



Increasing Your Lamb Crop Series

Manage for Seasonal Changes in Reproduction

Introduction

Seasonality of reproduction in sheep is governed by and cued to photoperiod/day length and results in significant variation in the quantity of lamb reaching the market, which often influences price (Figure 1). Therefore, overcoming seasonality by getting a proportion of ewes to breed out-of-season will not only increase the average number of lambs weaned per ewe per year but can also positively impact the marketing of lambs. The annual lambing rate is determined by the proportion of the flock that lambs and the number of lambs born per ewe lambing. Annual lambing rate is also affected by the frequency of lambing. In temperate regions, the seasonal reproduction in sheep limits the lambing frequency to once per year; however, three lambings in two years are often achieved in more tropical latitudes.

SEASONAL REPRODUCTION

Most breeds of sheep in the US are considered to be seasonally polyestrous with ewes having regular reproductive/estrous cycles during the fall months, after which, reproductive activity decreases, and eventually ceases in late spring and summer months in most of the flock (Figure 1). Seasonal changes in reproduction can be observed by changes in the proportion of females showing sexual receptivity (estrus/heat), but also involves an associated decline in the proportion of females ovulating and the ovulation rate (the number of eggs released each estrous cycle). The ram also shows seasonal changes in reproduction including, lower quantity and quality of semen and reduced sexual aggressiveness.

Overcoming seasonality by getting a proportion of ewes to breed out-of-season will not only increase the average number of lambs weaned per ewe, per year, but can also positively impact marketing of lambs.

Seasonality of reproduction in sheep is governed by and is attributed to photoperiod/day length. Decreasing photoperiod, or short days as occurs

in fall and early winter months, are stimulatory and results in increase secretion of hormones that stimulate the reproductive system. Conversely, increasing day length, as occurs in spring and summer, results in the suppression of reproduction.

The seasonal pattern of sheep reproduction results in most ewes being bred during a narrow window in the fall. The majority of their lambs are born in the spring and marketed in late summer and fall, resulting in a depression in prices. Breeding ewes out-of-season in spring and summer results in fall lambing, allowing producers to take advantage of the peak in prices in late fall and early spring (Figure 1).

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Comparison between seasonality of reproduction and lamb price

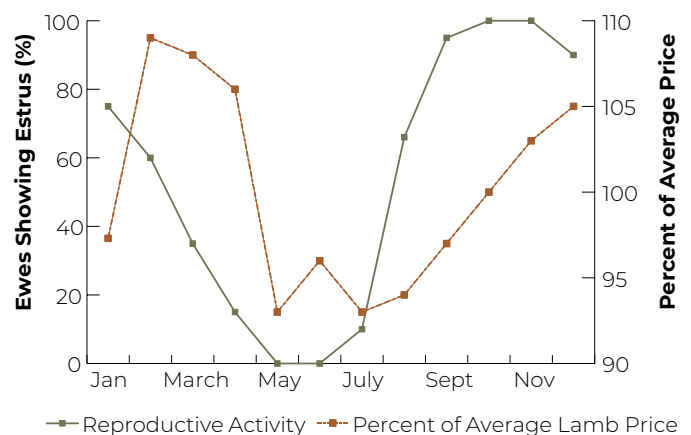


Figure 1



Overcoming seasonality by getting a proportion of ewes to breed out-of-season will not only increase the average number of lambs weaned per ewe, per year, but can also positively impact marketing of lambs.

APPROACHES TO BREEDING EWES OUT OF SEASON

1. Selecting the right breeds: The length of the breeding season varies among breeds of sheep. Most breeds of sheep that originated in the tropics, and those with Merino ancestry, have longer breeding seasons which allows for higher lambing rates to be achieved from spring-summer breeding.

2. Photoperiod manipulation: Exposure to an artificial stimulatory sequence of day length changes can be used to successfully breed ewes out-of-season. Specifically, exposing females to 15 to 16 hours of light during late winter/early spring for 45 to 60 days, followed by exposure to 30 to 25 days of a short day photoperiod consisting of 8 to 9 hours of light and 15 to 16 hours of darkness, will induce fertile estrus in ewes. While photoperiod manipulation can be quite effective, it requires an enclosed barn with electricity, three months of photoperiod manipulation, and it does not result in synchronized estrus.

