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Factors influencing the time to onset of oestrus after synchronisation treatment in ewes

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ABSTRACT

A series of four trials, each involving 1200 ewes have been conducted over the period 1986 to 1990. Ewes have been treated with various synchronisation treatments and the time to onset of oestrus monitored each month of the year. Results indicate that while overall mean values for each year don't differ, there were significant seasonal effects within years with the interval to onset being shorter during the breeding season. However the maximum difference between monthly means in any one year varied from 27 h to 17 h. Significant effects of synchronisation device were seen with ewes treated with sponges having a longer (+ 8 h) interval to onset than ewes treated with CIDR devices. While effects of ewe age and ewe liveweight were seen in some trials no consistant trend was identified. On most occasions significant interactions with month of year indicated inconsistancy of effect within any one trial. The recorded variation in interval from device removal to onset of oestrus is in agreement with that reported between flocks in the field. This variation is sufficient to effect conception rates to artificial insemination performed on a time basis and evaluation of contributing factors is required for the development of protocols for this activity.

Keywords Synchronisation, oestrus, time to onset, ewes, Coopworth, CIDR, sponge, PMSG.

INTRODUCTION

The conduct of artificial insemination at a pre-scheduled time following oestrus synchronisation of ewes has major savings in time and labour in comparison to that performed upon detection of oestrus in non-synchronized ewes. However, the successful outcome of timed AI depends on insemination being performed at a constant interval from the time to ovulation. This is very dependant on the synchronisation technique producing a precise and repeatable response in the ewe. As the interval from oestrus to ovulation is relatively constant in the ewe (Smith, 1977), then the interval from the end of synchronisation to the onset of oestrus is the parameter most likely to alter with factors that affect the precision and reliability of the synchronisation response. This parameter is also relatively easy to monitor and field studies in New Zealand have indicated considerable variation between flocks in the time from removal of synchronisation device and onset of oestrus. This paper reports on the results of a series of trials in which ewes were subjected to synchronisation treatment each month of the year and in which time to onset of oestrus was monitored.

MATERIALS AND METHODS

A series of trials were conducted at the Ruakura Agricultural Centre, Hamilton, New Zealand from 1986 to 1990 in which approximately 100 ewes were subjected to synchronisation treatment each month of the year. A standard synchronisation regime of 14 days treatment with an intravaginal device (CIDR,^{TM} Type-G, Carter Holt Harvey, Hamilton, New Zealand) combined with an injection of 400 i.u. PMSG (pregnecol; Heriot Developments Pty Ltd, Australia) at the time of device removal which occured at 08.30 h on the 3rd Monday of each month of the year. Following device removal the Coopworth ewes were joined for 5 days with entire Dorset rams (10%) fitted with harnesses and crayons. Tupping marks were recorded either every 6 h (0400, 1000, 1600 and 2200 h; trials 1 and 2) or twice daily (0800 and 1600 h; trials 3 and 4). At the time of each tup recording a second group of rams fitted with a different colour were introduced and the groups of rams were interchanged at each inspection. Ewe liveweight (following an 18 h period without feed or water) was recorded 8 days after the removal of the synchronisation device.

Variations on the synchronisation treatment were examined in each trial.

Trial 1
Ewes were treated only each second month and the effect of dose of PMSG given at time of CIDR removal (0 v 400 v 800 I.U.) was examined.

Trial 2
Ewes were treated with either intravaginal sponges (Repromap™, UpJohn) or CIDR devices and given 400 I.U. PMSG.

Trial 3
Different preparations of PMSG (concept vs pregnecol) at a constant dose of 400 I.U. were administered at CIDR removal.

Trial 4
Ewes were treated with CIDRs or previously used CIDRs which were washed in IUD wash (Ethical Agents Ltd New Zealand) after being used for a period of 14 days). Also Dorset x Coopworth ewes were compared with Coopworth ewes.

Analyses of the data included these treatment factors as well as effects of month of year, ewe age and fasted liveweight. Onset of oestrus was defined as being the mid point between tupping observations immediately prior to the first recorded tup mark for each ewe. The time from device removal to onset of oestrus was subjected to log transformation prior to analysis. The values reported in this paper are the retransformed predicted values based on the appropriate regression model used in the analysis.

RESULTS

The overall mean time to onset was similar for all trials and is presented in Table 1. Within all trials there were significant effects of month of year with the shorter intervals to onset occuring during the breeding season. The mean values for the standard treatment (new CIDR for 14 days plus 400 I.U. PMSG) in each trial are shown in Figure 1.

