Seasonal pattern of ovulation in Merino Romney and Merino x Romney ewes

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ABSTRACT

Ewes from five genotypes (Australian Merino, New Zealand Merino, Romney, Australian Merino x Romney, New Zealand Merino x Romney) were examined over 2 years from April 1986 to March 1988. Maiden 2-tooth ewes were used in the first year and mixed aged ewes in year 2. Ewes were treated with CIDRs (14 d) and joined with vasectomised rams every 6 weeks throughout the year. The incidence of oestrus and ovulation and ovulation rate were recorded.

In year 1, there were no discernible differences between the five genotypes in the pattern of ovulation response which ranged from about 100% in April to 70% in August, dropping to 3% in September and then to 0% until a recovery to 100% in the 4 Merino lines and 70% in the Romney by March. In year 2, the incidence of ovulation for all 5 genotypes was 100% for April, May and July. In August, 70% of the Merino lines and 55% of the Romney and Romney cross lines ovulated. Only the Australian Merino ovulated in November (8%) while both Merino lines ovulated in December (Australian 4%, New Zealand 14%). However in contrast to Year 1, in January the pure Merino lines showed 100% incidence of ovulation, the cross breed lines 60% and Romney 10%. By March, the cross breed incidence had reached 100% and the Romney 80%.

These data indicate a marked seasonal pattern of ovulation in all 5 genotypes with some indication of an earlier onset to the breeding season in Merino ewes.

Keywords Merino; Romney; Merino x Romney; oestrus; ovulation; seasonal patterns

INTRODUCTION

Recent developments within the New Zealand Meat Industry have highlighted a need for the year-round supply of lamb for the "chilled" meat trade. To achieve this spread in supply of lambs of the desired weight it is necessary to breed ewes outside the normal season. While this can be accomplished by hormonal induction it would be most economically achieved by the use of a ewe genotype capable of breeding outside the normal restricted breeding season.

In Australia, the Merino is generally acknow-ledged as having an extended breeding season that extends from December to October. The limited New Zealand data (Kelly *et al.*, 1976) on this breed suggest a much shorter breeding period from March to July. However there is evidence of considerable variation in the Australian pattern associated with age, strain, location, and year (Barrett *et al.*, 1962) and unpublished data in New Zealand (Davis pers. comm.) indicate the possibility of similar variation there.

The possible use of Merino genotypes as dams for out-of-season lamb production could further enhance their economic superiority achieved via their finer wool. Details of the seasonal patterns of reproduction in different environments are needed if exploitation of these genotypes is to be undertaken. This trial was conducted to provide information on the seasonal patterns of oestrus and ovulatory activity in strains of Merino adapted to the Waikato environment and of the cross breeds of these strains with the Romney.

MATERIAL AND METHODS

Trials

Two trials were conducted at Tokanui Research Station (38° S 175° E elevation 85 m). Trial 1 commenced in April 1986 and ended in April 1987 and utilised groups (n=33) of maiden 2 tooth ewes. Trial 2 commenced in April 1987 and ended in March 1988 and involved groups (n=25) of mixed age ewes.

Animals

Ewes of five different genotypes involved in the Merino sheep comparison at Tokanui were used

in this study. The genotypes used were:

AM: Australian Merino based on an importation of finewool Merinos from Victoria and Tasmania

NZM: New Zealand Merino based on selection of medium to strong wool animals from various New Zealand flocks

AMR: An interbred Merino x Romney line derived from cross breeding of AM rams and Romney ewes

NZMR: Cross bred line derived from the NZM

R: A control Romney line

The lines were established in 1969 and described by Carter (1969, 1973). All genotypes were run together throughout the trial. Vasectomised Dorset x Romney rams were used for the detection of oestrus and were joined at rate of 1:10 ewes.

Ewe Treatment

All ewes were treated with CIDRs for a period of 14 days. Vasectomised rams were joined at the time of CIDR removal. All ewes were laparoscoped to determine the number of ovulations 10 days later.

