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Reproduction performance of beef cattle mated naturally following synchronization in the Central Bushveld bioregion of South Africa

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Abstract

The estimated calving percentage of beef cattle is 62% in the commercial sector of South Africa. Fertility is regarded as the main component influencing total herd efficiency in beef cattle. If the long calving seasons can be shortened and the calving percentage increased, more and heavier calves with a more uniform age can be weaned. Cows calving earlier in the season also have an extended "recovery period" and have the opportunity to calve in a better body condition during the next season, compared to cows calving late in the season. Cows that calve early also have a better chance of conceiving in the next breeding season and are generally seen as the more fertile animals. Research has been undertaken to evaluate the effect of oestrous synchronization followed by natural mating on the calving rate and calving distribution of multiparous beef cows. In this trial Bonsmara cows were mated naturally after synchronization over a period of four years (2009 - 2012) in an extensive production system on natural sour-mixed bushveld. The synchronized cows calved earlier during the 2009 calving season and cows in anoestrus started cycling again. The average days-to-calving after the start of the breeding season was 243 days for the synchronized cows and 267 for the non-synchronized cows. The calves born from the synchronized cows were therefore, on average, 24 days older than the calves born from the non-synchronized cows. From 2010 onwards the difference declined and it seems the biggest effect was obtained during the first year of synchronization.

Keywords: Beef cattle, Marikana thorn veld, natural mating, oestrous synchronization
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Introduction

In the recent past (early 1970's) the introduction of feedlots and export markets has changed the beef production scene in South Africa dramatically (Du Plessis *et al*., 2006). Globally, the consumption of various products of animal origin continues to grow and this pattern is expected to continue for the immediate future (Arelovich, 2011). If the large numbers of weaner calves that are imported annually from neighbouring countries are taken into consideration, South Africa is still a net importer of beef. By increasing the off-take in the beef sector, South Africa could move towards self-sufficiency (Scholtz *et al*., 2008). The increasing demand currently for organically-produced animal protein from free ranging animals is also adding yet another dimension to beef production, which filters through to the whole production chain to include also the primary production unit, the cow and calf herd (Du Plessis *et al*., 2006).

Natural veld has long been acknowledged to play an important role in extensive beef cattle production (Meaker, 1984), but very little information is available on production efficiency norms for cowherds under these conditions (Du Plessis *et al*., 2006). Studies conducted on natural pastures have concentrated mainly on aspects that affect herd efficiency, including calving rate (Lademann & Schoeman, 1994), pre-weaning growth (Venter, 1977), supplementation of cows and calves (Lishman *et al*., 1984; Lademann & Schoeman, 1994; De Waal *et al*., 1996), as well as crossbreeding (Mentz, 1977; Meaker, 1984). Important production traits and aspects were addressed in these studies and the effect of the various traits and aspects on cow production and efficiency were illustrated (Du Plessis, 2006). However, none of the studies focused on the reproduction performance of the beef cattle mated naturally after synchronization in the Central Bushveld bioregion of South Africa.

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With fertility being regarded as the main component influencing total herd efficiency, it is therefore essential that the quoted calving rate of 62% in the commercial beef sector of South Africa needs to be improved. If the generally long calving seasons are shortened and calving rates increase, more and heavier calves of a uniform age can be weaned (Grobler *et al*., 2013). Cows calving earlier in the season have a longer "recovery period" to the next mating season and have the opportunity to calve in a better body condition during the next season than those cows calving late in the season (Odhiambo *et al*., 2009). Cows that calve early also have a better chance of conceiving in the next breeding season and are generally more fertile animals (Holm, 2006).

Materials and Methods

The study was undertaken to evaluate the effect of oestrous synchronization, followed by natural mating on calving rate and the distribution of actual calvings, to establish if synchronization can lead to an increase in the total weight of calves weaned in a limited calving season, most likely by decreasing the days to calving, but also by increasing the number of calves born.