Effects of ewe liveweight and age varied from trial to trial and from month to month within a trial (usually seen as significant interactions with month) but no consistant pattern or direction of effect was apparent.

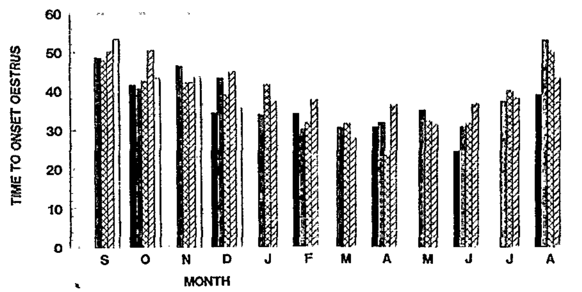

FIG 1 Mean time to onset of oestrus (h) from device removal for ewes treated, with a CIDR type G device for 14 days and injected with 400 i.u. PMSG at time of removal, in each month of the year for trials 1 (86-87), 2 (87-88), 3 (88-89), 4 (89-90), and the first 4 months of a new trial (90-91).

TABLE 1 Overall mean values (± s.e.).

Trial	Year	Time to oestrus (h)	Liveweight (kg)
1	86-87	34.7 ± 1.0	57.1 ± 0.3
2	87-88	36.5 ± 1.0	58.2 ± 0.3
3	88-89	35.8 ± 0.6	51.7 ± 0.2
4	89-90	36.3 ± 0.7	50.9 ± 0.2

Trial 1

In addition to the effect of month there were significant ($P<0.001$) interactions between month and dose of PMSG, month and ewe liveweight and between month and ewe age. The month x dose effect is due to the much longer interval for the zero dose group in the non-breeding season. There was no difference between 400 and 800 I.U. at any time and in the breeding season the zero dose was not different (Table 2). There was no consistant effect of ewe weight. An increase of 20 kg produced increases (up to 4.4 h) or decreases (up to -7.5 h) in any month and without any seasonal pattern. The effect of ewe age was equally inconsistant.

TABLE 2 Interaction between month and dose of PMSG on mean (s.e.) interval to onset of oestrus in Trial 1.

Month	Dose of PMSG (i.u.) 0	400	800
October	66.9 (8.9)	41.5 (2.4)	39.2 (2.5)
December	67.5 (11.9)	34.3 (2.2)	33.8 (1.8)
February	43.1 (2.5)	34.1 (1.8)	32.6 (1.7)
April	33.2 (1.7)	30.7 (1.6)	30.3 (1.6)
June	26.5 (1.5)	24.4 (1.6)	29.4 (1.7)
August	50.2 (3.9)	39.0 (2.1)	37.4 (2.1)

Trial 2

There was a significant ($P<0.001$) effect of synchronisation device, with the interval after sponge withdrawal being longer (40.1 ± 0.7) than that following CIDR treatment (32.9 ± 0.5) and this difference was consistant over the whole year. There was a significant ($P<0.05$) interaction between ewe weight and device. A 20 kg increase in ewe weight produced an 8 h longer interval in CIDR treated ewes compared to a 5.4 h increase in sponge treated ewes. While the overall trend was for an increase in liveweight to produce a longer interval this varied markedly from month to month without any seasonal pattern.

TABLE 3 Time to onset of oestrus (h) following treatment with CIDR + PMSG (400 I.U.) and predicted change due to an increase of 20 kg in ewe liveweight in Trial 3.

Month (1988-89)	Mean time to oestrus h (s.e.)	Change in interval due to a 20 kg increase in liveweight (h)
September	47.5 (2.2)	+ 4.1
October	41.7 (1.4)	+ 3.6
November	40.5 (1.5)	+ 3.4
December	38.6 (1.3)	+ 3.3
January	40.0 (1.4)	+ 3.4
February	29.9 (1.0)	+ 2.5
March	30.0 (1.0)	+ 2.3
April	22.1 (0.7)	+ 1.9
May	30.2 (1.0)	+ 2.6
June	29.7 (0.9)	+ 2.5
July	40.9 (1.3)	+ 3.5
August	49.7 (1.5)	+ 4.2

Trial 3

There was no overall effect of type of PMSG used although there was an interaction with month. There was a significant ($P<0.001$) effect of ewe liveweight with a 20 kg increase in liveweight producing increases in the interval to onset of oestrus ranging from + 4.2 h in the non-breeding season to + 2 h in the breeding season (February to June). The significant ($P<0.001$) effect of month was apparent and as in trial 2 the variability as well as the mean interval was lower during the breeding season (Table 3).

