OESTROUS ACTIVITY IN MERINO EWES IN WESTERN QUEENSLAND

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Summary

It was shown that oestrous activity in Merino ewes in western Queensland is influenced by the level of nutrition during the winter and spring. Thus the occurrence of oestrus during the winter and spring was influenced by the current level of nutrition whilst oestrous activity during the autumn and winter was influenced by the level of nutrition during the preceding spring.

Observations were undertaken on the occurrence of oestrus in eleven flocks in western Queensland joined at different times of the year. Six flocks joined during spring and early summer exhibited a moderately high incidence of oestrus following the introduction of rams although in some there was a low incidence during the first 17 days. In five flocks joined during the autumn and winter, oestrous activity was moderately high but less than would be anticipated at this time (incidence at 17 days, 52-79%; 21 days, 69-86%).

It is suggested that the wide variability in the occurrence of oestrus in flocks in western Queensland is related to the pastoral conditions prevailing during the late winter and spring.

I. INTRODUCTION

Oestrous activity in Merino ewes in tropical Australia is irregular and, in particular, the incidence of oestrus during the spring and summer is subject to considerable variation (Kelley and Shaw 1943; Stewart and Moir 1943; Moule 1950; Suijdendorp 1959; Smith 1960, 1964). In western Queensland, levels of oestrous activity recorded during the autumn and winter have been generally less than those observed in Merino ewes in New South Wales or Victoria (Morley 1948; Watson 1956; Dun, Ahmed and Morrant 1960; Smith 1960; Barrett, Reardon and Lambourne 1962; Queensland Department of Agriculture and Stock 1963). In some cases (Moule 1950; Smith 1960, 1964; Queensland Department of Agriculture and Stock 1963), the incidence of oestrus during the spring and early summer has been higher than that usually recorded during the autumn and winter.

It has been suggested that the level of oestrous activity in Merino ewes is influenced by the level of nutrition during the preceding winter and spring (Hunter 1962; Smith 1962) and thus in western Queensland, where pastoral conditions are normally declining during the late winter and spring, oestrous activity may be depressed due to this cause.

This paper records observations on the incidence of oestrus in Merino ewes joined at different times of the year in western Queensland and investigations of the effects, both current and delayed, of the level of nutrition during winter and spring upon oestrous activity in this environment.

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II. MATERIALS AND METHODS

(a) The environment

This work was undertaken in western Queensland on properties situated between latitudes 21 ° 50' and 24" 30' S and between the 15 and 18 inch (38 1 and 457 mm) isohyets. Most of the country is open and gently undulating, with a few scattered trees and shrubs. The Mitchell grasses (*Astrebla* spp.) dominate these open downs, but blue grass (***Dichanthium*** *sericeum*) and feathertop (***Aristida*** *latifolia*) are other perennials which may be of importance.

Pasture growth is normally dormant from about the beginning of May until September or later, depending upon adequate soil moisture which is usually not available before late December. The nutritional value of the pasture deteriorates during the late winter and spring; there is no top feed of any consequence and the sheep are usually on a submaintenance level of nutrition during this period.

Summer temperatures are high and maxima may reach the vicinity of 120°F (49°C), averaging over 95°F (35°C), while daily minima usually exceed 70°F (21°C). Winter temperatures seldom fall below 40°F (4°C) and daily maxima usually approximate 80°F (27°C).

(b) The effect of current level of nutrition on the occurrence of oestrus in late spring.

On October 29, 1962, 80 Merino ewes, three years old, which had previously lambed during April-May 1962, were divided into two groups. One group ("low") was placed on poor quality natural pasture at the rate of 23 ewes per acre whilst the other group ("high") was placed on natural pasture at the rate of one ewe per 4 acres and was offered lucerne hay at the rate of 0.34 kg/head/day. These treatments were continued for six weeks until December 10, 1962.

The ewes were weighed at both the commencement and termination of the treatments.

Rams were introduced into both groups on November 19 and remained for 21 days. The rams with both groups were fed a supplement during the mating period. The ewes were yarded twice weekly in order to record the occurrence of oestrus which was detected by the use of ewe-marking crayons (Radford, Watson and Wood 1960) on the rams.

(c) The effects of previous and current level of nutrition on the occurrence of oestrus in autumn and winter.

