SHORT COMMUNICATION

Influence of lambing-to-rebreeding interval on ewe reproductive performance in the anestrous season

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Goulet, F. and Castonguay, F.W. 2002. **Influence of lambing-to-rebreeding interval on ewe reproductive performance in anestrous season**. Can. J. Anim. Sci. **82**: 453–456. Seventy-nine primiparous crossbred Lacaune ewes were synchronized (in the anestrous season) with progestagen sponges, with mating at 75 or 90 d post-partum. Increasing the post-partum interval from 75 to 90 d improved body condition at mating, lambing rate, number of lambs born per ewe lambed, litter weight at birth, and number of lambs born per ewe treated. In conclusion, the productivity of primiparous ewes in an accelerated lambing system tended to improve when the lambing-to-rebreeding interval was increased from 75 to 90 d.

Key words: Ewe, post-partum, anestrus, estrus synchronization, fertility, prolificacy.

Goulet, F. et Castonguay, F.W. 2002. **Influence de l'intervalle agnelage-saillie sur les performances de reproduction des brebis en contre-saison sexuelle.** Can. J. Anim. Sci. **82**: 453–456. Soixante-dix-neuf brebis primipares croisées à prédominance Lacaune ont été synchronisées en contre-saison sexuelle avec une éponge vaginale pour réaliser une saillie à 75 j post-partum ou à 90 j post-partum. L'allongement de l'intervalle entre l'agnelage et la saillie a permis d'augmenter la condition corporelle à la saillie, le taux de fertilité, le nombre d'agneaux nés/brebis agnelée, le poids de la portée à la naissance et le nombre d'agneaux nés/brebis synchronisée. En conclusion, l'augmentation de l'intervalle entre l'agnelage et la remise en reproduction de 75 j à 90 j en contre-saison sexuelle a eu tendance à améliorer la productivité des brebis primipares soumises à un système de production accélérée.

Mots clés: Brebis, post-partum, anoestrus, synchronisation de l'œstrus, fertilité, prolificité.

The objectives of an accelerated lambing system are to increase ewe productivity and provide a more constant supply of lambs throughout the year for market needs. The most common accelerated lambing system in Canada attempts to achieve three lambings in 2 yr for each ewe. In this system, ewes must conceive rapidly after lambing. Thus, reducing the lambing-to-rebreeding interval remains a critical hurdle to ensure maximal reproductive efficiency. To achieve three lambings in 2 yr, ewes must be mated within 95 d postpartum (PP). Therefore, an increasing number of producers attempt to rebreed their ewes soon after weaning (around 60–70 d PP). However, decreasing the lambing-to-breeding interval beyond a certain point may not be the most profitable strategy for producers using the accelerated system. The literature indicates that, in estrous season, uterine involution is generally complete (O'Shea and Wright 1984) and normal luteal function is restored 2 mo after lambing (Wallace et al. 1989a). However, during the anestrous season, a high percentage of ewes are not able to conceive within 2 mo PP due to the negative effect of season on restoration of cyclicity (Cornu and Cognié 1984). Studies have also demonstrated that the duration of PP anestrus is affected by several factors, including nutrition (Wright et al. 1990; Rhind and Moss 1992), body condition (BC) (Bocquier et al. 1993), lactation (Mandiki et al. 1990), and breed (Dufour 1974). Moreover, for spring breeding, both seasonal and post-partum anestrus could delay the return to cyclicity after lambing. To induce fertile estrus during this period, treatment with a progestagen and PMSG is widely used across Canada. The objective of the present study was to compare the effects of two lambing-to-rebreeding intervals (75 vs. 90 d) during the anestrous season on ewe productivity in a commercial flock.

Seventy-nine primiparous crossbred (predominantly Lacaune) ewes in a commercial flock, averaging 1.5 yr of age, were used. During the experiment, all ewes received the same ration, composed of corn silage, alfalfa-millet silage, millet hay, barley, and soybean meal. Rations were calculat-

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Abbreviations: **BC**, body condition; **BW**, body weight; **LPPI**, long post-partum interval; **PP**, post-partum; **SPPI**, short post-partum interval ed according to the National Research Council (1985) requirements for specific physiological periods. Beginning 6 d prior to weaning (approximately 55 d PP), supplements and silages were reduced gradually each day and replaced by hay of lower quality. On the day of weaning and for the next 3 d, ewes were fed only hay. Thereafter, silage was increased daily to obtain a complete flushing ration after 7 d. This ration was fed until 2 wk after synchronized mating.

