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The effect of melatonin on the onset of first oestrus in Romney ewe lambs

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ABSTRACT

Shortened daylight hours have been shown to advance the onset of puberty in ewe lambs. In this experiment the pineal hormone melatonin was administered to mimic short days with the aim of advancing the onset of first oestrus in September-born ewe lambs.

Treatments were; no melatonin in 10 ml saline drenched daily (control), 2 mg melatonin in 10 ml saline drenched daily and 435 mg of melatonin implanted subcutaneously, each on 2 start dates—February 17 and March 17. Fertile rams were introduced on March 10 and April 7 respectively. All ewes were killed on July 28 and foetal crown-rump lengths measured to estimate the date of conception.

The mean dates of first tup in the early treatments were not statistically different (May 25, May 9 and May 13) but there was a difference between the control and implant in the estimated dates of conception (June 1 and May 17, $P<0.05$).

In the late treatments the mean dates of first tup were June 2, May 16 and May 10 respectively ($P<0.01$). However this difference did not lead to a treatment difference in the estimated date of conception because the percentages conceiving to the first tup were 38, 80, and 21 respectively.

INTRODUCTION

One of the reasons for the unpopularity of lambing hoggets amongst New Zealand farmers is that the onset of first oestrus is 6 weeks later than in adult ewes (Hight *et al.*, 1973). The later onset leads to late lambs which can be difficult to grow to a marketable size in summer drought.

In this trial the pineal hormone melatonin, the output of which increases during darkness, was administered to ewe lambs with the aim of mimicking short days and advancing the onset of first oestrus and conception.

MATERIALS AND METHODS

Eighty-five September-born Romney ewe lambs were grown together at pasture from November 23 (weaning) until February 17 when the lambs were divided randomly within live-weight stratifications into 6 treatment groups. Ewes of treatment 1 (control) were drenched daily with 10 ml of physiological saline 6 hours before sunset beginning on February 17; treatment 2 was similar except that the saline contained 2 mg of melatonin/ewe; treatment 3 ewes were implanted subcutaneously on February 17 with silastic capsules containing 435 mg of melatonin. The same treatments (4, 5 and 6) were given to 3 further groups from March 17. Two harnessed fertile rams were introduced to each group 3 weeks after the first treatment with first tup marks being recorded daily from ram introduction until May 13 and then weekly until ram removal on July 1. Ewes were laparoscoped to record number of corpera lutea 3 to 7 days after tup record. Ewes remained with the rams after the record of first tup but further tups and ovulations were not recorded.

Treatments 1, 2 and 3 grazed separate paddocks from March 10 and treatments 4, 5 and 6 from April 7. Treatments 1 and 4 and also 2 and 5 were recombined on April 12, all treatments were combined on May 13 and remained so until slaughter on July 28. The number of foetuses and their crown-rump lengths were recorded at this time. The latter were used to calculate an approximate date of conception using the equation of Cloete (1939) which relates age of foetus to crown-rump length. These approximate dates of conception were corrected to an actual tup date if one occurred within 8 days. This variate was called the estimated date of conception. The ewes were classified according to whether or not they had conceived to their first tup.

RESULTS

All treatments either lost weight or had small gains from mid-February until April 1 (Table 1), among the early treatments these liveweight changes were not significantly different, while among the late treatments the control lost the most weight ($P<0.01$). All treatments gained overall from April 1 to mid-May (Table 1), the greatest gain was made by the melatonin drench group among the early treatments ($P<0.05$) while the late groups were not significantly different. All data were corrected for live weight on April 1 before testing treatment differences.

There were no significant differences between treatments in the percentage of ewes tupped, ovulating at first tup, or pregnant, for either the early or late treatments (Table 2). There was an effect of live weight on April 1 on all variates for the late treatments, but among the late treatments the melatonin drench treatment had a high conception rate (80%), while the implant group had a low rate (21%), the control being intermediate.

There were no differences among the early treatments in the mean date of first tup but among the late treatments the implant group was 23 days earlier than the control while the melatonin group was 17 days earlier (Table 3). This difference among the late treatments was not evident for the estimated date of conception, and there was no live-weight effect on this variate (Table 3). Among the early treatments the difference between the implant and control treatments

TABLE 1 Live-weight changes (kg)

	Initial weight 17/2	Change 17/2-1/4	Change 1/4-16/5
Early Treatment			
1. Control	28.4	−0.7	1.4
2. Melatonin drench	28.1	0.1	3.9
3. Melatonin implant	28.2	−0.9	2.4
treatment		NS	*
Late Treatment			
4. Control	28.2	−2.9	3.2
5. Melatonin drench	28.2	−0.3	3.1
6. Melatonin implant	28.3	0.4	2.6
treatment		***	NS

TABLE 2 Effect of melatonin treatment on the percentage of ewes tupped, ovulating, pregnant and conceiving to first tup

	No. present	% tupped	% ovulating at first tup	% pregnant	% tupped conceiving to first tup
Early treatment					
1. Control	15	53	47	47	50
2. Melatonin drench	14	43	36	21	33
3. Melatonin implant	13	46	38	46	67
treatment		NS	NS	NS	NS
live weight 1/4		NS	NS	NS	NS
Late treatment					
4. Control	12	67	58	42	38
5. Melatonin drench	15	67	67	67	80
6. Melatonin implant	16	88	63	56	21
treatment		NS	NS	NS	*
live weight 1/4		**	**	*	NS

TABLE 3 Effect of melatonin treatment on the mean date of first tup and the estimated date of conception

	Mean date first tup	Range	Estimated date of conception	Range
Early Treatment				
1. Control	25/5	9/5-24/6	1/6	23/5-24/6
2. Melatonin drench	9/5	13/4-23/5	24/5	16/5-8/6
3. Melatonin implant	13/5	15/4-23/5	17/5	7/5-23/5
treatment	NS		NS	
live weight	**		*	
Late Treatment				
4. Control	2/6	10/5-29/6	30/5	23/5-9/6
5. Melatonin drench	16/5	25/4-8/6	21/5	25/4-8/6
6. Melatonin implant	10/5	26/4-23/5	27/5	25/4-26/6
treatment	**		NS	
live weight 1/4	*		NS	

of 15 days was significant ($P<0.05$). There was also a significant effect of live weight.

DISCUSSION

The melatonin implant inserted in mid-February induced first oestrus 12 days earlier than the control. This difference was not statistically significant, and because it was not associated with a drop in conception rate, the estimated date of conception was 2 weeks earlier than the control.

The oral daily melatonin treatment beginning in mid-March brought forward the mean date of first oestrus by 2 weeks while the implant did so by 3 weeks. This result has confirmed the work of Ducker *et al.* (1973) who found that an abrupt decrease in day length from 18 to 12 hours at 5 months of age stimulated the onset of puberty, and that of Kennaway *et al.* (1981) who found that melatonin treatment 8 hours before sunset could mimic the effects of darkness and bring forward the onset in adult Border Leicester × Merino ewes.

There was no difference among these late treatments in the estimated day of conception. This can be explained by the fact that only 3 out of 14 of the late implant group conceived to their first tup.

From these results melatonin appears to have potential for the early induction of oestrus and conception in the ewe lamb. Implantation showed more promise than drenching and was also less work, the only disadvantage being that it used more melatonin (435 *v* 170 mg per ewe, or \$9.50 *v* \$3.75 at retail imported prices). Future experiments will determine whether the implant dose can be reduced, and explore different sites and periods of administration.

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