3. Melatonin treatment: Melatonin is a hormone that is released by sheep when they are exposed to darkness. Sheep are exposed to a longer duration of melatonin secretion during the short days in fall and winter. This long duration of melatonin secretion triggers the release of other hormones that eventually result in the resumption of regular reproductive cycles and mating. Therefore, treatment of sheep with melatonin for as little as 35 days in late spring after they have been exposed to natural or artificial long day

photoperiod induces fertile mating in the summer. The use of melatonin removes the need for holding ewes in barns. However, commercial melatonin implants have not been approved for use in sheep by the Food and Drug Administration (FDA) and can only be used in the United States under the supervision of a veterinarian.

4. Ram effect: The anestrus period in ewes could be broken by abrupt introduction of novel rams. Pheromones, and to a lesser extent physical and visual perception, stimulates the release of hormones from the ewe that result in two peaks in estrus activity 17 and 24 days after the introduction of rams.

IMPROVING LAMBING RATES OF EWES BRED OUT-OF-SEASON

The following management practices can be used to improve lambing rates of ewes bred out-of-season:

1. Use the right genetics: (e.g., Kathadin) Dorsets, Polypay, Finish Landrace, and hair sheep breeds are among breeds with high reproductive rates from spring-summer breeding. Additionally, improvements in the proportion of ewes that conceive out-of-season can be made through selection. For example, the proportion of cross-bred Dorset ewes lambing from a May breeding season increased from 50 to 60% to over 85% due to selection over five generations. Therefore, using an appropriate breed combination and continuous selection can increase the lambing rate from out-of-season breeding.

2. Wean lambs and improve the nutritional status of the ewes: The proportion of ewes lambing to spring breeding is almost twice as high in dry as in lactating ewes (Table 1). Ewes with body condition scores of 2.7 or higher have higher lambing rates from out-of-season breeding than do ewes with lower body condition scores. To improve lambing rates, lambs should be weaned at least one month prior to introduction of rams, and ewes could be supplemented with grain to allow them to regain body condition.

Table 1. Reproductive performance is better in dry than in lactating ewes bred out-of-season.

Variable	Lactation Status	
	Weaned	Lactating
Estrus	95	73
Pregnancy rate (%)	75	27
Percent lambing (%)	81	45

Lactating ewes lambbed 2 to 3 months earlier, while dry ewes were weaned at least 2 months prior to breeding. All ewes were pretreated with progesterone controlled intravaginal drug releasing devices (CIDRs) for 5 days prior to introduction of rams.

3. Isolate ewes from rams: Ewes can become habituated to rams that are in close contact with them and so will not show the ram effect unless the rams are removed for a period of time or new/novel rams are introduced. To maximize the ram effect, separate rams from ewes for approximately one month prior to breeding so ewes cannot smell them.

4. Have a good age distribution of ewes: In general, the lambing rate of ewe lambs and yearlings bred out-of-season is lower and more variable than that observed in mature ewes in part due to lower expression of estrus.

5. Conduct breeding soundness examination on rams prior to use: Reproductively superior rams will not only breed more ewes, but also have higher first service conception rates, lower early embryonic death rates, and improved lambing rates. To identify superior rams, breeding soundness examinations should be performed and observation of libido and social behavior should be done prior to use. Only rams with good sperm concentration, motility, and morphology should be used.

6. Use rams with high sexual activity: The sexual activity of the ram, as assessed by the number of mounts and ejaculations, influences the percentage of ewes ovulating in response to ram effect. Sexual activity increases with age, therefore, using older rams will improve fertility. Additionally, photoperiod/melatonin treatments of rams increase their sexual activity. For example, exposing rams to a long day photoperiod (16 hours of light) during late winter, followed by treatment with melatonin or melatonin treatment (Should this be mentioned as a 'recommended' practice here when in the section above it is noted and highlighted that it is NOT currently an approved practice for sheep. I would suggest reomving from here.) beginning late spring and early summer, enhances sexual activity and increases the ram effect.