On September 26, 1962, a flock of 220 Merino ewes (born October-November 1961) was divided into three groups (maintenance-80 ewes; submaintenance-80 ewes; flushed-60 ewes) which were then placed on different levels of nutrition for a period of twelve weeks, ending on December 18, 1962. The groups were then combined to form a single flock until May 5, 1963 when each of the three groups was further divided into two sub-groups which were placed on either a high or low plane of nutrition for a period of twelve weeks, ending on July 27, 1963. In all cases the level of nutrition was controlled by variations in the stocking rate and, when not undergoing different treatments, the groups were combined and placed in a single paddock. Throughout the experiment the ewes were weighed at regular intervals and prior to and at the terminations of each treatment; they were also treated regularly with thiabendazole and calcium arsenate for the control of internal parasites.

Vasectomised rams were joined with the ewes on March 19 and July 12, 1963, for 35 days on each occasion. The flushed group was not joined on the latter occasion. Oestrus was detected by the use of ewe-marking crayons on the rams.

(d) The occurrence of oestrus in flocks mated at various times.

Flocks of medium-wool Peppin Merino ewes were joined with entire Merino rams at the rate of 2½ -3 % on five occasions during autumn and winter (for a period of five weeks) and on six occasions during spring and summer (for a period of ten weeks). Details of the flocks, existing pastoral conditions and time of joining and immediately previous lambing are summarised in Table 1. Throughout all of the observations, the sheep were in paddocks stocked at the rate of one sheep to 4-6 acres.

The ewes were identified by means of numbered eartags and oestrus was detected by the use of ewe-marking crayons on the rams. The sheep were yarded at least once weekly in order that details of those ewes that had mated might be recorded. Observations on the flock mated on March 19, 1959 included the recording of oestrus at intervals of 4-12 hours.

III. RESULTS

(a) The effect of current level of nutrition on the occurrence of oestrus in late spring.

The effect of current level of nutrition upon the incidence of oestrus during late spring is shown in Table 2. There was a higher incidence of oestrus during

TABLE 1

Details of flocks joined at various times of the year in western Queensland

Flock	Date rams introduced	Ewes		Immediately previous lambing period	Pastoral conditions at time of joining
		Age (years)	Number		
1	March 19, 1959	2–4	131	September-November, 1958	Excellent
2	May 21, 1961	3–6	339	October-November, 1960	Good
3	October 25, 1961	2½	487	June-August, 1961	Poor
4	January 9, 1962	2½	400	June-August, 1961	Excellent
5	May 21, 1962	3–6	318	October-November, 1961	Good
6	October 11, 1962	(a) 1½ (b) 6	95 200	nil March-May, 1962	Excellent
7	November 6, 1962	3–6	182	March-May, 1962	Poor
8	November 27, 1962	3½	116	June-August, 1962	Poor
9	March 18, 1963	3–6	149	September-November, 1962	Excellent
10	May 23, 1963	3–6	342	October-November, 1962	Excellent
11	November 13, 1963	3½	101	March-May, 1963	Good

TABLE 2

The effect of level of nutrition upon the incidence of oestrus during lute spring

Time after introduction of rams (days)	Number of ewes exhibiting oestrus (percentage in parentheses)		Difference	
	High Level	Low Level	χ^2	P
7	12 (30)	4 (10)	3.83	= 0.05
14	26 (65)	7 (17.5)	16.71	< 0.001
17	32 (80)	12 (30)	18.23	< 0.001
21	37 (92.5)	29 (72.5)	4.24	< 0.05
Total Ewes	40	40		

the first 17 days in the "high" group, however at 21 days this difference had commenced to disappear. It is obvious that the level of nutrition influenced the level of spontaneous oestrous activity and thus there was a significant difference ($\chi^2 = 12.9$, $P<0.001$) between the two groups in the ratio of ewes oestrous 0-1 7 days to ewes oestrous 18-21 days.

Bodyweight changes within the two groups and the relation of bodyweight and bodyweight changes to the occurrence of oestrus are shown in Table 3. Analysis of variance indicated that within both groups ewes oestrous from 0 to 17 days weighed significantly more on December 10 than ewes which did not exhibit oestrus (high, $P < 0.05$; low, $P < 0.01$) . The mean bodyweight on October 29 of ewes oestrous O-17 days was greater in the 'high' group than that of ewes anoestrous at 17 days ($P < 0.05$) and in the 'low' group than that of ewes anoestrous at 21 days ($P < 0.05$). In the 'high' group, ewes oestrous 0-17 days gained more bodyweight ($P < 0.05$) than those which had not exhibited oestrus during that period.

