Seasonal changes in oestrus, ovulation and conception of Coopworth ewes treated with CIDRs and PMSG

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ABSTRACT

Mixed-age Coopworth ewes (594) were allocated to 18 groups on the basis of age and live weight. Three groups (n=33) were treated and joined every second month from June 1986 until April 1987. Ewes were treated with controlled internal drug releasers (CIDR) for 14 d and either 0, 400, or 800 iu. pregnant mare serum gonadotrophin (PMSG) at CIDR removal. Entire Poll Dorset rams (10%) were joined at CIDR removal and changed every 6 h during oestrus. Data on interval from CIDR removal to onset of oestrus, duration of oestrus, ovulation rate, pregnancy rate and lambing performance were recorded for all groups.

The interval from CIDR removal to the onset of oestrus increased in the non-breeding season and this was modified by PMSG treatment which shortened the interval. The duration of oestrus was shorter in the non-breeding season in ewes with no PMSG and longer in ewes with the higher dose of PMSG. Both dose levels of PMSG prevented the out-of-season reductions in the incidence of oestrus and ovulation.

Ovulation rate increased with dose of PMSG and all treatments showed a seasonal change. A decline in conception rate was a major problem even in PMSG treated ewes during the non-breeding season.

Keywords CIDR, PMSG, Coopworth, season, oestrus, ovulation, conception, reproduction, ewes.

INTRODUCTION

The use of progesterone and pregnant mare's serum gonadotrophin (PMSG) treatment to advance the breeding season or to induce oestrus in the non-breeding season has been known for many years (Robinson, 1954). However, there is very little information available on the seasonal differences in the response of ewes to such treatment. Some workers have reported seasonal differences in ovulation rate (Lamond, 1964; Laster and Glimp, 1974; Gherardi and Lindsay, 1980) while others have reported differences in oestrus-ovulation time relationships (Smith, 1977) and time from treatment to luteinising hormone (LH) surge (Echternkamp, 1982). Robinson (1980) has documented a seasonal effect on fertility following intravaginal sponges and PMSG.

The lack of information on changes in response with season is a major constraint to the commercial adoption of out-of-season lamb production in New Zealand. The present trial was conducted to provide basic data on the seasonal changes in reproductive performance of ewes treated with controlled internal drug releasers (CIDR) and PMSG.

MATERIALS AND METHODS

Animals and Design

Five hundred and ninety four mixed-age (3-to 7-year-old) Coopworth ewes were allocated to 18 treatment groups on the basis of age, live weight, and previous lambing performance in the autumn of 1986. Eighteen (2-to 4-year old) Poll Dorset rams were used for mating in 6 teams of 3 rams.

A 3 x 6 factorial (n=33; N=594) design was used. Three ewe treatments compared at 6 different times of the year.

During every second month of the year commencing in June 1986, 3 groups of ewes were treated with (1) CIDR (Alex Harvey Industries, Hamilton. N.Z.) for 14 d; (2) CIDR (14d) + 400 iu. PMSG (Pregnecol, Heriot Agvet Pty Ltd) at CIDR withdrawal or; (3) CIDR +800 iu. PMSG at CIDR withdrawal. PMSG injection was at 0900h. Ewes were then joined with 3 harnessed rams per treatment for mating.

Reproductive Parameters

The time from treatment (CIDR withdrawal) to onset of oestrus and the duration of oestrus (interval from 1st to last tup recording) were determined. Ewes were inspected every 6 h (0300, 0900, 1500 and 2100h) for tup marks. Once the first ewe had shown oestrus then the rams were changed. Each team of rams was alternatively joined or rested for periods of 6 h and joined to a different group of ewes each time.

Five days after CIDR withdrawal the 3 groups of ewes were joined in 1 mob with 5 rams for a further 3 weeks during which tupping records were

taken 3 times weekly. Laparoscopy was performed 9 d after CIDR removal to determine ovulation rate.

Real time ultrasonic scanning was performed 50 to 60 d after CIDR removal. Detailed lambing records were obtained to provide information on preganancy.

Grazing Management

Ewes were rotationally grazed throughout the trial and feed allowances adjusted for seasonal fluctuations so as to maintain a uniform mean live weight at mating (58kg) for all groups.

RESULTS

Mean values of oestrus, ovulation and conception parameters are presented for each treatment and time in Table 1.

There were significant ($P<0.001$) effects of PMSG dose and month of treatment as well as a dose x month interaction on both the time to onset of oestrus and duration of oestrus. The mean time to onset was longer in ewes treated with CIDRs alone (40.9 h) than for those receiving PMSG (37.5 h). There was no difference between the 2 PMSG doses. Time to onset increased in the non-breeding season from 32h in June to 46h in December and back to 32h in April. The interaction was due to there being no differences between doses of PMSG in June or April and a large dose effect in October and December produced by the longer interval in the CIDR only ewes.

Mean duration of oestrus increased with dose of PMSG (14.3h; 16.8h and 26.1h for 0, 400, and 800

TABLE 1 Effect of treatment and season on oestrus, ovulation and lambing in Coopworth ewes.