The rams remained with the ewes for a further 18 days after a change in crayon colour on the day of laparoscopy. Records of tuppings were taken on days 4, 7, 10, 21 and 25 after CIDR removal. Rams were removed on day 28 and CIDRs were inserted for 14 days. This procedure was repeated at 6-week intervals throughout the year.

Analysis of Data

A total of 34 ewes in Trial 1 and 16 ewes in Trial 2 yielded incomplete data sets as a result of death, loss, unplanned pregnancy or the development of adhesions that prevented complete visualisation of both ovaries. These were evenly spread among genotypes and thus only the data from ewes with complete records were analysed.

RESULTS

Incidence of Oestrus

In Trial 1 (Table 1) over 90 per cent of ewes in all genotypes exhibited oestrus at commencement on April 2. The proportion exhibiting oestrus gradually declined each month so that on August 5 between 55 and 75% of ewes were showing oestrus. Fewer AM ewes exhibited oestrus during this period. The majority of ewes had stopped showing oestrus by September and no further oestrous activity was observed until early March when 15-30% of ewes showed oestrus. The proportion cycling at the April examination was less than in March and less than in April of the previous year.

TABLE 1 Percentage of ewes detected in oestrus at each laparascopy (Trial 1).

Date	Breed				
	AM	NZM	AMR	NZMR	R
02.04.86	91 ^{ab}	87 ^{b}	88 ^{b}	97 ^{ab}	100 ^{a}
13.05.86	79	91	77	87	85
24.06.86	39 ^{c}	59 ^{bc}	73 ^{b}	76 ^{b}	93 ^{a}
05.08.86	55	59	53	75	75
16.09.86	3	0	0	9	3
29.10.86	0	0	0	0	0
05.12.86	0	0	0	0	0
15.01.87	0	0	0	0	0
03.03.87	19	18	33	28	15
10.04.87	13	15	7	21	12

Different superscripts indicate significant differences between breeds ($P<0.05$)

TABLE 2 Percentage of ewes detected in oestrus at each laparascopy (Trial 2).

Date	Breed				
	AM	NZM	AMR	NZMR	R
10.04.87	17 ^{b}	36 ^{ab}	43 ^{ab}	48 ^{a}	23 ^{b}
28.05.87	42 ^{b}	46 ^{b}	57 ^{ab}	76 ^{a}	58 ^{ab}
02.07.87	71 ^{ab}	73 ^{ab}	76 ^{ab}	92 ^{a}	58 ^{b}
11.08.87	21 ^{ab}	23 ^{ab}	38 ^{ab}	16 ^{b}	44 ^{a}
22.09.87	13 ^{a}	9 ^{ab}	5 ^{b}	0 ^{b}	0 ^{b}
03.11.87	0	0	0	0	0
15.12.87	0	0	0	0	0
27.01.88	63 ^{a}	73 ^{a}	38 ^{b}	28 ^{b}	2 ^{c}
10.03.88	42 ^{ab}	59 ^{a}	38 ^{ab}	44 ^{ab}	26 ^{b}

In Trial 2 (Table 2) 17 to 48% of the ewes exhibited oestrus at the commencement of the

trial in April 1987. This increased to a maximum of 60-90% in July and declined rapidly through August. Activity had almost ceased in September with only about 12% of the Merino genotypes exhibiting oestrus. Oestrous activity resumed in January in Merino ewes (63-73%) and in cross breed ewes (38-44%) but was virtually absent in Romney ewes. The level of activity in Romney ewes increased in March to 26% but there was little change in the other genotypes in both trials. During the main breeding season, most of the ewes that exhibited oestrus at the synchronised cycle showed a return oestrus about 17 days later. The incidence of return oestrus ceased abruptly in August in both trials and none were observed following resumption of activity in January 1988. An occasional return oestrus was recorded following the March synchronisation in both trials.