Thus, both the level of nutrition and initial bodyweight, independent of the level of nutrition, influenced the level of oestrous activity during late spring.

TABLE 3

Effect of level of nutrition upon bodyweight and the relation of bodyweight and bodyweight changes to the occurrence of oestrus

Ewes	Level of nutrition	Number of ewes	Mean bodyweight (kg)		Mean change in bodyweight (kg)
			October 29, 1962	December 10, 1962	
All	High	40	35.1	36.9	+ 1.8
	Low	40	35.3	32.5	— 2.8
Oestrous 0-17 days	High	32	35.6	37.6	+ 2.0
	Low	12	36.6	34.1	— 2.5
Oestrous 18-21 days	High	5	33.3	34.9	+ 1.6
	Low	17	35.5	32.4	— 3.0
Not oestrous 0-21 days	High	3	32.6	33.1	+ 0.5
	Low	11	33.6	30.7	— 2.9

(*b*) *The effects of previous and current level* of *nutrition on the occurrence* of *oestrus in autumn and winter.*

The bodyweight changes of the ewes in the different subgroups are shown in Figure 1. There were no significant differences in the mean bodyweights of the groups or subgroups on September 26, 1962, February 13, 1963 or April 25, 1963. The maintenance group was significantly heavier ($P < 0.01$) than both the submaintenance and flushed groups on November 6, 1962 whilst on December 18, 1962 both the maintenance and flushed groups weighed more ($P < 0.01$) than the submaintenance group. On July 27, 1963 none of the high plane subgroups differed significantly in their mean bodyweights nor did the low plane subgroups differ significantly from each other, however the high plane subgroups were significantly heavier ($P < 0.01$) than the low plane subgroups.

The effects of level of nutrition upon the occurrence of oestrus are shown in Figure 2. During March-April 1963 there was a significant effect of level of nutrition during spring 1962 upon the incidence of oestrus during the first 17

