Effect of Sexual Partners on the Oestrous Behaviour Response in Zebu Cattle (*Bos Indicus*) Following Synchronisation with a Progestagen (Synchro-Mate B)

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ABSTRACT : With the purpose of determining the influence of sexual partners on the oestrous behaviour and to evaluate the accuracy of predicting the time from implant withdrawal to sexual receptivity following a treatment with Synchromate B (SMB), 15 adult Brahman cows were used in each of three phases. During phase I and II, random pairs of animals were induced to display oestrus one pair after the other at daily intervals, while in phase III, cows were induced alternately, every other day, one cow on the 1st day, two on the 3rd, one on the 5th, two on the 7th until all cows were treated. Sixty six percent of the cows in phases I and II, and 80% in phase III came into oestrous after treatment. The interval between implant withdrawal and, expected and observed oestrous was statistically different in all phases. Clustering of oestrous was evident. Cows displayed sexual receptivity within a range of -24 to +96; -24 to +72 and -216 to +192 hours after implant withdrawal for the three phases, respectively, with a tendency for cows treated first (within treatments), to delay their oestrus signs and vice versa. In phase III, four cows showed oestrous behaviour with the implant in place. These in spite of not observing pre-ovulatory follicles. Correlation values of 0.99, 0.93 and 0.90 ($P<0.05$) were found respectively among treatments, between the number of cows coming into oestrus and the number of mounts observed. These findings suggest that there are social and behavioural factors in a herd that may override exogenous synchronisation treatments. (*Asian-Aus. J. Anim. Sci. 1999. Vol. 12, No. 4 : 515-519*)

Key Words : Oestrous Behaviour, Oestrus Synchronisation, Tropics, Zebu Cattle, Sexual Mate

INTRODUCTION

Upon reviewing the literature Galina and Arthur (1990) concluded that the major restraint to the widespread use of AI in beef cattle in Latin America is the difficulty in detecting cows in oestrous. Oestrous synchronisation is used to assist in overcoming this problem. One of the treatments used is a progestagen-oestrogen combination (Synchro-mate B) which results in a relatively circumscribed oestral response (Odde, 1990).

However, in a recent study (Medrano et. al., 1996) where cows were induced into oestrous individually one after the other at daily intervals all cows came into oestrous in a cluster rather than at the expected times, suggesting an important role of social partners in the expression of overt oestrous behaviour.

The purpose of the present study was to determine the influence of predetermined sexual partners (cows programmed to come in oestrous by pairs) on oestrous behaviour and to evaluate the accuracy of predicting the time from implant withdrawal to sexual receptivity following a treatment with Synchro-mate B in Zebu cattle.

MATERIALS AND METHODS

The experiment was carried out in the state of Morelos, Mexico (18° 41" N, 99° 21" W) located in the arid tropic region, at 1020 m above sea level. Average annual precipitation for the area is 750 mm. Annual temperatures fluctuate between 18 and 28℃.

A herd of 15 Brahman cows aged between three to six years was used in each of three phases with one month interval between phases. All animals were examined for 30 days prior to implant insertion every four days by ultrasound (Tokio-Keiki LS 1000 equipment with a 7.5 MHz transducer) to assess the presence of a corpus luteum or follicular development and determine whether the animals were exhibiting oestrous cycles (Driancourt, 1991; Ginther, 1993). Following withdrawal, ultrasound examinations were carried out every other day for 20 days. Follicles smaller than 9 mm, or corpus luteum were reported if they were present at least in two consecutive examinations. Follicles > 12 mm found one day before or on the day of oestrous, were reported as pre-ovulatory follicles.

Three cows were sexually inactive during phases I and II, but were cycling in the third phase. Twelve cows were randomly treated during phases I and II. Three cows in each phase remained untreated. The fifteen cows were treated in phase III. Conspicuously, large numbers were painted on the flanks of the cows to facilitate identification during the daily continuous observation period (from 0600 until 1800 h), which started after removal of the first implant, and ended 120 hours after removal of the last. All animals were maintained in a six hectare field planted with *Cynodon sp.* and were supplemented with a mixture of molasses, hen manure and milled sorghum.

During phases I and II, pairs of animals were randomly formed and induced to display oestrous with

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SMB, one pair after the other at daily intervals. Phase II was conducted identically as phase I due to the feasibility of repeating the experiment. In phase III, cows were induced alternately, every other day, one cow on the first day, two on the third, one on the fifth, two on the seventh until all 15 animals received treatment. Among each phase, a 30 days period was allowed.

