

## SYNCHRONIZATION OF OVULATION IN BEEF HERDS: IMPROVED CONCEPTION RATE AFTER AND INTERRUPTED COURSE OF PROGESTERONE ADMINISTRATION

J.F.W. Grosskopf

Receipt of MS 14.8.73.

Department of Animal Production, University of Pretoria, Pretoria

**OPSOMMING:** OVULASIESINKRONISASIE IN VLEISBEESKUDDES: VERBETERDE KONSEPSIESYFERS NA 'N ONDERBROKE KURSUS VAN PROGESTEROONTOEDIENINGS

Die bronstigheidsiklusse van vleisraskoeie en/of verse is in ses kuddes deur binnespiersie progesteroninspuitings gesinkroniseer. Om die koeie wat met die aanvang van die behandeling in die laat fase van 'n siklus verkeer en wat dikwels gedegenererde ova na sinkronisasie vrystel uit te skakel is die behandeling in twee fases verdeel. Eers is vier 48-uurlikse inspuitings van 50 mg progesteron in propilenglikol toegedien, dan is 'n periode van 8 dae oorgeslaan voordat die tweede reeks van ses 48-uurlikse progesteroninspuitings hervat is. Met hierdie metode is uiters bevredigende resultate met inseminasie tydens die eerste gesinkroniseerde bronstigheid verkry in 4 uit die 6 kuddes. Konsepsiesyfers wat tussen 69 en 86% gevarieer het is behaal wat goed vergelyk met die gemiddelde van ongeveer 70% vir eerste inseminasie sonder sinkronisasie en 'n groot verbetering is op die gemiddelde besettingsyfer van 47% (36 tot 58%) wat voorheen na progesteroninspuitings behaal is.

### SUMMARY

The oestrous cycles of cows and/or heifers were synchronized in six herds by the intramuscular administration of progesterone. In order to exclude those cows that were in the latter third of their cycles at the onset of treatment, the herds were first presynchronized by four 48-hourly injections of 50 mg of progesterone in propylene glycol and after an interval of eight days, treatment was resumed by giving them 6 more such 48-hourly injections. Conception figures varying from 69 to 86% were attained in 4 of the 6 trials during the synchronized oestrus. These compare favourably with normal first insemination figures uncomplicated by synchronization and represent a marked improvement on the average figure of 47% (36 to 58%) previously experienced after synchronization with progesterone.

Poor conception rates in cattle are uniformly common during the first oestrus after synchronization with progesterone or the orally active progestogens (Jöchle, 1972). Menné and Grosskopf (1968, 1969) and Menné (1969) have published some of the typical results experienced with beef cattle in South Africa. This unnaturally low fertility limits the practical application of oestrus synchronization, especially in lactating cows. The beef cow's *post partum* anoestrous period of over 70 days (Bosman and Harwin, 1969) and her gestation period of approximately 290 days (Skinner and Joubert, 1963) does not allow much time to get her pregnant again so that she can consistently calve during the same season of consecutive years. A high conception rate during the first synchronized oestrus is therefore of prime importance.

The exact cause of this lowered fertility is still obscure although various workers have attempted to establish the underlying causes. According to Hansel (1967) the compounds with the highest progestational activity also have the greatest depressing influence on fertility. He was also of opinion that the use of progesterone resulted in lower fertility than when methyl-acetoxyprogesterone (MAP) was the progestational agent.

The suitability of the uterine medium for sperm transport after treatment with progestogens has been questioned. Shelton and Moore (1966) proved it to be normal for the survival of fertilized ova but it may be different for sperm. Jöchle (1969) spoke about a "hostile uterine environment" which may be detrimental to normal sperm transport. Lamming (1973) supports this hypothesis by showing that fertilization does not occur in cases where the

corpus luteum still secreted even low levels of progesterone at the time of ovulation.

Delayed ovulation may also contribute towards lower conception rates. In synchronizing cows for an experiment to induce multi-ovulations, Jurriaanse (1973) found that quite a number of cows ovulated later than 36 to 48 hours after the onset of oestrus, some of them also showing prolonged heat periods. Van der Westhuysen (1972), on the other hand, found a large percentage of cows that ovulated without showing any detectable signs of heat, especially in the Afrikaner breed.