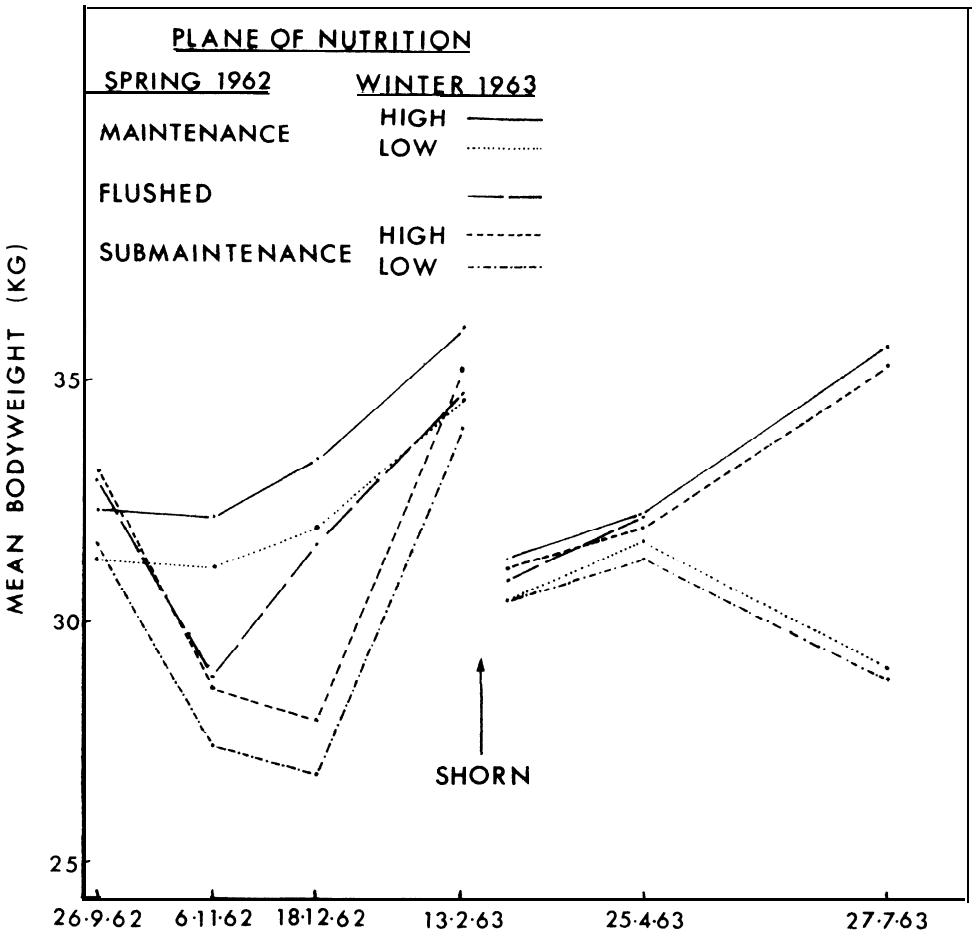

Fig. 1.—The effect of different levels of nutrition upon mean bodyweights.

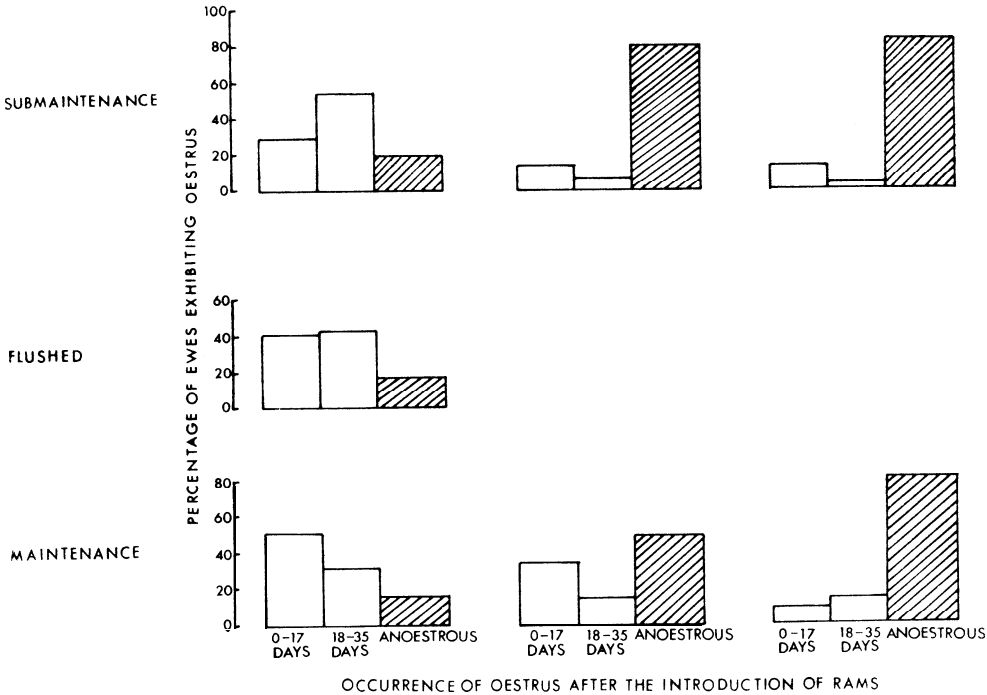

Fig. 2.—The effects of level of nutrition during spring 1962 and winter 1963 upon the incidence of oestrus during autumn and winter 1963.

days ($\chi^2 = 7.6$, $P < 0.05$) and upon the ratio of ewes oestrous during the first 17 days to ewes oestrous from 18 to 35 days ($\chi^2 = 8.4$, $P < 0.02$), but there was no effect upon the total incidence of oestrus during the 35 day period. Only the differences between the maintenance and submaintenance groups were significant (incidence of oestrus to 17 days, $\chi^2 = 6.64$, $P = 0.01$; O-l 7 day oestrus/ 18-35 day oestrus, $\chi^2 = 6.8$, $P < 0.01$).