The SMB treatment (Sanofi, Mexico) consisted of an ear implant containing 6 mg of norgestomet left in place for nine days. On the day of the implant application, an intra-muscular injection of estradiol valerate (5 mg) and norgestomet (3 mg) was also given. Animals were handled from 09:00 to 11:00 each day that management was required. Oestrous behaviour (sexual receptivity) was expected to occur between 31 and 57 hr. following implant removal (Porras et al., 1993). Standing immobile to be mounted was the dependent variable used in determining oestrus.

The Kolmogorov-Smirnov, two sample test was used to compare intervals between implant withdrawal for expected vs. observed oestrus. The Spearman rank correlation was used to measure the relation between the rank order of the expected and observed onsets of oestrus among phases, and for the relation between the number of cows coming into oestrus at any given time and the number of mounts observed daily (Siegel and Castellan, 1988).

RESULTS

Sixty six percent (8/12) of the treated cows in phases I and II and eighty percent (12/15) in phase III showed sexually receptive behaviour (stood immobile to be mounted), although three of them displayed oestrous behaviour with the implant in place.

The distribution of the expected and observed sexual receptivity taken as the time to onset of oestrus after implant withdrawal was statistically different in the three phases ($p<0.10$, $p<0.05$ and $p<0.05$, respectively). A tendency was seen for the animals to display oestrous behaviour in groups. This clustering effect was evident in all experiments, with five, four and three cows showing oestrous behaviour instead of one or two per day. Even though these animals showed oestrous behaviour within the expected time range, they failed to display oestrus at daily intervals as expected according to the experimental design. Correlation values of 0.72, 0.96 and 0.65 ($p<0.05$) were found between the rank order of expected and observed onset of oestrous in phases one, two and three respectively (table 1). Cows displayed oestrus within a maximum range of 408 hours, from -24 hr after implant removal to +96 hr in phase I; -24 to +72 in phase II and -216 to +192 in phase III, respectively. There was a tendency for the animals treated first (within treatments) to delay their oestrus compared to those treated last (figure 1). Inclusively in phase III, four animals exhibited oestrous behaviour even with progestagen implants in place.

None of the non treated cows displayed sexual behaviour in phases I and II (table 2). All animals observed in oestrus (standing to be mounted) during phase I and II showed large follicles on the day before or at the day of oestrus, even if this behaviour was displayed out of the range of the expected oestrus. However in phase III, oestrous behaviour was observed in cows even with progestagen implants in place. In these cases ultrasonic examination of the ovary showed no evidence of follicular development (pre-ovulatory follicles) associated with the behaviour observed (table 2).

Table 1. Correlation value between the rank order of the expected and observed oestrus in the three phases

Cow ID	Phase I		Phase II		Phase III	
	Rank order of expected oestrus	Rank order of observed oestrus	Rank order of expected oestrus	Rank order of observed oestrus	Rank order of expected oestrus	Rank order of observed oestrus
4	5th			4th	7th	6th
5	1st	2nd	4th	3rd	2nd	1st
6	6th	4th		5th	4th	
7	5th	4th	2nd	2nd	8th	7th
8			5th	4th	7th	8th
9	1st		1st	1st	2nd	5th
10		3rd	2nd		10th	5th
11	3rd	4th	1st	2nd	10th	4th
12	2nd	1st	4th		3rd	2nd
13	2nd				4th	4th
15	3rd	2nd	3rd		6th	5th
16	4th		6th	4th	9th	
18	6th	4th	3rd	2nd	1st	1st
19			6th	4th	8th	
20	4th	4th	5th	4th	5th	3rd
r^2		0.72		0.96		0.65

Table 2. Ultrasound findings (ovarian activity before and after a progestagen implant) and oestrus manifestation

Phase I			Phase II			Phase III		
Cow id.	US** findings	Oestrus	Cow id.	US findings	Oestrus	Cow id.	US. findings	Oestrus
4	f		4*			4	f	+
5	F CL	+	5	F CL	+	5	F CL	+
6	F CL	+	6*			6	f	
7	F CL	+	7	F CL	+	7	F CL	+
8*	f		8	F CL	+	8	F CL	+
9	f		9	F CL	+	9	F CL	+
10*	F CL		10			10	f	+
11	F CL	+	11	F CL		11	f	+
12	F CL	+	12	f		12	F CL	+
13	f		13*	CL		13	F CL	+
15	F CL	+	15	f		15	F CL	+
16	f		16	F CL	+	16		
18	F CL	+	18	F CL	+	18	F CL	+
19*	f		19	F CL	+	19		
20	F CL	+	20	F CL	+	20	F CL	+

* Non treated animals. ** US=Ultrasound.
f=follicles < 9mm for more than two consecutive examinations.
F=pre-ovulatory follicle (> 12 mm).
CL=corpus luteum for more than two consecutive examinations.