Following lambing in January and February, ewes were kept in groups of 16 or 17 according to their lambing dates (lactation pen). After weaning, ewes in a lactation pen were allocated into two smaller pens (each with eight or nine ewes), to minimize the range in lambing dates within each pen. Ewes in these pens were randomly assigned to one of the two breeding treatments: mating at 75 d (SPPI) or 90 d (LPPI). Five replicates of both treatments were conducted. To synchronize estrus, ewes were treated with progestagen vaginal sponges (Veramix®, Pharmacia Animal Health, Orangeville, ON) for 14 d. At sponge withdrawal, ewes received an intramuscular injection of 600 IU of PMSG (Folligon®, Intervet, Whitby, ON). Sponges were inserted at 59 and 74 d PP in ewes destined to be mated at 75 and 90 d PP, respectively. Two rams were placed in each pen (of eight or nine ewes) for a 2-d period, starting 48 h after sponge removal. Each pen of ewes was subsequently exposed to a single ram for 17 d, starting 14 d after sponge removal. All rams used were equipped with a marking harness. Mean mating dates for synchronized breeding were l 6 and 20 April for the SPPI and LPPI treatments, respectively.

Body weight (BW) and BC [range of 1 (very thin) to 5 (very fat)] of ewes were measured at lambing and weaning prior to the experiment, and at mating and lambing following treatments. Approximately 80 d post-mating, pregnancy rates were determined by ultrasonography (Aloka SSD-210DX with 3.5 MHz linear-array transducer; Tokyo, Japan). Lambing rates to synchronized estrus, overall lambing rates, and number of lambs born per ewe treated were determined. The experiment was conducted in accordance with the guidelines of the Canadian Council on Animal Care (Conseil canadien de protection des animaux 1993) and was approved by the Laval University Animal Care Committee.

The LOGISTIC procedure of SAS Institute Inc. (1990) was used to analyze the percentage of estrus induction, pregnancy and lambing rates. The CATMOD procedure was used to analyze the number of lambs born and weaned as well as BC and the change in BC between weaning and mating. Body weight and the change in BW between weaning and mating were analyzed with the GLM procedure. The number of lambs born was included in the model used for lamb birth weight and the number of lambs raised was included in the model for lamb weight gain. Data were expressed as means ± SE.

The number of lambs born (1.8 ± 0.1 vs 1.7 ± 0.1) and raised (1.5 ± 0.1 vs 1.5 ± 0.1) at the lambing preceding the experiment (data not shown) were similar for ewes in SPPI and LPPI treatments. Ewe BW (46.4 ± 1.0 kg vs. 44.4 ± 1.0 kg) and BC (2.6 ± 0.1 vs. 2.6 ± 0.1) at the weaning prior to treatment did not differ between SPPI and LPPI groups.

Table 1. Body weight and body condition changes in primiparous ewes mated at 75 d (SPPI) or 90 d (LPPI) post-partum in anestrous season

	SPPI	LPPI	Probability
Number of ewes	39	40	
Body weight at mating (kg)	49.4 ± 1.2	50.0 ± 0.8	NS
Body condition at mating	2.7 ± 0.1	3.1 ± 0.1	***
Change in body weight between weaning and mating (kg)	3.0 ± 0.3	5.6 ± 0.4	**
Change in body condition between weaning and mating	0.13 ± 0.05	0.49 ± 0.05	***
Body weight at lambing (kg)	48.7 ± 1.1	47.9 ± 1.0	NS
Body condition at lambing	2.6 ± 0.1	2.6 ± 0.1	NS

**, *** $P < 0.01$ and $P < 0.001$, respectively.

Table 2. Reproductive performance of primiparous ewes mated at 75 d (SPPI) or 90 d (LPPI) post-partum in anestrous season

	SPPI	LPPI	Probability
Number of ewes	39	40	
Estrus synchronization rate (%)	92.3	97.5	NS
Pregnancy rate at 80 d of gestation (%)	71.8	84.6	NS
Lambing rate to sync hronized estrus (%)	61.5	80.0	$P = 0.06$
Overall lambing rate (%)	64.1	80.0	$P = 0.11$
Interval from mating to lambing (d)	143.4 ± 1.2	141.5 ± 0.9	NS
Number of lambs born	1.75 ± 0.13	2.00 ± 0.11	$P = 0.13$
Lamb weight at birth (kg)	3.2 ± 0.2	3.0 ± 0.2	NS
Litter weight at birth (kg)	5.4 ± 0.4	6.3 ± 0.4	$P = 0.10$
Number of lambs born/ewe treated	1.05 ± 0.16	1.50 ± 0.17	$P = 0.06$

Therefore, ewes of both treatments were very similar prior to the treatment protocol.

The interval between lambing and breeding was 74.4 ± 0.1 d for SPPI treatment and 89.5 ± 0.3 d for LPPI. At mating, BC was greater ($P < 0.001$) for ewes in LPPI treatment (Table 1), but no difference in BW was observed. During the interval from weaning to mating, changes in BC and BW were greater ($P < 0.001$ and $P < 0.01$, respectively) for ewes receiving the LPPI treatment versus the SPPI treatment. There was no difference between treatments for BC or BW at the subsequent lambing.

