days apart to target “mid-luteal” CLs. These protocols have been demonstrated to achieve up to 70% pregnancy rate (Abecia et al., 2015). Variable stage of follicular waves may account for results. When combined with Male effect, improved AI results (61%) (Abecia et al., 2015).

**Progesterone**

The most commonly used method of synchronising the breeding season and advancing it when combining with PMSG is the use of intravaginal sponges. Sponges based on a 12-14 day programme
followed by PMSG if necessary at time of sponge removal. Sponges are highly effective in synchronising cyclicity and therefore necessitates a high ewe: ram ratio or 1:10 when using an adult ram or 1:5 if using a ram lamb. A 48 hour delay between sponge removal and ram introduction is essential to prevent repetitive service of a single early cycling ewe. Those not holding to first heat should represent to the ram 17 days later. When using PSMG to breed out of season, it is likely that ewes not holding to the first advanced/synchronised heat will return to quiescence until seasonality returns. Retention rates of over 90% are often achieved, and pregnancy rates to first cycle of >80% are not uncommon.

Sponge application in maiden ewes can be challenging with potential for persistent hymen or immature vaginal canals (Gascoigne et al., 2016).

Long term usage has been demonstrated to compromise fertility with development of anti-PMSG antibodies.

**Conclusions**

We can manipulate the sheep breeding season to facilitate performance, lamb value, genetic gain, animal welfare and ultimately PROFITABILITY. Programmes must be well prepared and general health imperative. Tup fertility is 50% of overall fertility and even more important in compact and single sire mating programmes. Flocks needs to understand what their lambing “may look like” can they manage such a lambing? Condensing lambing may also condense problems- labour, facilities, and underlying nutrition is imperative. As vets, facilitating these discussions and how to achieve optimal results can promote flock engagement with both commercial flocks and smallholders alike.

**Key further reading**


Advancing: Using teasers

40-60% ewes (Boundy, 1996) Animals which show a shortened cycle need to be primed and need another normal cycle.

40-60% ewes (Boundy, 1996) CL after silent heat normal, primes and 18-20 days after teaser in- Behavioural oestrus.

Day 0 2 4 6 8 10 12 14 16 18 20 22 24 26

'Silent' oestrus
(ovulation only)

Fertile oestrus
(ovulation plus behaviour)

From Henderson (1995) InPractice