TABLE 4 Effect of ewe breed and month of year on interval to onset of oestrus and predicted change due to a 20 kg increase in liveweight in Trial 4.

Month	Mean (s.e.) interval to oestrus (h)		Change in interval due to a 20 kg increase in liveweight (h)	
	Dorset X Coopworth	Coopworth	Dorset X Coopworth	Coopworth
September	46.2 (3.4)	49.7 (2.6)	- 6.7	+ 2.7
October	43.7 (2.8)	49.8 (2.4)	- 8.1	+ 2.4
December	40.0 (2.5)	42.8 (1.9)	- 7.9	+ 2.2
February	34.4 (2.2)	37.4 (1.6)	- 6.5	+ 1.8
March	26.8 (1.9)	27.4 (1.2)	- 4.7	+ 1.3
April	32.9 (2.1)	30.6 (1.4)	- 6.6	+ 1.6
May	31.2 (2.2)	26.6 (1.2)	- 5.8	+ 1.3
June	41.9 (2.8)	33.9 (1.6)	- 7.2	+ 1.5
July	36.6 (2.3)	34.4 (1.6)	- 7.2	+ 1.7
August	40.1 (2.6)	40.4 (1.8)	- 7.7	+ 2.0

Note: Data for November and January was incomplete and these months were ommitted from the analysis and prediction calculations.

Trial 4

In addition to the significant effect of month there were significant ($P<0.05$) interactions between month and CIDR treatment; between breed and month and between breed and ewe liveweight. There was no overall effect of CIDR treatment on interval to onset of oestrus but differences between treatments varied markedly both in amount and direction from month to month. While there was no overall breed difference the interaction with month showed a seasonal pattern with the Dorset X Coopworth ewes having a shorter interval in the non-breeding season and gradually changing to a longer interval towards the end of the breeding season (Table 4). The breed by ewe liveweight interaction is due to the different direction of change in interval produced by a 20 kg increase in ewe liveweight (Dorset x Coopworth -6.3 h and Coopworth + 2 h).

DISCUSSION

The marked seasonal pattern in the interval from synchronization device removal to the onset of oestrus was consistant from trial to trial although the mean value for any one month differed from year to year. This seasonal pattern is consistant with that reported for both sponge and CIDR treated ewes in New Zealand (Smith 1977; Smith *et al.*, 1988; Smith *et al.*, 1989) and for ovariectomised ewes treated with progesterone and oestrogen injections (Fletcher and Lindsay, 1971). These results all suggest a seasonal shift in the sensitivity to oestrogen of the behavioural centres which is most likely due to changes in patterns of melatonin production.

The between year differences in any particular month (Fig. 1) do not seem as marked as that reported by (Welch *et al.*, 1990). These workers also reported variable effects of ewe liveweight and nutrition on the response. However examination of the data from the present trials indicates that while ewe liveweight contributes to the variation, in time to onset, there is no consistant effect either in magnitude or direction of the change of response between trials or even between months within a trial. Thus knowledge of ewe liveweight would not assist in predicting the time to onset in a particular flock. However there is a need to further examine the effect of plane of nutrition on the time to onset as liveweight may not be a sensitive enough parameter to monitor changes that could influence the response. It is therefore quite clear that attempts to devise a "standard protocol" for the artificial insemination of ewes on a time basis following synchronisation of oestrus will result in a very variable outcome and dissatisfaction with results in individual flocks.

The protocols for all insemination programmes need to be adjusted for the time of the year, ewe breed and we suspect "local factors" that may influence the onset of the breeding season in that environment. The effect of device type seen in trial 2 is important and the difference in interval sufficient to demand consideration of this factor when insemination trials to compare devices are conducted (Wilson and Maxwell, 1989) and also when protocols based on data obtained with one type of device are adopted for animals treated with a different device.

The effect of dose of progestagen in intravaginal sponges on time to onset is well documented (Robinson and Smith, 1967) with the higher the dose the longer the interval to oestrus. Thus the lack of any consistant effect between the new or used CIDR devices is suprising particularly as these two devices produce different patterns and levels of circulating progesterone in treated ewes. Ewes treated with the previously used device have much lower levels than those treated with the new devices (J.F. Smith, unpublished).

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