In 1970 van Niekerk and Belonje published an acceptable explanation for the lower fertility when they showed that those cows which were in the last third of their oestrous cycles at the onset of progestogen (MAP) treatment developed abnormal follicles which housed degenerated ova. For this reason they suggested the possibility of "presynchronizing" cows before the actual synchronization is undertaken. This suggestion was tested in a number of beef herds.

### Procedure

All trials were performed under practical farming conditions in different regions of South Africa during summer, early and late winter breeding seasons. Progestogen treatment consisted of ten 48-hourly intramuscular progesterone injections over a period of 26 days during which the drug was withheld for 8 consecutive days after the first four injections. This means that every cow received 50 mg progesterone in propylene glycol on days number 1; 3; 5;

7; 16; 18; 20; 22; 24 and 26. The first four administrations were regarded as the presynchronization period and normally the majority of cows showed signs of heat during the period of 8 days following this presynchronization period but were not inseminated. After the completion of the second series of progesterone injections the herds were observed for oestrus as from about 54 hrs after the last administration of the drug. All cows in oestrus were inseminated between 10 and 16 hrs after being found on heat. In the few cases where cows remained in oestrus longer they were inseminated a second, and in exceptional cases, even a third time at 24-hourly intervals.

After an interval of approximately three weeks a number of cows previously inseminated were again found in oestrus and were re-inseminated. During the second oestrous period some cows were also observed on heat for the first time, indicating that they were probably missed during the first synchronized oestrus period. Subsequent to this second period the cows and heifers of most of the herds were allowed to run with bulls for the remainder of the breeding season.

The following herds were treated:

- Herd A: Bonsmara herd in the Northern Transvaal, January 1971.  
 Herd B: The same herd, January 1972.  
 Herd C: Bonsmara herd in the north western Transvaal, August 1972.

Herd D: Hereford crossbred heifers, 15–16 months old, Natal, June 1972.

Herd E: Crossbred beef herd, Griqualand East, October 1971.

Herd F: Brahman herd, South West Africa, November, 1971.

The number of animals treated, the ages of the calves of the lactating cows, the calving history of the herd and the nutritional level of the herd during the experiments are given in Table 1.

For the experimental herd A, 80 cows and 40 heifers running with bulls under similar conditions on the same farm were regarded as a control group for the purpose of overall breeding performance during that season. In the case of herd C, the other cows and heifers on the same farm which were running with bulls, were used to compare their ultimate conception rate with that of the synchronized group.

Conception rates were determined by rectal palpation approximately 3–3½ months after the first insemination in order to distinguish between pregnancies derived from the first or second oestrus periods.

The results were compared to those obtained by Menné and Grosskopf (1968–1969), Menné (1969) and Grosskopf (unpublished) in experiments where the same level of progesterone was employed but as a continuous series of 48-hourly injections over 15 or 17 days.

Table 1

*The number of females treated in each herd, their stage of production and level of nutrition*

Herd No.	Number of animals treated			Age of calves (Range) in days)	Calving history of herd	Nutritional level
	Lact. cows	Dry cows	Heifers			
A	40	—	10	41–79	Good	Excellent pasture
B	66	—	5	33–99	Good	Excellent pasture
C	70	4	19	15–89	Good	Very dry natural pasture
D	—	—	48	—	Excellent	Hay and concentrates average daily gain 0,50 kg
E	—	21	9	—	Good	Spring grazing
F	2	12	78	—	Fair	Very dry natural pasture
Total	178	37	169			

## Results and Discussion

The main object of these trials was to attempt to increase conception rates during the first synchronized oestrus to above the 40 to 50% normally encountered after synchronization. The results are therefore tabulated with this in mind and treating the lactating cows, dry cows and heifers separately.

