Effect of oestrogen pre-treatment and duration of CIDR® treatment on pattern of onset of oestrus in ewes

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ABSTRACT

Two trials were conducted which examined the effect of duration of CIDR® device treatment on the pattern of onset of oestrus. Trial 1 involved a total of 1,342 (Coopworth or Polled Dorset x Coopworth) ewes treated with either a CIDR® (type G) for 14 days and 400 i.u. PMSG at withdrawal, or a CIDR® for 10 days with 1.0 mg ODB at insertion and 400 i.u. PMSG at withdrawal. Observations were performed each month from February to August. Trial 2 conducted in April involved 4 groups of 50 Coopworth ewes and compared the 14 d CIDR® and 10 day CIDR® + ODB treatments both with and without PMSG at withdrawal.

There was a seasonal shift in the pattern of onset of oestrus in trial 1 with a shorter interval from device withdrawal to oestrus during the breeding season (March-June). The 10 day CIDR® + ODB treatment produced both a delayed pattern of onset in both trials and also a higher proportion of ewes not detected in oestrus. Ewe liveweight also influenced the pattern, with heavier ewes having an earlier onset of oestrus. The effect of PMSG in trial 2 was to advance the onset pattern but this was only apparent when combined with the standard 14 day CIDR® treatment.

Keywords CIDR®, PMSG, ODB, Oestrous synchronisation, Coopworth, Polled Dorset, time to onset of oestrus, liveweight, ewes, duration of treatment.

INTRODUCTION

The conduct of artificial insemination at a pre-scheduled time following oestrus synchronisation of ewes (timed AI) has major savings in time and labour in comparison to that performed upon detection of oestrus (on heat AI) in non-synchronised ewes. However, since the successful outcome of AI depends on insemination being performed at a consistent interval from the time of ovulation, the timed AI programmes are very dependant on the synchronisation technique producing a precise and repeatable response in the ewe (Shackell et al. 1990). Recent reports (Smith et al., 1991 a & b) have shown variability in time from device removal to onset of oestrus in ewes treated with intravaginal devices. In addition there is evidence in the cow that the length of progestagen treatment can effect conception at the subsequent synchronised oestrus (Smith and Tervit, 1980) with the shorter duration of treatment having higher conception rates. Such short term treatment requires the pre-treatment administration of oestrogen to be successful (Smith and McGowan, 1982).

This paper presents data from two trials designed to compare the efficacy of CIDR® intravaginal devices administered for different periods with and without oestradiol pre-treatment.

MATERIALS AND METHODS

Trial 1

Groups of Coopworth and Polled Dorset x Coopworth ewes were given either a standard treatment (consisting of a CIDR® (type G) device [Carter Holt Harvey, Hamilton, NZ] inserted for 14 days with 400 i.u. pregnant mares serum gonadotrophin [PMSG, Pregnecol, Heriot Developments Pty Ltd, Australia] given at time of device withdrawal) or a short treatment (a CIDR® type G device for 10 days with an injection of 1.0 mg oestradiol benzoate [ODB, Sigma Ltd] in arachis oil at insertion and 400 i.u. PMSG on withdrawal). Ewes were joined with either 10% Polled Dorset entire rams or with 10% Polled Dorset x Romney vasectomised rams. Tupping marks were recorded at 0800 and 1600 h each day for 3 days.

The treatments were repeated each month from February to August in 1991.

Trial 2

In April 1991 mixed aged Coopworth ewes were allocated to 4 groups (n=50) and treated with the standard (14 d) or short (10 d + ODB) CIDR® treatments both with and without 400 i.u. PMSG at withdrawal.

Ewes were joined in separate groups with 10% Dorset x Romney vasectomised rams and tupping marks recorded twice daily (0800 and 1600 h) for 5 days.

In both trials fasted (16 h) ewe liveweight was recorded at insertion of CIDR® devices.

