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STUDIES ON REPRODUCTIVE PERFORMANCE OF BEEF CATTLE IN A SUBTROPICAL ENVIRONMENT.

1. CONCEPTION RATE, LENGTH OF OESTRUS CYCLE AND LENGTH OF GESTATION

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SUMMARY

Data from 198 cow matings and 209 heifer matings were provided by animals equally distributed between 9-week mating periods in either spring, summer or autumn during 1961–1965 at "Brian Pastures" in south-eastern Queensland.

First service and overall conception rates showed no effect from the influence of season of mating, year, class of animal or lactational status. Calving rate was similarly unaffected.

Recorded services per conception were higher for the spring-mating group than for the autumn group. There was a positive association between liveweight change during the first month of mating and first service conception rate.

Length of oestrus period was 20·5 ± 0·96 days for cows and 20·9 ± 0·96 days for heifers. Gestation length was 279·6 ± 1·00 days for cows and 278·7 ± 1·00 days for heifers. Neither oestrus period nor gestation length was affected by any of the factors considered.

I. INTRODUCTION

Beef breeding cattle in Queensland do not normally have access to improved pasture or crop and are usually fed supplements only in times of nutritional stress. Thus their growth and reproductive performance are determined by the seasonal fluctuations in quality and quantity of native pastures. Usually matings are arranged so that calvings coincide with the flush of pasture growth (Davenport and Neil 1958; Alexander *et al.* 1960; Donaldson and Larkin 1963).

Studies on reproduction in beef breeding herds in Queensland (Osborne 1960; Donaldson 1962; Howard 1966; Jenkins and Hirst 1966) indicate their generally poor performance, particularly in the northern part of the State, and

indicate the important influence of nutrition on fertility. However, there is little information available upon the breeding performance of cattle in south-eastern Queensland.

This study is concerned with the description of the conception rate, length of oestrus cycle and length of gestation of beef cows in a herd in south-eastern Queensland and is part of a general examination of reproductive performance in this herd.

II. EXPERIMENTAL PROCEDURE

Observations were carried out over the period 1958-1965 at "Brian Pastures" Pasture Research Station in south-eastern Queensland, approximately 10 miles from Gayndah in latitude 25°40′S. The average rainfall is 29 in. and the rainfall is mainly of summer incidence. The principal pasture grasses are *Heteropogon contortus* (bunch spear grass) and species of *Bothriochloa* and *Dichanthium* (blue grasses).

The cattle used initially in 1959 were 66 Poll Hereford heifers of similar age mated to two Poll Hereford bulls. Prior to mating, these heifers were randomly allocated to three seasonal mating groups each of 22 animals, in which they remained for the duration of the study. The groups were mated in three periods—

(1) October 8-December 10 (spring)

(2) January 8-March 12 (summer)

(3) April 8-July 10 (autumn).

Cows were removed from the groups only by death or failure to produce a calf over two successive mating seasons. A stocking rate of 8 ac per animal was maintained throughout the period.

In 1961 and subsequent years, 2-year-old Poll Hereford heifers were mated with each of the groups to provide a comparison between the conception rate of heifers and that of adult cows. They were run together for several months prior to mating. A total of 209 heifers was used over the period.

From October 1961, services were recorded by the use of leather head stalls carrying a crayon marker as described by Yeates and Crowley (1961). During mating, inspection of the breeding groups was made daily on horseback to note those females which were marked with crayons by the bulls.

The cows and heifers were examined *per rectum* for pregnancy status at three times, namely 10 weeks after mating commenced, 8 weeks after the end of mating and during mid-pregnancy. During the calving period, daily inspection allowed the recording of birth dates and the weighing and identification of newly born calves. Body-weight of the cattle was recorded at monthly intervals, using a cattle-weighing scale with an accuracy of $\pm$ 1 lb. The same procedure of mustering, handling and weighing was used on all occasions.

Conception to first service and conception over the mating period were calculated, based upon the pregnancy examinations. Since an examination 10 weeks after the commencement of mating can detect pregnancies during the first 3-4 weeks of mating with accuracy (N. C. Barr personal communication) the conception rate based on this examination has been taken to calculate a first service conception rate. The foetal age assessed during the first pregnancy examination was confirmed at the subsequent examination and by the calving date.

The length of the oestrus cycle was calculated from the interval between services recorded by the crayon marker, and the duration of gestation was determined.

Body-weight changes were calculated for the month immediately prior to mating, the first month and the second month of mating. The method of statistical analysis was that of Rao (1955) for non-orthogonal multiple classified data with unequal numbers in the sub-classes.