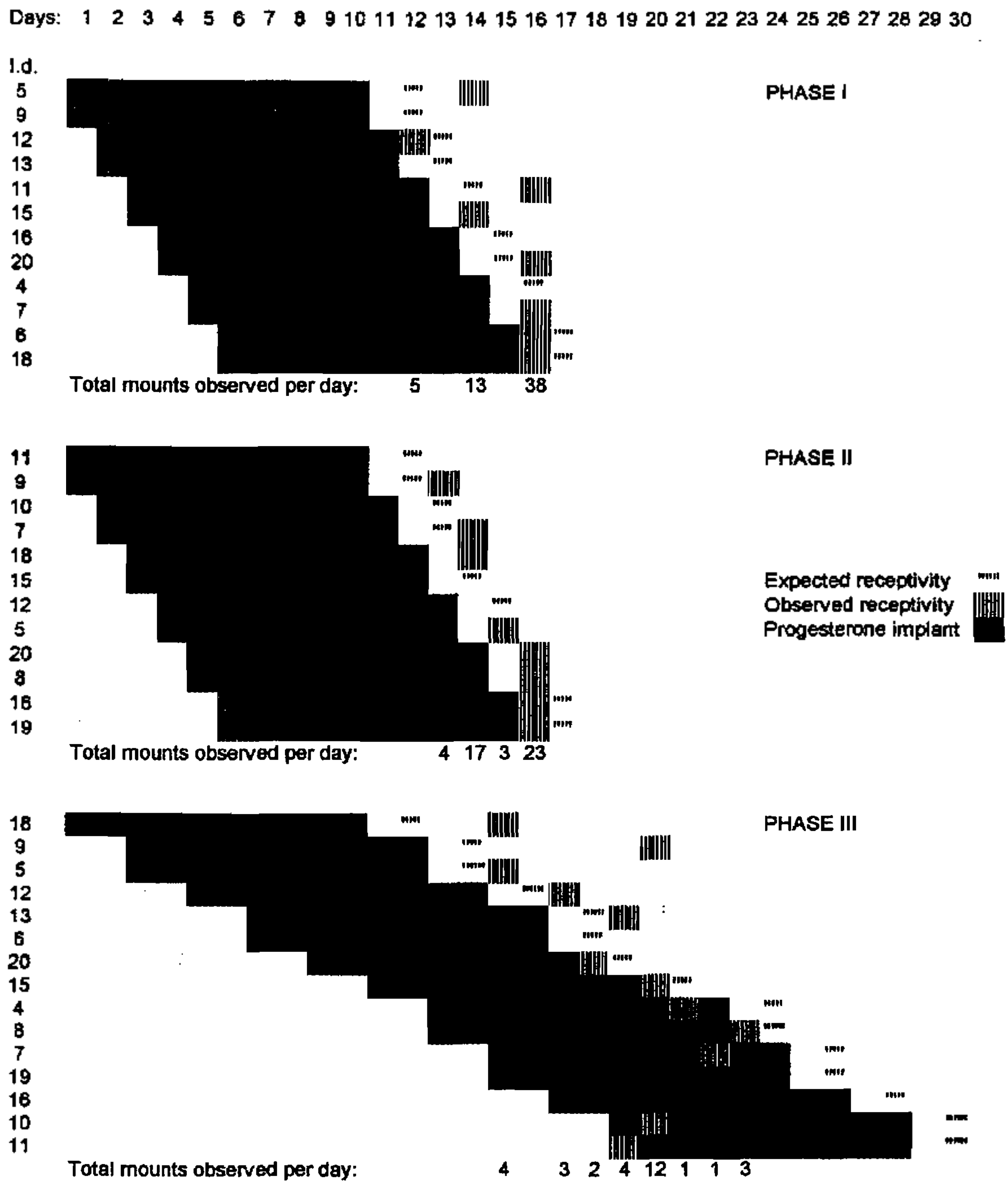

Figure 1. Implant phase (progestagen), day of expected and observed receptivity and counts observed per day during the three phase of the experiment

The average total number of mounts observed per day increased from 2.5 mounts with one or two cows in oestrous, to 12 with three, 23 with four and 38 with five cows in oestrous at the same time (figure 1). Correlation values of 0.99, 0.93 and 0.90 ($p<0.05$) were found respectively, between the number of cows coming into oestrus each day and the number of mounts observed daily.

The clustering of oestrous behaviour was particularly prominent in two pairs of cows; animals number 6 and 18 in phase I, and 16 and 19 in phase II. These pairs of animals displayed sexual activity with each other as intended, although 24 hours before expected. Cows 7 and 18 came into oestrus concomitantly in phases I and II, even though they were not programmed to be in oestrus on the same dates. Only six cows (two in phase I and four in phase II) showed oestrous behaviour when expected.