Analyses of data

In trial 1 in addition to the effect of CIDR® treatment the analysis included effects of month of year, ewe age, ewe breed, entire vs vasectomised rams and fasted liveweight. In trial 2 the analysis was confined to the synchronisation treatments.

The parameter analysed was the percentage of ewes that had exhibited oestrus by a certain time and this was performed for each tupping time interval.

The values reported in this paper are the predicted values based on the appropriate regression model used in the analysis.

RESULTS

Trial 1

The numbers of animals used varied from month to month and are indicated in Table 1.

There were significant effects of synchronisation treatment ($P<0.001$) month of year ($P<0.001$), ewe liveweight ($P<0.01$) and

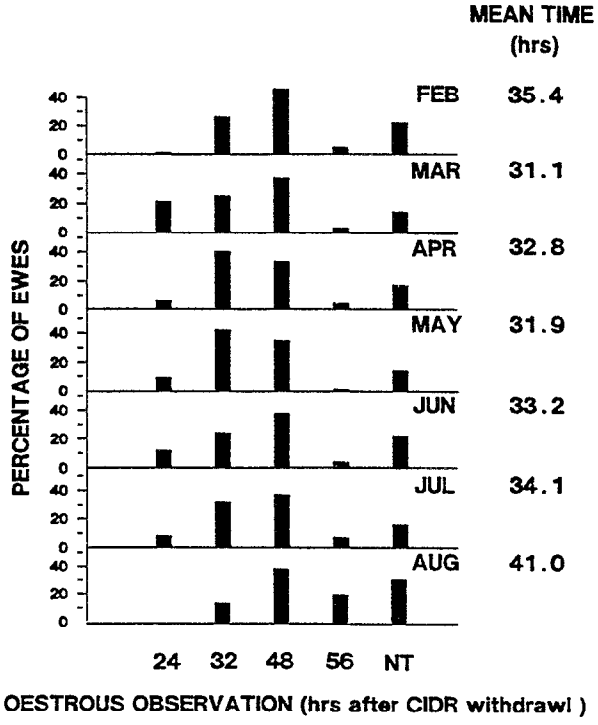
TABLE 1 Number of ewes in each treatment group in trial 1.

Month		Synchronisation treatment: 14 day, Entire ram	14 day, Vasectomised ram	10 day + ODB, Entire ram	10 day + ODB, Vasectomised ram
February	6	25	50	25	50
March	7	25	70	25	70
April	8	26	67	24	68
May	9	24	71	24	68
June	10	25	70	23	72
July	11	25	72	25	71
August	11	25	98	24	100
TOTAL		175	498	170	499

ewe breed (P<0.05) on the proportion of ewes that had exhibited oestrus at each of the times analysed.

The month of year effect is illustrated in Fig. 1. which shows the distribution of onset and mean time to onset from device removal for each month. There was a later onset (in February and August) at either end of the breeding season.

FIGURE 1 Distribution of and mean time to onset of oestrus from device removal for each month in trial 1 (Predicted values meaned for synchronisation treatment and adjusted to a 60 kg ewe liveweight). NT = not detected in oestrus by 56 h.



The synchronisation effect is illustrated in Fig. 2. which shows a slower and more precise onset with the shorter treatment. However this treatment also has a higher proportion of ewes not tupped by 56 hr after device removal. This effect was consistent in all months (Table 2.).

The mean ewe liveweight for the trial was 60 kg and had no effect on the number of ewes exhibiting oestrus. However liveweight effected the pattern of onset with the heavier ewes being earlier. For each 5 kg increase in liveweight (range 45-75 kg) there was an additional 1% of ewes in oestrus within 24 h of device removal and an extra 3% by 32 h.

FIGURE 2 Effect of synchronisation treatment on the distribution of time to onset of oestrus from device removal in trial 1 (predicted values meaned for month of year and adjusted to a 60 kg ewe liveweight). NT = not detected in oestrus by 56 h.