### Occurrence of oestrus

According to past experience the first synchronized heat period can be regarded as the five-day period from the third to the seventh day after the last administration of the drug. The first cows in oestrus were normally observed during the early morning of the third day (approximately 68 hrs after the last progesterone injection). Table 2 gives the percentage of cows or heifers treated that responded to synchronization during the first heat period. As expected, the dry cows all responded to treatment but only 70% of the lactating cows exhibited signs of heat during the first synchronized oestrus period.

### Conception rate

The results of the inseminations during the different oestrous periods are presented in Table 3. Table 4 gives the corresponding figures obtained in previous experiments where the continuous method of progesterone administration was employed. From the figures in Table 3 it can be seen that the conception rates during the first oestrus compare very favourably with those of the second oestrus period except for herd C. In this trial it was only discovered later that the semen of 2 of the 3 bulls used was below standard and that only 5 of the calves were sired by these 2 bulls during the synchronized oestrous period. The poorer results obtained with herd F may be ascribed to poor quality semen which accidentally thawed during the storage period. The conception rates also compare favourably with the average conception figures to first insemination of approximately 70% reported by most A.I. stations and are a vast improvement on those presented in Table 4.

### Percentages of calves born from first synchronized oestrus

The number of pregnancies derived from insemination during each of the first two oestrus periods after synchronization or from service during subsequent oestrus periods during the particular breeding season are presented in Table 5. Even with the inclusion of herd C, nearly two thirds of all calves born were derived from insemination during the first synchronized oestrus.

The corresponding figures attained after synchronization by the continuous method of progesterone administration, as derived from Table 4, were:

Percentage of calves born from first oestrus .....	51%
do. from second oestrus .....	36%
do. from subsequent oestrus .....	13%

### Effect of synchronization on general herd fertility

It has been found repeatedly in the past by comparison with control groups that synchronization with progesterone alone has no effect on the percentage of cows that will come into oestrus in a particular herd during a particular season. Synchronization only assisted to group the oestrus periods, in that way relieving the burden of daily observations for oestrus and inseminations over an extended period. In herd A the final pregnancy rate of 78% in the synchronized group of lactating cows compared favourably with the 75% of the remaining 81 untreated lactating cows on the farm. In the case of herd C, 86% of the untreated cows and heifers running with bulls conceived while only 74% of the synchronized group were pregnant at the end of the breeding season. The possible reason for this has been discussed earlier.

### Conclusions

It appears that the technique of first bringing all cows into the same stage of the oestrus cycle by "presynchronization" before the actual synchronization is performed does assist to overcome the poor fertility generally ex-

Table 2

Percentage of cows and heifers observed to be in oestrus during the first synchronized oestrus period

Herd	Lactating Cows	Dry Cows	Heifers
A	75	—	60
B	61	—	80
C	73	100	85
D	—	—	81
E	—	100	78
F	100	100	78
Total	70	100	79

**Table 3**

*Conception rates to insemination during the first and second synchronized oestrus periods (Interrupted progesterone treatment)*

HERD	1st Oestrus			2nd Oestrus		
	No. inseminated	No. conceived	% conceived	No. inseminated	No. conceived	% conceived
A Lact. cows	30	27	86	4	4	80
Heifers	6	4		1	0	
B Lact. cows	41	31	73	17	13	72
Heifers	4	2		1	0	
C Lact. cows	51	22	41	26	20	79
Dry cows	4	2		1	1	
Heifers	16	5		7	6	
D Heifers	39	27	69	12	9	75
E Dry cows	21	18	79	4	4	89
Heifers	7	4		5	4	
F Lact. cows	2	1	56	1	0	36
Dry cows	12	7		5	3	
Heifers	63	35		22	7	
Total	296	185	63	106	71	67

**Table 4**

*Conception rate in beef females to insemination during different stages after progesterone administration (8 or 9 successive 48-hourly injections)*

First Synchronized oestrus		2nd Synchronized oestrus		Subsequent oestrus		Reference
No. Inseminated	% Conception	No. Inseminated	% Conception	No. Inseminated	% Conception	
52	39	29	69	11	82	Menné & Grosskopf (1968)
58	50	23	91	17	65	do.
73	36	39	77	21	67	Menné & Grosskopf (1969)
52	58	15	67	3	33	Menné (1969)
22	50	7	86	2	50	do.
41	56	9	81	6	83	do.
--	--	76	76	15	86	Grosskopf (1971, Unpublished)
85	47	44	82	8	75	Grosskopf (1970, Unpublished)
383	47	242	77	83	72	