Incidence of Ovulation

In Trial 1 (Table 3), over 90% of the ewes in all genotypes ovulated in April, May and June. This dropped significantly to between 60-80% in August. Ovulatory activity ceased in all genotypes in September and did not resume until the following March. At this time the Romney group had significantly fewer (70% *v* 100%, $P<0.05$) ewes ovulating than did the other genotypes. In April over 90% of ewes in all genotypes ovulated. In Trial 2 (Table 4), a similar pattern was seen with almost all ewes ovulating during April, May and July and activity declining in August to between 50-60% of the various genotypes. The AM group had the highest level of ($P<0.05$) activity in this month. The cessation of activity was later than in Trial 1 with 10-20% of ewes of all genotypes ovulating in September. Up to 14% of the two Merino genotypes ovulated during November and December but none of the cross breed or Romney ewes.

TABLE 3 Seasonal change in the proporation of ewes ovulating and their ovulation rate for 5 ewe genotypes (Trial 1).

Date		Breed				
		AM	NZM	AMR	NZMR	R
02.04.86	% ov (1)	100	97	97	100	100
	OR (2)	1.06 ^{c}	1.17 ^{bc}	1.55 ^{a}	1.26 ^{b}	1.34 ^{ab}
13.05.86	% ov	100	100	100	100	100
	OR	1.12 ^{b}	1.13 ^{b}	1.33 ^{a}	1.24 ^{ab}	1.06 ^{b}
24.06.86	% ov	91	97	100	97	97
	OR	1.03 ^{b}	1.03 ^{b}	1.23 ^{a}	1.12 ^{ab}	1.10 ^{ab}
05.08.86	% ov	72	63	67	81	69
	OR	1.14	1.05	1.24	1.24	1.13
15.09.86	% ov	3	3	0	3	3
	OR	1.00	1.00	-	1.00	2.00
29.10.86	% ov	0	0	0	0	0
	OR	-	-	-	--	-
05.12.86	% ov	0	0	0	0	0
	OR	-	-	-	--	-
15.01.87	% ov	0	0	0	0	0
	OR	-	-	-	-	-
03.03.87	% ov	100 a	93 a	100 a	100 a	73 b
	OR	1.11 ^{b}	1.30 ^{ab}	1.41 ^{a}	1.21 ^{ab}	1.21 ^{ab}
10.04.87	% ov	91	96	96	100	92
	OR	1.00 ^{b}	1.00 ^{b}	1.19 ^{ab}	1.14 ^{ab}	1.30 ^{a}

(1) % ov = percentage of ewes ovulating
(2) OR = ovulating rate of those ewes ovulating
Different subscripts indicate significant differences between breeds ($P<0.05$)

TABLE 4 Seasonal changes in the percentage of ewes ovulating and their ovulation rate for 5 ewe genotypes (Trial 2).

Date		Breed AM	NZM	AMR	NZMR	R
10.04.87	% ov (1)	92	100	100	96	100
	OR (2)	1.04	1.08	1.33	1.24	1.16
28.05.87	% ov	100	100	100	100	100
	OR	1.04	1.08	1.17	1.15	1.24
02.07.87	% ov	100	91	91	100	95
	OR	1.15	1.09	1.40	1.08	1.27
11.08.87	% ov	79 ^{a}	59 ^{ab}	52 ^{b}	52 ^{b}	65 ^{ab}
	OR	1.03	1.24	1.42	1.23	1.05
22.09.87	% ov	13	09	10	20	12
	OR	1.00	1.00	1.00	1.00	1.00
03.11.87	% ov	8	0	0	0	0
	OR	1.00	-	-	-	-
15.12.87	% ov	4	14	0	0	0
	OR	1.00	1.00	-	-	-
27.01.88	% ov	100 ^{a}	100 ^{a}	62 ^{b}	60 ^{b}	9 ^{c}
	OR	1.17	1.23	1.23	1.20	1.20
10.03.88	% ov	96 ^{ab}	100 ^{a}	91 ^{ab}	100 ^{a}	84 ^{b}
	OR	1.18	1.18	1.32	1.26	1.23

(1) Percentage of ewes ovulating
(2) Ovulation rate of those ewes ovulating
Different superscripts indicate significant diffence between genotypes

Ovulatory activity resumed in January 1988 with 100% of the Merino ewes ovulating. Their ovulation activity was greater ($P < 0.05$) than that of the cross breeds (61%) which in turn was greater ($P < 0.05$) than that of the Romneys (9%). By March the cross breed groups had achieved 90-100% ewes ovulating with the Romneys less at 84% ($P < 0.05$).