-During July-August 1963, the incidence of oestrus was greater in the maintenance-high subgroup than in the others, the difference increasing after the first 17 days except in the case of the maintenance-low subgroup, in which case the difference was diminished and lost its significance (Table 4). Thus there was

TABLE 4

The significance* of *differences* *in oestrous activity between* *subgroups, July-August, 1963

Comparison of Maintenance-high with:	Period			
	0-17 days		0-35 days	
	χ^2	P	χ^2	P
Maintenance-low	5.43	< 0.02	3.57	< 0.10
Submaintenance-high	2.83	< 0.10	4.52	< 0.05
Submaintenance-low	4.14	< 0.05	9.02	< 0.01

a significant effect of the current level of nutrition upon the incidence of oestrus during the first 17 days ($\chi^2 = 4.0$, $P < 0.05$), however there was also a significant effect of the level of nutrition during the preceding spring upon the incidence of oestrus to 35 days ($\chi^2 = 4.34$, $P < 0.05$).

(c) The occurrence of oestrus in flocks mated at various times.

The incidence of oestrus in the five flocks joined during the autumn and winter is shown in Table 5. In the flock joined on May 21, 1962, there was a lower level of oestrous activity than in the other flocks (incidence at 17 and 21 days, $P < 0.001$) and the ratio of total ewes oestrous at 17 days to total ewes oestrous at 21 days was also less ($P < 0.01$) . In no flock did the incidence of oestrus at 2 1 days exceed 86%.

In all flocks joined during the spring and summer, other than that joined on October 11, 1962, there was an obviously delayed onset of oestrus, which was not apparently closely related to the time of joining (Table 6). The incidence of oestrus both 14 and 21 days after the introduction of rams was less ($P < 0.001$) in the flocks joined on October 25, 1961 and November 27, 1962 than in any other flock. In the flock joined on October 11, 1962, the incidence of oestrus was significantly lower ($P < 0.001$) in the young ($1\frac{1}{2}$ year old) ewes than in the older ewes.

There was a higher incidence of oestrus to 17 and 21 days in the older ewes of the flock mated on October 11, 1962 than in any of the five flocks mated during the autumn and winter.

The duration of oestrus was recorded on 193 occasions during March-April 1959 and the mean duration ($\pm$ standard error) was 25.13 ± 0.08 hours. The mean duration of the oestrous cycle in 98 ewes during the same period was 16.93 ± 0.14 days.

IV. DISCUSSION

It has been shown that the level of spontaneous oestrous activity during the late spring and early summer was influenced by the current level of nutrition, and Killeen (1961) has observed a similar effect in Border Leicester X Merino ewes in southern New South Wales. It was also shown that the bodyweight of the ewes, independent of the level of nutrition, influenced spontaneous oestrous activity. Dun, Ahmed and Morrant (1960) observed significant annual fluctuations in the level of spontaneous oestrous activity in Merino ewes joined during spring in western New South Wales; a typical "lag and peak" pattern (Schinckel 1954) was observed when pastoral conditions were poor at the time of mating, otherwise there was a high level (81 to 95 %) of oestrous activity during the first 18 days. Quinlan and Mare (193 1) and Smith (1960) have also observed that the incidence of oestrus in Merino ewes during spring is least in drought years.

Oestrous activity during the autumn and winter was influenced by the level of nutrition during the preceding spring; confirming the observations of Hunter (1962) and Smith (1962). During March-April, this effect was most obvious in the incidence of oestrus during the first 17 days, whilst during July-August it

TABLE 5

Incidence of oestrus in Merino ewes in western Queensland during the autumn and winter

Time after introduction of rams	Number of ewes exhibiting oestrus									
	Flock 9 mated March 18, 1963		Flock 1 mated March 19, 1959		Flock 2 mated May 21, 1961		Flock 5 mated May 21, 1962		Flock 10 mated May 23, 1963	
days	number	(%)	number	(%)	number	(%)	number	(%)	number	(%)
7	44	(29.5)	57	(43.5)	133	(39.8)	60	(18.9)	141	(41.2)
14	76	(51.0)	91	(69.4)	216	(63.7)	132	(41.5)	211	(61.7)
17	112	(75.2)	103	(78.6)	266	(78.5)	164	(51.6)	260	(76.0)
21	128	(85.9)	111	(84.7)	290	(85.5)	218	(68.6)	293	(85.7)
28	—*		113	(86.2)	327	(96.4)	275	(86.5)	327	(95.6)
35	—*		116	(88.4)	330	(97.3)	285	(89.6)	332	(97.1)
Total ewes	149		131		339		318		342	

*No record.