Treatment	Month of joining					
	June	August	October	December	February	April
Incidence of oestrus (%)						
CIDR	97	48	19	11	78	97
CIDR +400 PMSG	96	94	90	69	97	94
CIDR +800 PMSG	92	87	90	100	97	97
Interval to oestrus from CIDR removal (h)						
CIDR	33.0	51.4	73.8	69.0	44.0	33.4
CIDR +400 PMSG	29.5	40.0	43.0	34.8	34.4	31.1
CIDR +800 PMSG	33.3	37.6	43.1	35.6	33.8	30.4
Duration of oestrus (h)						
CIDR	17.7	18.4	7.8	3.0	10.9	14.6
CIDR +400 PMSG	16.9	23.7	13.0	20.4	17.9	13.1
CIDR +800 PMSG	13.7	27.0	22.6	43.2	31.3	17.6
Incidence of ovulation (%)						
CIDR	100	66	33	27	100	100
CIDR +400 PMSG	100	100	97	100	100	100
CIDR +800 PMSG	100	100	97	100	100	97
Ovulation rate (ovulations/ewe treated)						
CIDR	1.77	1.10	0.44	0.37	1.44	1.88
CIDR +400 PMSG	2.17	1.77	2.03	2.35	2.33	2.23
CIDR +800 PMSG	2.92	2.60	2.50	3.33	3.22	3.13
Conception rate (Ewes pregnant/ewes joined) (%). First cycle only						
CIDR	63	17	11	3	31	42
CIDR +400 PMSG	44	32	30	45	68	52
CIDR +800 PMSG	31	37	43	47	53	55
Conception rate (Ewes pregnant/ewes joined) (%). Overall						
CIDR	83	24	11	7	63	94
CIDR +400 PMSG	67	39	30	52	90	81
CIDR +800 PMSG	73	37	47	50	75	90
Lambs born/ewes joined (%)						
CIDR	133	47	14	3	104	97
CIDR +400 PMSG	113	65	52	87	145	121
CIDR +800PMSG	104	67	77	73	132	118

iu. respectively; $P<0.001$. Oestrus duration also increased out-of-season for the 800 iu. PMSG treated ewes but decreased at this time for those ewes receiving CIDRs alone. This is highlighted by the pronounced dose response seen out of season while no dose effect was seen in season.

The number of ovulations per ewe treated also showed significant ($P<0.001$) effects of dose and month and an interaction between dose and month. There was an increase in ovulation rate with dose of PMSG (1.18, 2.11, 2.88). The CIDR only ewes showed a marked decline from 1.77 in June to 0.44 in October and December followed by an increase back to 1.90 in April. This was primarily due to an increased incidence of anovular ewes out-of-season in this group. No such pattern was seen in the PMSG treated ewes.

The proportion of ewes that conceived to the first synchronised mating was influenced by dose ($P<0.01$) and month ($P<0.05$). There was also a significant ($P<0.001$) interaction between dose and month. Mean monthly conception ranged for 30% out-of-season to 50% in-season, while mean conception in the CIDR only group was 16% and in the PMSG groups 45%. Overall conception rate including ewes that returned to service in the 6 weeks following syncronization showed effects of month ($P<0.001$) and an interaction between month and dose ($P<0.01$). Mean monthly overall conception ranged from 30% out-of-season to 88% in-season. The CIDR only group were again lowest out-of-season but tended to be higher in-season and this cancelled out any overall dose effect.

While all treatments showed a decline in conception out-of-season this was much more pronounced in the CIDR only group. These results are reflected in the reduced number of lambs born per ewe treated out-of-season.

DISCUSSION

These data showed a marked seasonal pattern in the incidence of oestrus and ovulation in the absence of PMSG treatment. Very few ewes exhibited oestrus or ovulated in the period outside the normal breeding season for this breed as defined by Kelly *et al.* (1976) and Smith *et al.* (1987). This is consistent with the seasonal pattern reported by Robinson (1971) for Merino ewes treated with intravaginal sponges.

Treatment with PMSG at the time of CIDR removal at either dose level used in this trial was sufficient to overcome the seasonal inhibition of ovulation and oestrus. Within the breeding season PMSG treatment had little effect on the time from CIDR removal to onset of oestrus or on the duration of oestrus. Out-of-season the time to onset increased considerably in the CIDR only group and this coupled with the much shorter duration of oestrus most probably reflects the seasonal decrease in sensitivity to oestrogen (Fletcher and Lindsay, 1971). The PMSG treated groups tended to have a slightly longer time to onset out-of-season than in-season but their oestrous durations were longer out-of-season. The longer time to onset out-of-season is in agreement with that reported by Smith (1977) for Romney ewes treated with sponges and PMSG. The longer duration of oestrus is more difficult to interpret, although the mean values may have been inflated by an increased proportion of ewes in the higher (800 iu.) PMSG treated group that displayed a split oestrus during the non-breeding season. Some ewes had variable periods in which oestrus was not detected. These periods were preceded and followed by more than 1 oestrous observation.

The seasonal decline in conception rate (ewes primarily due to an increased proportion of non-ovulation ewes in the CIDR only group. There was also some indication of a decline in the ovulation rate of those ewes ovulating out-of-season. These data are consistent with that reported for non-synchronised ewes at those times of the year (Kelly *et al.*, 1976; Smith *et al.*, 1987). In the PMSG treated ewes there was less indication of any seasonal shift although ovulation rates were lower in August and October than at other times. This is in general agreement with the findings of Gherardi and Lindsay (1980) for PMSG treated animals.

The seasonal decline in conception rate (ewes pregnant/ewes joined) for the CIDR only ewes was primarily due to a decline in the proportion of ewes ovulating and exhibiting oestrus. However, this does not explain the decline in conception rate for the PMSG treated ewes. This decline is similar to that reported by Robinson (1980) and may reflect seasonal changes in the fertility of the ram as well as that of the ewe.

In summary the results indicate that while treatment with CIDRs and PMSG is capable of inducing full ovulation and oestrous behaviour in Coopworth ewes out-of-season this is not accompanied by full fertility. Nor did the ewes begin regular cyclic activity after treatment. Thus ewes treated in August, October and December had much lower lambing percentages than those treated in February, April or June. This reduced performance must be regarded as a substantial additional cost to the treatment of ewes for out-of-season lamb production. Techniques for the preparation of rams and mating management strategies should be studied as a means of increasing the out-of-season conception rate.

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