III. RESULTS

(a) Conception Rate

When the effects of year and type of female were removed there were no significant differences between mating groups in either conception rate based on the first rectal examination or overall conception rate (Table 1).

TABLE 1

EFFECT OF SEASON OF YEAR, YEAR, AND CLASS OF ANIMAL ON CONCEPTION RATE AND CALVING PERCENTAGE

Variate	First Service Conception Rate (%)	Overall Conception Rate (%)	Calving Percentage
Mating group—			
Spring	59·5	88·9	85·2
Summer	54·9	86·2	75·5
Autumn	60·5	81·9	75·0
Necessary difference* ..	21·8	9·9	19·1
Year—			
1961	36·3	91·8	85·9
1962	68·7	88·0	81·2
1963	71·2	84·5	79·7
1964	60·5	82·2	80·3
1965	54·7	81·9	65·7
Necessary difference* ..	30·4	13·8	26·5
Class of animal—			
Cow	52·8	82·5	78·1
Heifer	63·7	88·9	79·0
Necessary difference* ..	16·7	7·6	14·6

* Necessary difference for significance $P < 0{\cdot}05$.

When years were compared with the other two variates held constant, the only difference of statistical significance ($P < 0{\cdot}05$) was detected between the first service conception rate in 1961 and 1963. No differences were detected between cows and heifers.

No significant differences were detected in the percentage of lactating cows between years or between mating groups (Table 2). The regression of percentage lactating at mating on conception rate was not significant, indicating that there was no relationship between lactational status and conception rate under the conditions of this study.

TABLE 2

PERCENTAGE OF COWS LACTATING AT MATING AND EFFECT OF SEASON OF YEAR, YEAR, AND CLASS OF ANIMAL ON BODY-WEIGHT CHANGES IN RELATION TO MATING PERIOD

Variate	Cows Lactating at Mating (%)	Body-weight Gain		
		Month Before Mating (lb)	First Month During Mating (lb)	Second Month During Mating (lb)
Mating group—				
Spring	80·4	22·9	22·4	24·8
Summer	80·4	43·0	42·9	47·2
Autumn	69·4	16·0	14·5	15·2
Necessary difference* ..	23·1	10·2	9·9	9·7
Year—				
1961	61·3	35·4	35·7	39·0
1962	81·3	14·3	17·7	17·6
1963	90·7	26·9	24·7	23·9
1964	83·0	43·2	41·8	46·3
1965	67·3	16·7	12·9	18·4
Necessary difference* ..	33·5	15·0	14·6	14·3
Class of animal—				
Cow	..	20·5	21·3	23·7
Heifer	..	34·1	31·9	34·4
Necessary difference* ..	..	7·6	7·3	7·2

* Necessary difference for significance $P < 0{\cdot}05$.

Significant differences in body-weight change were detected between the summer-mated group and the other two groups both for the month prior to mating and for the 2 months after the commencement of mating (Table 3). There were also differences between years and classes of animal, with heifers showing the greater body-weight change (Table 2). When these body-weight changes were related to the conception rates during the respective periods, significant weight differences during the first month of mating were recorded between cows conceiving and cows not conceiving ($P < 0{\cdot}05$). The number involved in the second service and the third service conception rates decreased markedly and were too small for an adequate comparison (Table 3).

TABLE 3

EFFECT OF BODY-WEIGHT CHANGES ON FIRST, SECOND, AND THIRD SERVICE CONCEPTION RATES

Conception	Body-weight Gain (lb)		
	Month Before Mating	First Month of Mating	Second Month of Mating
First service—			
Conceived	27·5	33·1	..
Not conceived	20·4	22·8	..
Necessary difference* ..	8·1	8·9	..
Second service—			
Conceived	..	37·9	29·6
Not conceived	..	33·1	25·2
Necessary difference* ..	..	12·4	16·0
Third Service—			
Conceived	..	..	21·6
Not conceived	..	..	8·4
Necessary difference* ..	..	..	21·6

* Necessary difference for significance $P < 0{\cdot}05$.

(b) Services per Conception

The number of services per conception for the spring-mating group was significantly higher than that for the winter group, with the summer group intermediate between them (Table 4). No significant differences were demonstrated between years or classes of animal.