TABLE 6

Incidence of oestrus in Merino ewes in western Queensland during the spring and summer

Time after introduction of rams	Number of ewes exhibiting oestrus													
	Flock 6 mated Oct. 11, 1962 (a)		Flock 6 mated Oct. 11, 1962 (b)		Flock 3 mated Oct. 25, 1961		Flock 7 mated Nov. 6, 1962		Flock 11 mated Nov. 13, 1963		Flock 8 mated Nov. 27, 1962		Flock 4 mated Jan. 9, 1962	
days	number	(%)	number	(%)	number	(%)	number	(%)	number	(%)	number	(%)	number	(%)
14	50	(52.6)	112	(61.0)	78	(16.0)	53	(29.1)	44	(43.6)	15	(12.9)	162	(40.5)
17	61	(64.2)	171	(85.5)	122	(25.0)	—*	—*	—*	—*	—*	—*	231	(57.7)
21	63	(66.5)	175	(87.5)	210	(43.1)	117	(64.3)	67	(66.3)	29	(25.0)	257	(64.2)
28	78	(82.1)	189	(94.5)	352	(72.3)	165	(90.7)	78	(77.2)	82	(70.7)	—*	—*
35	—*	—*	—*	—*	—*	—*	168	(92.3)	95	(94.1)	88	(75.9)	284	(71.0)
70	—*	—*	—*	—*	418	(85.8)	—*	—*	101	(100)	97	(83.6)	381	(95.2)
Total number of ewes	95		200		487		182		101		116		400	

*No record.

influenced the total incidence of oestrus to 35 days, the difference being dependent upon a difference in the number of ewes in which oestrus occurred 18-35 days after the introduction of rams. During July-August, however, the incidence of oestrus was influenced more by the current level of nutrition, particularly during the first 17 days, although the effects of level of nutrition at the two periods were interdependent. The effect of current level of nutrition upon the incidence of oestrus was associated with differences in current bodyweight whilst the effect of nutrition during the preceding spring was not.

In the flocks joined during the autumn and winter, the pattern of incidence of oestrus was fairly uniform except for the flock joined on May 21, 1962 in which there was a reduced incidence of oestrus during the first 17 days; although current pastoral conditions were good, this flock had been exposed to very poor pastoral conditions during the preceding spring. In these flocks, the maximum incidence of oestrus at 21 days was 86% whereas Dun, Ahmed and Morrant (1960) observed an incidence of 9 l-98 % at 18 days in Merino ewes joined during autumn in western New South Wales; this reflects the general tendency for oestrous activity in Merino ewes during autumn and winter to be less in western Queensland (Smith 1960; Queensland Department of Agriculture and Stock 1963) than that in New South Wales or Victoria (Morley 1948; Watson 1956; Dun, Ahmed and Morrant 1960; Barrett, Reardon and Lambourne 1962).

In most of the flocks joined during spring and early summer, the incidence of oestrus was low during the first 17 days and in two flocks there was a peak occurrence of oestrus between 18 and 28 days after the introduction of rams. Other observations in this environment (Queensland Department of Agriculture and Stock 1963) have indicated that during spring and summer the majority of ewes exhibited oestrus between 15 and 28 days after the introduction of rams; Moule (personal communication) has observed, in five flocks joined during October-November, that the majority of ewes exhibited their first oestrus between 18 and 36 days, with the mean incidence reaching a peak between 19 and 23 days, after the introduction of rams. This pattern of oestrous activity is obviously due to the stimulating influence of the introduction of rams (Schinckel 1954). Nevertheless, a high level (85%) of spontaneous (i.e. during the first 17 days) oestrous activity was observed in the flock of adult ewes joined on October 11, 1962 on good pastures and Moule (1950) has observed 93 and 99% of ewes exhibiting oestrus within 21 days when mated in late October on good pastures. The low levels of oestrous activity in the flocks joined on October 25, 196 1 and November 27, 1962, both of which had lambed during the preceding June-August, were probably influenced by the time of parturition prior to joining (Smith 1964).

Variations in oestrous activity observed in the eleven flocks joined at different times of the year were consistent with the effects of variation in prevailing and previous pastoral conditions and variations in the interval from parturition, and were less obviously associated with photoperiodicity, the synchroniser of oestrous activity (Yeates 1949, 1956).

The duration of behavioural oestrus recorded in these observations was similar to that observed in Merino ewes in other environments, as was the duration of the oestrous cycle (Quinlan and Mare 1931; Roux 1936; Kelley 1937; Joubert 1962).

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