The percentage of ewes detected in estrus following sponge withdrawal was 92.3 and 97.5% for SPPI and LPPI treatments (Table 2). Although pregnancy rate (80 d) was not significantly different between treatments, there was a tendency ($P = 0.06$) for the LPPI treatment to increase lambing rates to synchronized estrus. Overall lambing rate also tended ($P = 0.11$) to be higher in LPPI (80.0%) than in SPPI (64.1%). The LPPI treatment tended ($P = 0.13$) to increase the number of lambs born. No significant effect on lamb weight at birth was observed for either treatment. There was a trend ($P = 0.10$) toward higher litter weight at birth in the LPPI treatment. Overall productivity (number of lambs born per ewe treated) tended ($P = 0.06$) to be higher for ewes in the LPPI treatment. Ewes in the SPPI treatment produced 1.05 lambs at birth per ewe treated, in comparison to 1.50 lambs for ewes in LPPI.

There was no significant difference between groups in the proportion of ewes immediately following the synchronization treatment bred (overall, 94%). Similarly, Tritschler et al. (1991) reported a 96% estrus rate in ewes synchronized with a similar regimen. The results of the present experiment suggest that PP interval affects reproductive performance in ewes synchronized with a sponge and PMSG and bred during the anovulatory season. In this study, fertility to the synchronized estrus and overall fertility rate in LPPI treatment were 18.5 and 15.9% higher, respectively, than in SPPI treatment. These findings are supported by Cornu and Cognié (1984) who demonstrated that, in Romanov ewes synchronized (with a vaginal sponge) in the anestrous season, an increase in PP interval improved lambing rates (41.0, 67.6 and 86.4% for PP intervals of 50, 65 and 80 d, respectively).

In the present study, only 1.3% of ewes lambed following breeding that occurred between approximately 2 and 4 wk after sponge removal. This is in agreement with Martin et al. (1986) who demonstrated that the use of a progestagen and PMSG treatment during the anestrous season does not induce continuous ovarian cyclicity.

Litter size in ewes mated at 90 d PP tended to be greater (P = 0.13) than in those mated at 75 d PP. These results are consistent with those of Cornu and Cognié (1984), who showed a progressive increase in litter size with increasing PP interval (2.03, 2.29 and 2.74 for 50, 65 and 80 d intervals from lambing to rebreeding, respectively). The number of lambs born for each ewe treated was also higher for ewes in the LPPI treatment. Compared to ewes in the LPPI treatment, those in the SPPI treatment group seemed incapable of achieving their full reproductive potential. This difference in productivity (0.45 extra lambs/ewe treated) is important economically, especially in large flocks with accelerated (every 8 mo) lambing.

Differences in BC at mating and BW variation between weaning and mating could in part explain our results. In this experiment, ewes in the SPPI treatment received 12 d of flushing ration prior to mating, whereas those in the LPPI treatment received 27 d. The length of the weaning-to-mating interval can significantly affect changes in BW and BC, as reported by Merrel (1990). It is generally accepted that diet and nutritional status have substantial effects on sheep reproduction. Wright et al. (1990) showed that the nutritional management of ewes during the breeding season is critical for attaining a short interval from lambing to first estrus. Both BC at mating (Gunn et al. 1991) and the change in BW prior to mating (Molina et al. 1994) were identified as sources of variation in fertility and prolificacy; in a system with three lambing periods in 2 yr, ewes with BC > 3.0 at mating had a higher lambing rate that those ewes with BC < 2.0 (Molina et al. 1994). In our experiment, ewes in the LPPI treatment had higher BC at mating as well as greater changes in BC and BW between weaning and mating, compared to ewes in the SPPI treatment. The mechanisms by which nutrient status, BC and BW affect reproductive performance are not fully understood.

In the present study, several factors, including ovulation rate, fertilization rate and embryo survival may have influenced fertility and litter size. In studies using shorter PP intervals than those used in the present experiment, estrus and ovulation were successfully induced prior to 35 d PP (Wallace et al. 1989a). Embryos recovered from ewes induced to ovulate at 4 wk PP were of good quality (McKelvey 1989) and viable following transfer into ewes at 150 d PP (Wallace et al. 1989b). In addition, poor fertility observed in ewes synchronized in the early PP period did not seem to be related to fertilization failure (Wallace et al. 1989b). However, when ewes lamb during the anestrous season, Cornu and Cognié (1984) suggest that embryonic survival and/or fertilization rate were lower in ewes mated prior to 80 d PP. Gunn and Doney (1975) noted an influence of BC at mating on embryo mortality. Thus, the mechanisms responsible for reduced fertility following progestagen treatment during PP period are not well understood.

The length of the lambing-to-rebreeding interval is one of most important considerations involved in maximizing reproductive efficiency in an accelerated breeding system. In this experiment, increasing the lambing-to-rebreeding interval from 75 to 90 d PP tended to improve the productivity of primiparous ewes (in an accelerated lambing system) synchronized with a progestagen treatment in the anestrous season. Further investigations should be done to establish precise recommendations for sheep producers.

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