This study reports on the results from the first 4 years of the study being conducted at the Roodeplaat experimental farm of the ARC-Animal Production Institute (25º34'11.27''S; 28º22'05.36''E) on 900 ha of natural rangeland. The vegetation in the study area has been described as Savanna (Rutherford & Westfall, 1994), Sourish Mixed Bushveld (Veld Type 19) (Acocks, 1988), Clay Thorn Bushveld (Low & Rebelo, 1996) and Marikana Thornveld (Mucina & Rutherford, 2006) in the Savanna Biome, Central Bushveld bioregion, described as Marikana Thornveld. Mean daily minimum/maximum temperatures ranged from 16 ºC minimum to 30 ºC maximum in February (summer) to 2 ºC minimum to 21 ºC maximum in July (winter), as shown in Table 1. Mean annual rainfall for the past 10 years is 768 mm, of which 83% occurred from October to March. During the study period, the mean annual rainfall was 951 mm ranging from 676 mm to 1324 mm (Table 2). The stocking rate, as determined by seasonal veld analysis of 7 ha/LSU, was strictly adhered to, with no changes in stocking rate over the study period. Data was analyzed using the Proc GLM of SAS (SAS, 2000).

Table 1 Monthly minimum and maximum temperatures (ºC) over the four year trial period at Roodeplaat, Pretoria (AGROMET data base, 1994)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2009	18/30	16/29	14/28	9/28	6/22	4/22	1/20	4/23	9/29	14/29	14/28	16/29
2010	18/29	16/31	15/30	13/24	8/24	2/21	4/21	4/25	9/30	14/32	16/30	16/29
2011	17/28	16/29	15/30	12/25	6/24	1/21	1/20	4/24	8/29	12/29	14/30	17/29
2012	17/31	17/31	14/30	9/26	6/26	2/22	3/23	5/25	9/26	12/28	14/29	16/29

Ninety-two extensively managed multiparous Bonsmara cows, ranging in age from 3 to 12 years, were used to compare calving rate, calving interval distribution, with or without oestrous synchronization over a 4 year period. Cows were divided into four groups with similar age, metabolic body weight (Meissner *et al*., 1983) and a previous calving history structure. Half of the cows in each group were synchronized prior to breeding. The same individual cows were then synchronized each year. Cows were implanted on day 0 with an implant behind the ear containing 3 mg progestagen Norgestomet and the implant was removed on day 10, when the cows were injected intra muscular with 3 mg Norgestomet and 5 mg oestradiol valerate before mating commenced 56 h later with one fertile bull per group. The breeding season commenced early January each year and ended 80 days later. The bulls were rotated every year between the different groups. Herd management practices (e.g. dipping, vaccination) were standardized for all groups. The calving percentage and calving interval distribution were recorded. Cows were extensively managed with a commercial summer and winter lick available during summer and winter months, respectively, and calves were weaned at an average age of 7 months.

Results and Discussion

The calving percentage was the highest during the first calving season (2009) and lowest during the second calving season (2010). A possible factor that could have contributed to the low calving percentage in

2010 was the drought conditions which had a negative impact on the veld condition (Table 2). Bedell & Ganskopp (1980) reported that in range cows, oestrus can be delayed, pregnancy rates decreased and calf body weight at weaning reduced during drought conditions, while Mulliniks *et al*. (2012) found that yearly precipitation did not account for variation in days to first postpartum ovulation, pregnancy rates or days to lowest body weight in beef cattle. Rainfall prior to the breeding season and rainfall within the breeding season may have had an effect on forage availability, as well as cow adaptability. From Table 3 it would seem that the lowest calving percentage was preceded by low rainfall and dry conditions during the breeding season. Over the four year observation period no significant difference (P = 0.49) was recorded in the calving percentage of cows that were either synchronized at the beginning of the breeding season and cows that were bred naturally, without synchronization (Table 4). Although the project started with 23 multiparous cows in each group, 5 heifers were also included in each group which made the bull to cow ratio 1 : 28. The 12 synchronized cows may have been too many for one bull at a given time. There was, however, a significant difference (P = 0.04) between years in respect of calving rate over the four year period. Differences in the rainfall and ambient temperature over the four-year period could have contributed to this effect.