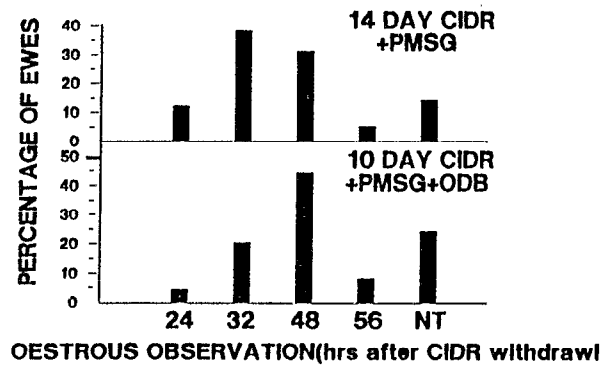


TABLE 2 Effect of synchronisation treatment and month of year on the proportion of ewes exhibiting oestrus at various times after device withdrawal (predicted values) adjusted for 60 kg liveweight)

Month	Synchronisation[1] treatment	Time after device withdrawal (h): 16	28	40	52	NT[2]
February	14 d	2.1	37.8	40.8	3.2	16.1
	10 d+ODB	0.6	14.6	51.8	5.4	27.6
March	14 d	33.7	30.0	25.4	1.3	9.5
	10 d+ODB	12.4	19.9	47.6	2.8	17.3
April	14 d	9.4	54.5	22.0	2.3	11.8
	10 d+ODB	2.7	31.0	41.1	4.2	21.0
May	14 d	11.8	55.8	21.2	1.0	10.2
	10 d+ODB	3.5	32.8	43.3	2.1	18.3
June	14 d	19.6	31.8	32.7	2.9	15.1
	10 d+ODB	6.2	18.2	48.9	5.0	21.8
July	14 d	14.1	40.9	28.7	7.1	9.3
	10 d+ODB	4.3	21.8	45.0	12.3	16.6
August	14 d	0.0	18.9	41.7	18.0	21.3
	10 d+ODB	0.0	5.9	36.7	22.4	35.0

[1]Synchronisation treatment:
14 d = CIDR® type G for 14 days and 400 i.u. PMSG at time of withdrawal
10 d+ODB = CIDR® type G for 10 days with 1.0 mg ODB at insertion and 400 i.u. PMSG on withdrawal.

[2]NT = Ewes not detected in oestrus by 56 h after device removal.

The Polled Dorset x Coopworth ewes tended to have an earlier onset each month compared to the Coopworth ewes and in June and August a higher proportion of the cross-bred ewes exhibited oestrus.

There were no significant interactions between these main effects, however there was an inexplicable interaction (P<0.001) between month of year and type of ram (entire v vasectomised) in the proportion of ewes exhibiting oestrus by 32 h.

Conception rates from the entire matings are presented in Table 3. These show a tendency (P=0.1) for the longer duration CIDR® treatment (14 d) to have a higher conception than the shorter (10 d + ODB) treatment (62.3% v 53.5%) and for conception rates to be lower at either end of the breeding season.

TABLE 3 Effect of month of year and synchronisation treatment on conception rate1 to natural mating with ram:ewe ratio of 1:10.

Month	Synchronisation Treatment[2]	
	14 d	10 d+ODB
February	52.0	56.0
March	72.0	48.0
April	57.7	54.2
May	70.8	50.0
June	72.0	65.2
July	64.0	56.0
August	48.0	45.8

[1]Conception rate = values shown are percentage of ewes treated pregnant at ultrasonic scanning 60 days later.