7. Use a high ram to ewe ratio: The proportion of ewes ovulating, and subsequently lambing, following ram introduction during the non-breeding season is increased with a greater ram to ewe ratio. This is in part due to the lower semen quality and sexual activity of rams during the non-breeding season and synchronized nature of the induced estrus. In general ram:ewe ratios of more than 1:18, or 6 rams per 100 ewes, is recommended.

8. Pre-treat ewes with controlled intravaginal drug releasing devices (CIDRs): When ewes are treated with progesterone (the hormone contained in CIDRs) for 5 to 7 days prior to ram introduction synchronized estrus and ovulation occur in greater than 70% of the ewes between 2 to 4 days after CIDR removal. Lambing rates are at least 60% higher than that observed in ewes introduced to rams only over a 30 day breeding period (Table 2).

Table 2. Reproductive performance of ewes bred out-of-season is improved by pre-treatment with CIDRs.

Variable	Treatment	
	Control	CIDR
Percent lambing (%)	41 to 45	63 to 83
Prolificacy (%)	150	150 to 160
Lambing rate (%)	60 to 68	95 to 125

Summary of results from studies in which ewes were introduced to rams alone (Control) or pretreated with progesterone (CIDR) for 5 days prior to introduction of rams.

CONCLUSION

Implementing practices to manage seasonal reproduction requires an increased investment and change in management practices. However, lambing rates that are equal to or greater than the current national average can be achieved from out-of-season breeding. Lambs derived from ewes bred out-of-season demand higher prices and will provide consistency in the quality and quantity of lamb in the market place (Figure 1). Moreover, when used as a component of an accelerated lambing program, out-of-season breeding will result in significantly higher annual lambing rates which will improve the productivity and profitability of your sheep operation.

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LITERATURE CITED

- Knights, M., Baptiste, Q.S., & Lewis, P. E. (2002). Reproductive Performance of anestrous ewes treated with used-CIDR devices and estrogen. Joint Annual Meeting of the ADSA/ASAS Quebec City, Canada, July, 21-25, 2002. *J. Anim. Sci.*, 80: (Suppl. 1): 297.
- Knights, M., Maze, T. D., Bridges, P. J., Lewis, P. E., & Inskeep, E. K. (2001). Short-term treatment with a controlled internal drug releasing (CIDR) device and FSH to induce fertile estrus and increase prolificacy in anestrous ewes. *Theriogenology*, 55:1181-1191.
- Knights, M., Baptiste, Q. S., & Lewis, P. E. (2002). Ability of ram introduction to induce an increase in LH secretion, estrus and ovulation in fall-born ewe lambs during anestrus. *Anim. Reprod. Sci.*, 69 (3-4):199-209.
- Knights, M., Baptiste, Q. S., Dixon, A.B., Pate, J.L., Marsh, D., Inskeep, E.K., & Lewis, P. E. (2003). Effect of Dosage of Follicle Stimulating Hormone (FSH), Vehicle and Time of Injection on Ovulation Rate and Prolificacy in Anestrous Ewes. *Small Ruminant Research*, 50:1-9.
- Knights, M., Singh-Knights, D., Bourne, G.A., Inskeep, E.K., & Lewis, P.E. (2004) Use of the ram effect to induce out of season breeding. Workshop on productivity and profitability of ovine enterprises. 7th World Sheep and Wool Congress, July 17-14th Quebec, Canada. July 20, 2004, pp 355-377
- D'Souza, K.N.D., Rastle-Simpson, S.L., Redhead, A.K., Baptiste, Q., Smith, B. & Knights, M. (2014). Gonadotropin stimulation using P.G. 600® on reproductive success of non-lactating anestrous ewes. *Anim. Reprod. Sci.*, 148: 115-120.
- Knights, M., Redhead, A.K., D'Souza, K.N.D., S.L., & Baptiste, Q. (2015). Effect of stimulation with a gonadotropin mixture on reproductive outcome in nulliparous ewes bred during seasonal anestrus and early breeding season. *Anim. Reprod. Sci.*, 159: 198-204.