Table 5

Percentage of all pregnancies derived from insemination during the different oestrus periods after synchronization

HERD	1st Oestrus	2nd Oestrus	Subsequent Oestrus
A	84	11	5
B	61	24	15
C	40	38	22
D	75	25	0
E	67	24	9
F	73	17	10
Mean	64	24	12

perienced during the first synchronized oestrus. Although results in all herds were not as good, conception figures of between 70% and 90% have been attained after insemination during the synchronized oestrus. This compares favourably with the average conception figure of approximately 70% to first insemination without synchronization, reported by A.I. organisations. It is therefore concluded that normal conception rates can be achieved during the first synchronized oestrus but that the results can be greatly influenced by the reproductive status of the particular herd. This in turn is mainly dependent on the management, the

nutritional level and the degree of selection for fertility which is practised in the herd.

#### Acknowledgements

A number of farmers have kindly co-operated in this project. Messrs. J. van Amstel, P. Kraupner, B.G. Brönn, B. Wöbling and R.W. Purchase are thanked for their assistance, for keeping the records so meticulously and for allowing their herds to be used for these trials.

#### References

- BOSMAN, D.J. & HARWIN, G.O. 1969. The occurrence of post partum oestrus in beef cows under ranching conditions. *Proc. S. Afr. Soc. Anim. Prod.* 8, 165.
- HANSEL, W. 1967. Control of the ovarian cycle in cattle. In: *Reproduction in the female mammal*. Ed. G.E. Lamming and E.C. Amoroso. London: Butterworths.
- JÖCHLE, W. 1969. Latest and practical problems arising during oestrus synchronization. *Proc. S. Afr. Soc. Anim. Prod.* 8, 23.
- JÖCHLE, W. 1972. Pharmacological aspects of the control of the cycle in domestic animals. *Proc. VIIIth Int. Congr. Anim. Reprod. artif. Insem., Munich 1972*, 1, 97.
- JURRIAANSE, A. 1973. *Die invloed van speenouderdom en sekere hormoonbehandelings op eierstokaktiwiteit in vleisbeeste*. M.Sc. (Agric.), Thesis, University of Pretoria.
- LAMMING, G.E. 1973. Progress with the control of oestrus and ovulation in farm livestock. *S. Afr. J. Anim. Sci.* (in the press).
- MENNÉ, P.F. 1969. *Synchronization of ovulation in ranching cattle*. M.Sc. (Agric.) thesis, University of Pretoria.
- MENNÉ, P.F. & GROSSKOPF, J.F.W. 1968. Experience with synchronization of ovulation in beef cattle. *Proc. S. Afr. Soc. Anim. Prod.* 7, 151.
- MENNÉ, P.F. & GROSSKOPF, J.F.W. 1969. Synchronized breeding of beef cattle. *Proc. S. Afr. Soc. Anim. Prod.*, 8, 167.
- SHELTON, J.N. & MOORE, N.W. 1966. Survival of fertilized eggs transferred to ewes after progesterone treatment. *J. Reprod. Fert.* 11, 149.
- SKINNER, J.D. & JOUBERT, D.M. 1963. A further note on the duration of pregnancy and birth weight in beef cattle in the sub-tropics. *Proc. Afr. Soc. Anim. Prod.* 2, 104.
- VAN NIEKERK, C.H. & BELONJE, P.C. 1970. Post partum synchronization of the oestrus period of lactating Friesland cows with 6-methyl, 17-acetoxypregesterone (MAP) and PMSG. 2 Observations on ovarian abnormalities. *J. S. Afr. vet. med. Ass.* 41, 47.
- VAN DER WESTHUYSEN, J.M. 1972. Differences in progesterone synchronized oestrus and ovulation in cattle breeds. *S. Afr. J. Anim. Sci.* 2, 91.