Distribution of Oestrus and Ovulation Incidence

In Trial 1 there was little difference between genotypes in the number of times ewes ovulated. Only one ewe ovulated less than 4 times. The majority ovulated 6 times out of the 10 inspections but very few ewes ovulated 7 times. Oestrous behaviour was somewhat more variable with the Merino genotypes tending to have exhibited oestrus less often than the other breeds (Fig. 1). In Trial 2, ewes of the Merino genotypes tended to ovulate more often than the other groups. However the maximum of 8 ovulations from 9 examinations was attained by only a few ewes (Fig. 2). The distribution of tupping was more variable and while some ewes of the Merino groups exhibited oestrus most often the AM group also contained ewes with the least number of tups.

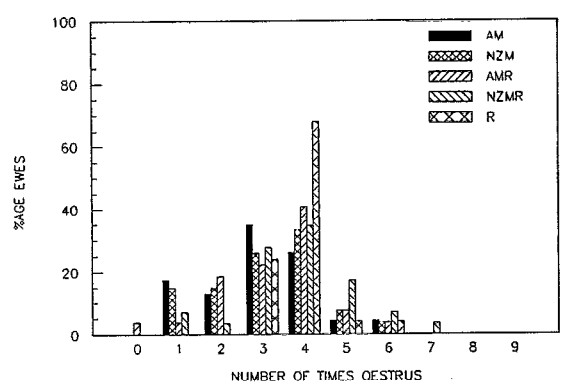

FIG. 1 Distribution of incidence of detection of oestrus in ewes of 5 genotypes in one year (Trial 1; maximum of 10 observations).

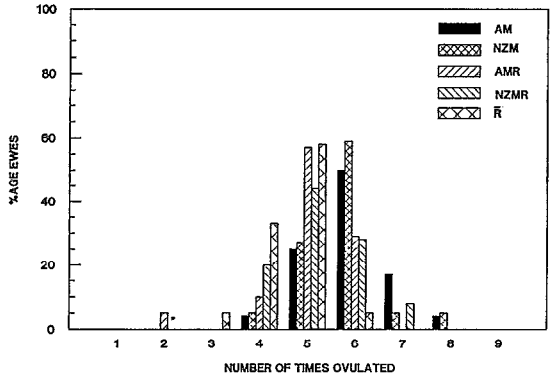

FIG. 2 Distribution of incidence of ovulation for ewes of 5 genotypes in one year (Trial 2; maximum of 9 observations).

Ovulation Rate

In Trial 1, the Merino genotypes, in particular the AM, had lower ovulation rates (number of ovulations per ewe that ovulated) than cross breeds and Romneys from April to June and in the following March and April (Table 3). Ovulation rate declined in all genotypes towards the end of the breeding season. A similar effect was seen in Trial 2 (Table 4).

TABLE 5 Mean ewe live weight (kg)at time of laparoscopy (Trial 1). (SEM ranged from 0.7 to 1.3kg).

Date	Breed				
	AM	NZM	AMR	NZMR	R
02.04.86	38.9	41.7	48.0	50.3	47.0
13.05.86	35.5	38.4	45.7	47.1	44.8
24.06.86	37.7	39.7	48.3	50.2	48.8
05.08.86	37.1	39.7	48.7	51.2	49.7
16.09.86	39.3	42.3	52.8	54.4	53.6
29.10.86	38.4	41.7	53.3	54.0	53.0
05.12.86	36.7	41.9	51.5	51.1	53.1
24.01.87#	-	-	-	-	-
03.03.87	36.8	40.9	51.5	51.1	53.1
10.04.87	33.2	36.0	45.6	45.2	46.8

No liveweight data available

Live Weight

In Trial 1 (Table 5), the two Merino groups were significantly lighter than the cross breed and Romney groups which showed a slight increase in weight during the period May-October and thereafter remained constant. The Merino groups were more static throughout the trial. In Trial 2 the commencement weight for all groups was lower than in Trial 1 and again the two Merino groups were lighter than the other 3 groups (Table 6). All groups showed an increase in weight in the period from May to December. This was much more substantial for the cross breed and Romney groups than for the pure Merino groups.