[2]Synchronisation treatment:

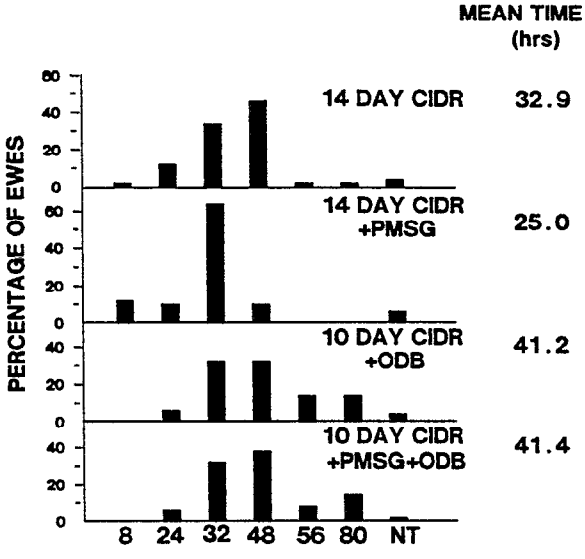
14 d = CIDR® type G for 14 days and 400 i.u. PMSG at time of withdrawal

10 d+ODB = CIDR® type G for 10 days with 1.0 mg ODB at insertion and 400 i.u. PMSG on withdrawal.

Trial 2

There were significant effects of duration of treatment ($P<0.01$) and PMSG ($P<0.01$) on time to onset of oestrus (Fig. 3) with the longer (14 d) treatments being earlier and PMSG also advancing the onset. However most of the PMSG effect was confined to the 14 d treatment.

FIGURE 3 Effect of synchronisation treatment on the distribution of and mean time to onset of oestrus from device removal in trial 2. NT = not detected in oestrus by 80 h.



DISCUSSION

The seasonal differences in pattern of onset of oestrus (with an earlier onset during the breeding season) is consistent with those reported previously (Smith 1977, Smith et al., 1988, 1989, 1991b). This could be due to seasonal differences in sensitivity to oestradiol as reflected in oestrous behaviour response (Fletcher and Lindsay 1971).

The later, and generally more precise, onset with the short term (10 day + ODB) treatment is consistent with that reported for dairy cattle (K. L. Macmillan - personal communication) and is most probably a reflection of better synchronised follicle development in the oestrogen treated ewes. Oestrogen has follicular atretic effects and this type of treatment is considered to achieve a re-programming of follicular waves (Engelhardt et al., 1989). Alternatively the short term (10 day) CIDR® treatment could have produced higher blood levels of progesterone at the time of withdrawal and thus resulted in a later onset, as increased dose of progestagen in the sponge has been shown to delay onset of oestrus (Robinson and Smith 1967).

However the later onset was also accompanied by a tail to the response pattern which resulted in more ewes not detected in oestrus in trial 1 and a higher proportion of very late ewes in trial 2. Thus any advantage gained by the more precise onset may be lost by the failure of ewes to be detected in oestrus. The lower conception rates in ewes following the short term treatment is in marked contrast to that seen with this type of treatment in cattle (Smith and Tervit, 1980). However in the present trials this may reflect the fact that fewer ewes cycled.

In contrast to findings over previous years (Smith et al., 1991 b) there was a consistent effect of ewe liveweight in the present trials with heavier ewes having an earlier onset, which confirms other reports to this effect (Welsh et al., 1990; T.W. Knight personal communication).

There was an effect of breed indicated by an earlier onset of estrus in the Polled Dorset x Coopworth ewes. The magnitude of this varied from month to month which is consistent with that reported previously (Smith et al., 1991b).

The effect of PMSG treatment in trial 2 was intriguing. The failure of PMSG to change the pattern of onset in the short term, oestrogen treated group, is probably due to the effect oestrogen has had on the stage of follicle development. The earlier onset with PMSG in the standard 14 d CIDR® treated groups is consistent with other reports. However the very precise onset seen in trial 2 was not fully duplicated in trial 1 where identical treatments were used in the same month although the pattern of onset with this treatment in April and May was more precise than in other months.

These results confirm previous reports on the variability of the onset of oestrus following synchronisation with CIDR® devices and indicate some of the factors that contribute to this variation. The use of a short term (10 day) CIDR® device treatment coupled with administration of ODB does not appear to offer any appreciable benefits as a synchronisation technique for timed AI. However the results indicate that some benefit may be gained from the use of PMSG even in the breeding season.

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