Table 2 Average annual rainfall during the study period for the respective years in the Central Bushveld bioregion (AGROMET data base, 1994)

Year	Jan.-Dec. rainfall (mm)
2008	1072
2009	1324
2010	772
2011	1031
2012	676
Average	951

Table 3 Rainfall recording during the trial including three months prior to breeding and three months within the breeding season

Year	Rainfall Oct.-March (mm)	Calving season (year)	Total calving percentage ±SD (%)
2008/2009	666	2009	86.56 ± 8.65
2009/2010	541	2010	57.88 ± 13.22
2010/2011	933	2011	76.41 ± 18.32
2011/2012	546	2012	72.27 ± 21.96

Table 4 Mean (± SD) calving rate of cows synchronized or not synchronized, for the 2009 – 2012 breeding seasons

Synchronization	Yes	No
Calving % 2009	86.9 ± 12.5	86.3 ± 4.3
Calving % 2010	55.8 ± 13.2	60.0 ± 14.9
Calving % 2011	78.1 ± 12.6	74.8 ± 24.9
Calving % 2012	68.6 ± 24.6	85.9 ± 4.7

In general, the synchronized cows calved earlier during the 2009 calving season and cows in anoestrus were induced to start cycling again. The average period to calving after breeding was 243 days for the synchronized cows and 267 for the non-synchronized cows. The calves born from the synchronized cows were, therefore, on average, 24 days older than the calves born from the non-synchronized cows. The preliminary results from the first year of the four year study indicated that a practical way to decrease the length of the breeding season is by oestrous synchronization followed by natural mating. If long calving seasons are shortened and calving rates increased, more and heavier calves of a uniform age can be weaned. From 2010 onwards, however, this difference was not noted and it would seem as if the biggest effect was obtained during the first year of oestrous synchronization.

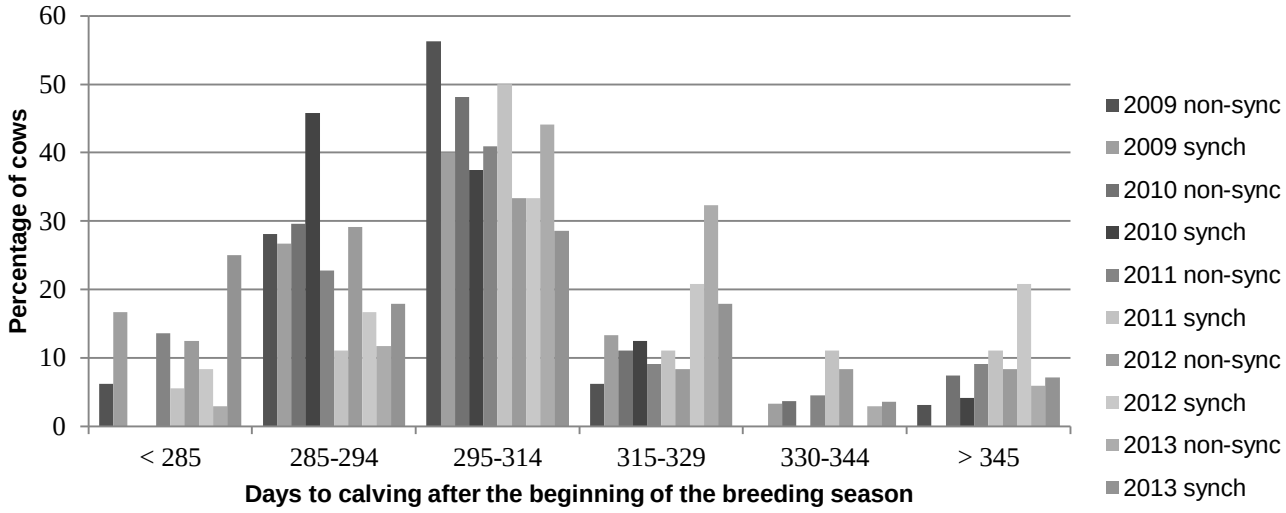

Figure 1 Interval (days) to calving for the synchronized and non-synchronized cows for the period 2009 - 2012.

Conclusion

From this study it would seem that there is no economic advantage in synchronizing fertile productive cows each consecutive year during their productive lives under extensively managed conditions on Marikana Thornveld.

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