TABLE 6 Mean ewe weight (kg)at time of laparascopy (Trial 2) (SEM ranged from 0.7 to 1.5kg).

Date	Breed				
	AM	NZM	AMR	NZMR	R
10.04.87	30.7	36.9	43.3	41.4	41.0
27.05.87	32.5	37.7	42.6	41.5	41.4
02.07.87	37.6	42.1	50.9	48.6	50.2
11.08.87	40.2	42.6	52.8	51.4	53.1
22.09.87	37.6	41.9	53.0	52.0	53.5
03.11.87	42.1	48.1	59.3	58.0	59.8
15.12.87	43.2	48.9	58.9	58.4	62.4
27.01.88	42.8	49.5	56.4	56.5	59.7
10.03.88	41.0	46.7	55.1	54.6	56.3

DISCUSSION

Under New Zealand conditions the Merino exhibits a very seasonal pattern of reproductive activity. The onset of activity in this trial was only slightly earlier (6 weeks) than that for the Romney with the cross breeds being intermediate. This is in general agreement with the report by Kelly *et al.* (1976). However the earlier onset of ovulatory activity by the Merino ewes in Trial 2 (January) was substantially earlier than that reported by Kelly *et al.* (1976). The seasonal pattern in ovulatory activity seen was much more pronounced than that reported for Merinos run in constant contact with the ram under Australian conditions (Fletcher and Geytenbeek, 1970; Dun *et al.*, 1960; Barrett *et al.*, 1962) and is more akin to that reported for Merino ewes in the United Kingdom (Tempest and Boaz, 1973). The marked difference in response between the two trials in this experiment is a common but as yet unexplained phenomena in studies on seasonal

breeding patterns (Barrett *et al.*, 1962; Edgar and Bilkey, 1963; Tervit *et al.*, 1977; Smith *et al.*, 1988).

The failure of the Merino ewes to respond during January in Trial 1 of this experiment could have been due to their age and/or to their lower live weights and the tendency for a liveweight loss compared to the higher weights and liveweight gain seen during January in Trial 2.

The 14-day periods of isolation from the teaser rams between each test may not have been sufficient to overcome any refractoriness (Oldham and Cognie, 1980) and may thus have limited any possible "ram effect" on advancement of the breeding season. It was to minimise any such effects that the trials were started in the middle of the breeding season.

Treatment with CIDRs was used in this experiment both to facilitate laparoscopic examinations by synchronisation of ovulation and to enhance the expression of oestrus. Kelly *et al.* (1976) reported that failure to detect oestrus, particularly in the Merino, was a major problem with his experiment. In the present trials, ewes continued to display oestrus much later into the season than was reported by Kelly *et al.* (1976).

However there was a major problem associated with oestrus detection (or behaviour) during the summer/autumn of 1987 (end of Trial 1 and beginning of Trial 2). This was shown by all breeds and most probably reflects the low live weights and liveweight loss recorded (Smith, 1965).

Differences in ovulatory response shown in Trial 2 during January illustrate an apparent genetic effect with the cross breeds being intermediate between the pure breeds. Social facilitation due to all ewes being run together could have minimised the differences between genotypes observed in this experiment. The failure to detect any difference in the two sources of Merino is of considerable interest. The NZM were derived basically from South Australian strong wool sources and as such would have been expected to have a longer breeding season than the fine wool Saxony based AM. The lack of any selection pressure for out-of-season breeding for a number of generations whilst under New Zealand conditions may have resulted in dilution of this characteristic.

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