TABLE 4

EFFECT OF SEASON OF YEAR, YEAR, AND CLASS OF ANIMAL ON SERVICES PER CONCEPTION, LENGTH OF OESTRUS PERIOD AND GESTATION LENGTH

Variate	Services per Conception	Length of Oestrus Period (days)	Gestation Length (days)
Mating group—			
Spring	1·57	19·7	278·5
Summer	1·30	21·9	279·1
Autumn	1·20	20·6	278·4
Necessary difference* ..	0·36	2·8	2·6
Year—			
1961	1·14	21·1	276·5
1962	1·52	21·2	277·8
1963	1·32	20·4	279·7
1964	1·26	19·1	280·8
1965	1·54	21·8	278·4
Necessary difference* ..	0·53	3·3	4·4
Class of animal—			
Cow	1·47	20·5	278·6
Heifer	1·25	20·9	278·7
Necessary difference* ..	0·27	1·9	2·0

* Necessary difference for significance $P < 0{\cdot}05$.

S.E. for length of oestrus period (cows and heifers) $= \pm 0{\cdot}96$.

S.E. for gestation length (cows and heifers) $= \pm 1{\cdot}00$.

(c) Length of Oestrus Cycle

No significant differences between mating groups, years or classes of animal were shown in the length of oestrus cycle (Table 4).

(d) Duration of Gestation

No significant differences in gestation length were detected between mating groups or between classes of animal. The gestation length of animals both in 1961 and in 1962 was significantly shorter than in 1964, with that in 1963 and in 1965 being intermediate in length. This increased gestation length in 1964 coincides with the greatest weight changes of any year over the month before mating and the 2 months during mating.

(e) Calving Percentage

Calving percentage was similar for mating groups, years and classes of animal (Table 1). The regression of overall conception rate (Y) on calving percentage (X) was significant ($P < 0{\cdot}05$):

$$Y = -17{\cdot}30 + 1{\cdot}12X$$

IV. DISCUSSION

The three seasons of mating covered an annual period of 8 months from spring to early winter and provided a wide range of nutritional conditions. This is substantiated by the significant differences in body-weight change between breeding seasons and years. Despite this, the only significant effect on fertility was that of body-weight gain during the first month of mating on first service conception rate. Season of mating, year, age, lactational status and body-weight change at other times did not influence fertility.

A 9-week mating period which provided an opportunity for three matings was considered adequate for conception for healthy breeding cows (Lasley and Bogart 1943). The high proportion of conceptions to first service in relation to the overall conception rate supports this view.

The retention of cows in the same group and their remating at the same time each year ensured that the service of those cows which had calved prior to the commencement of mating would occur in the 60–120 days post-partum interval, which is considered the optimal period for conception (Trimberger 1954; Fallon 1958; Georgiev 1962; Băcīc *et al.* 1964).

The data suggest that differences in conception rates between 9-week mating periods commencing between early October and early April would be too small to detect with experimental groups of this size, if they did indeed exist. This same order of reliability could be expected when animals were mated at the same time in successive years, irrespective of the mating result of the previous year.

With constant handling the bulls became quite docile, so the presence of observers affecting fertility variations as reported by Hafez (1960) is unlikely to be a feature in this experiment.

Provision for females to become familiar with each other before mating was made by the procedure of running the heifers together for a period before their addition to the group of cows. This precaution, together with daily observation from horseback during the mating season, provided the type of management advocated by Rottensten and Touchberry (1957) in order to overcome the likelihood of fear and timidity occurring and their consequent adverse effect on fertility (Hafez and Lindsay 1965). The measurements of oestrus cycle length suggest that these factors did not have a measurable effect in this situation.

Animals which conceived to first service gained weight during mating at a faster rate than those which did not conceive. This association between body-weight change and conception rate is supported by the observations of Wiltbank *et al.* (1964) and Carroll and Hoerlein (1966) with pen feeding and grazing animals respectively.

No information was available on exhibition of oestrus prior to the beginning of mating and calculations on cycle length were only possible on animals for which two or more recorded services were available during the actual period of mating. First service conception rates were appoximately 58%, so the records for the estimation of cycle length were from comparatively few animals and may have tended to represent the performance of the less efficient breeders. However, the length of oestrus cycle in this study agreed with the generally accepted time of 21 days, with no difference between cows and heifers.

Although gestation length was similar in all groups, significant differences ($P<0{\cdot}05$) were noted in 1964 as compared with 1961 and 1962. It is interesting to note that in the same year the highest rates of body-weight gain were recorded, suggesting that cows in stronger condition had a longer gestation period.

No influence of lactation status on conception rate was established in this study. This is in contrast to the report of Plasto (1968) in a study with Shorthorn cattle in the tropical area of the State (lat. 20°S.); he found lactational status was associated with a lower rate of gain and conception rate during the mating. Lampkin and Kennedy (1965), in an environment intermediate in latitude between that of Plasto (1968) and the present study, observed an association between lactational status, body-weight change and calf production.

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