The mean number of mounts received per cow in oestrus was 1.93 ± 1.85, in a range from one to seven.

The mean number of sexual partners with any individual cow in oestrus was 4.6 1.8 ; 5.0 0.9 and 1.5 0.6 for phases I, II and III, respectively, (range=1 to 8; table 3).

Table 3. Number of sexual mates involved per phase

Rider cow ID*	Number of sexual participants involved with a specific oestrus cow		
	Phase I	Phase II	Phase III
4		3	1
5	3	4	1
6	4	6	
7	5	6	1
8		5	1
9		6	2
10			1
11	4		2
12	2		2
13			1
15	8		3
16		5	
18	5	5	3
19		5	
20	6	5	1
Total receptive cows	8	8	12
Mean number of mates SD per phase	4.6 ± 1.8^{a}	5 ± 0.9^{a}	1.5 ± 0.6^{b}

ID: identification number.
[a,b] Means in the same row with different superscripts differ $p<0.05$.

DISCUSSION

The efficacy of the synchronisation treatment in phases I and II was low. However, an 80% detection rate in phase III agrees with earlier results for Zebu type cattle treated with a progestagen under Mexican conditions (Porras et al., 1993).

In the present study one or two cows should have been in oestrus every day while the rest of the herd was under the influence of an active progesterone implant, that is in metaestrus or diestrus. Some cows exhibited mounting in the absence of active follicles capable of ovulation perhaps due to the effects of social facilitation and excitement (Kilgour et al., 1977; Medrano et al., 1996). These interfere with the accurate presentation of cows suitable for insemination. It is likely that these cows were imitating the behaviour of an animal in true oestrus. The clustering of the sexual behaviour of the other cows supports this supposition and agrees with previous reports (Gutierrez et al., 1993 ; Lamothe et al., 1995; Medrano et al., 1996). In effect Medrano et al. (1996) found that inducing one animal per day to display oestrus, 40% of the cows implanted with a progestagen showed overt signs of oestrus outside the expected range from 31 to 57 hours after implant removal, showing a tendency in Zebu cows under field conditions to manifest synergistic sexual behaviour. These phenomena have also being noticed in cows observed for spontaneous oestrus. Lamothe et al. (1994) found that after 93 days of oestrus detection of the periods of sexual activity studied, 10.8% were observed when only one cow was active or receptive while in 75.6% three or more cows simultaneously displayed sexual activity or passivity. However, in these studies, no information about ovarian activity is given.

Social cues may facilitate the synchronization of oestrous cycling within reproductive groups. Social interaction could trigger the release of chemical signals known to synchronize oestrous cycles (McClintock, 1978, 1981). Vandenbergh and Izard (1983) reported that exposure to the cervical mucus of oestrus dairy cows enhanced oestrus synchronisation in herd-mates during artificial induction of oestrus. Wright et al. (1994) found that cervical mucus from cows in oestrus appears to contain a compound or compounds which can reduce the post-partum anestrous period in cows.

Hierarchy may also be an important factor in the synchronisation of oestrus in ungulates. Orihuela et al., (1988), found that 60% of the mounts recorded were initiated by cows higher in the hierarchy order than those being mounted.

The onset of the observed oestrus in the present study was different from the expected. In addition to normal variation in the onset of oestrus, there is some evidence that environmental circumstances can influence oestrus expression. For example, Vaca et al. (1985), found that 50% of the animals injected with $PGF_2\alpha$, showed sexual receptivity around 118 hours following injection, after being let loose in the field. Orihuela et. al. (1983), reported that about 80% of the non-synchronized cattle displayed oestrus within the same range of hours that their synchronized pairs. Other experiments have shown that factors like abrupt changes in handling conditions, such as being moved to a new pasture; hazardous environmental conditions such as heavy rain, strong winds, or tropical storms (Hurnik, 1987), or the near presence of the bulls (Kilgour et al., 1977) may inhibit the expression of behavioural oestrus.

The number of mounts received per hour was greater when more than one cow was in oestrus at the same time. This finding agrees with previous reports that show an increase of activity in the sexually active female group when more animals are simultaneously in oestrus, phenomenon which has been well documented in *Bos taurus* breeds (Hurnik et al., 1975; King et al., 1976; Kilgour et al., 1977 and Castellanos et al., 1997) but to our knowledge not in Zebu type cattle.

In summary, the fact that mounting behaviour was some times observed at a different time from when oestrus was expected, suggests that there are social and behavioural factors in the herd that may override exogenous synchronization treatment.

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