OESTRUS SYNCHRONIZATION IN BEEF CATTLE A REVIEW

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INTRODUCTION

The most important consideration in the economics of beef cattle production is that of reproduction. If a cow does not cycle regularly, conceive at the desired time, and rear a healthy calf, then any other quality that she may have will be of little use. While increases in reproductive efficiency can be achieved by changes to existing methods of management, the use of controlled breeding techniques, in particular the control of oestrus and ovulation, offers a considerable potential for future improvement. Many aspects of this topic have recently been the subject of a number of review articles (Lamond, 1964; Robinson, 1969; Mauleon, 1974; Roche, 1976a; Gordon, 1976; Smith, 1976a) and therefore will be only briefly discussed in this paper.

ADVANTAGES OF SYNCHRONIZATION

The most obvious advantage of synchronization is in the facilitation of the use of A.I. in beef cows and the reduction of the costs of the A.I. programme through savings in time, labour, special food requirements, technician and semen costs. A less obvious but probably more important benefit is that of improved overall management and associated gains that can result from having a concentrated period of mating and a subsequent concentration of calving at the beginning of the calving period.

HOW SYNCHRONIZATION IS ACHIEVED

Oestrus and ovulation are controlled by the modification of the normal endogenous hormone patterns with exogenous hormones. Normally, the luteal phase of the cycle is manipulated and it can either be shortened (prostaglandins, oestrogens) or prolonged (progestagens). Greater precision in time of ovulation has been obtained by supplementing these treatments with gonadotrophin releasing hormone (GnRH), human chorionic gonadotrophin (HCG) or oestrogen.

REQUIREMENTS OF A SATISFACTORY TECHNIQUE

To be effective and practical a system of oestrus and ovulation control must:

(1) Be easy and quick to administer with minimal stock handling and stress.

(2) Result in a high proportion of animals showing heat or ovulating (*i.e.*, be able to overcome anoestrus if necessary).

(3) Precisely synchronize ovulation to allow a single insemination on a time basis and eliminate the need for oestrus detection.

(4) Result in a conception rate to this insemination equivalent to that obtained in untreated control animals.

(5) Be cheap.

TECHNIQUES AND RESULTS

Recent data for some of the various techniques are summarized in Table 1.

PROSTAGLANDINS

Most current research is involved with the response to a single or double injection of prostaglandin F2α or one of the potent analogues (Cooper and Rowson, 1975; Smith, 1976b). In general, a single treatment induces rapid regression of the corpus luteum. However, it is not effective if administered before day 5 or beyond day 18 of the oestrus cycle. Thus up to 30% of cyclic animals may fail to synchronize to a single injection but this can be overcome by the use of two injections 11 days apart when all animals theoretically should be in a responsive stage of the cycle. This produces an effective synchronization in cyclic animals but does not have any effect on the anoestrous animal (Roche, 1976b). For most economical use it is necessary either to have a pre-treatment heat check system or to perform ovarian palpations, particularly in beef suckler herds. While these checks defeat some of the objects of the exercise and increase the cost, attempts to use prostaglandins in New Zealand beef herds without this initial screening have on occasions proved disastrous (Smith and Innes, unpublished). With screening, good results have been obtained (A. Day and M. D. Berwyn-Jones, pers. comm.). Gordon (1976) reports that "there is agreement among

TABLE 1: SUMMARY OF EXPERIMENTS IN OESTRUS SYNCHRONIZATION

Reference	*Treatment*[1]	*A.I.*[2] *Time*	*No. of Cows*	*Conception to First Service (% cows treated)*
Cooper *et al.* (1976)	control	N.M.	cows 2676	47
	2 × ICI80996	T72 + 96	+	44
	2 × ICI80996	T72	heif 1134	36
Day and Berwyn-Jones (unpub.)	control	Det or	heif 288	47
	control	NM	cows 300	47
	2 × ICI80996	T72 + 96	heif 356	41
	2 × ICI80996	T72 + 96	cows 400	34
Smith and Innes (unpub.)	(a) control	Det	70	40
	2 × ICI80996	Det	143	20
	2 × ICI80996	T72 + 96	71	18
	(b) control	Det	105	52
	2 × ICI80996	Det	102	36
	2 × ICI80996	T72 + 96	98	38
Roche (1976a)	control	Det	107	39
	2 × ICI80996	T72 + 96	278	33
	PRID (12d) + ICI80996	T56 + 72	204	52
Roche *et al.* (1976)	control	Det	769	44
	PRID (12d)	Det	637	52
	PRID (12d)	T56 + 74	653	69
	PRID (12d)	T56	321	71
	PRID (12d) + GnRH (38h)	T56	252	64

Kaltenbach and Graves (1975)	control	Det	103	46
	implant	Det	300	32
	implant + GnRH (30h)	T42	299	33
Wishart and Young (1974)	implant	Det	53	47
	implant	T48	51	41
	implant	T48 + 60	46	65
Zaied (1975)	control	Det	95	28
	implant (9d)	Det	98	44
	implant (9d) + GnRH (30h)	T42	99	43
	implant (12d)	Det	103	37
	implant (12d) + GnRH (30h)	T42	103	41
Chupin *et al.* (1975)	implant (13d) + EV	Det	194	46
	implant (13d) — EV	Det	130	27

[1] 2 × ICI80996 = Two injections 11 days apart of 500 µg ICI80996
implant = A hydron implant containing 6 mg Norgestamet (G. D. Searle & Co.) inserted for 9 days
GnRH (30h) = injection of gonadotrophin releasing hormone at a time (30 hours) after implant removal
PRID = Intravaginal silastic coils containing 6% progesterone (Abbott Labs.) inserted for 12 days
EV = injection of oestradiol valerate
Det = Cows inseminated upon detection of oestrus
T = Cows inseminated at a fixed time after end of treatment
NM = Natural mating

investigators that fertility after prostaglandin treatment is not impaired". However, recent data from Haldon Station (Smith and Innes, unpublished) show a marked depression in fertility of the prostaglandin-treated animals as compared with controls (Table 1). Insemination on a time basis is possible and it is recommended that this be at 80 h after prostaglandin treatment for a single insemination or at 72 and 96 h for a double insemination. The available data suggest that a double insemination is required to obtain a satisfactory conception rate (Cooper *et al.*, 1976).

Progesterone and Progestagens

A large number of these compounds have been evaluated over the past decades and three major methods of administration have been developed:

(1) Oral — not practicable under New Zealand conditions.

(2) Intravaginal — either in the form of sponges (Smith, 1974; Sreenan, 1974) or metal spirals coated with silicone rubber (Prid-Abbotts) which have overcome the problem of premature loss of the sponge (Roche, 1976c).

(3) Subcutaneous implants — the most promising of these is the hydron ear implant containing a small amount of a very potent progestagen (G. D. Searle — Synchromate B) and effective control has been reported by a number of workers (Wishart and Young, 1974; Mauleon, 1974; Wiltbank and Gonzalez-Padilla, 1975; Zaied *et al.*, 1976; Kaltenbach and Graves, 1975; Chupin *et al.*, 1975).

The synchronization of oestrus and ovulation with the latter two treatments is very precise. The major obstacle to the ready acceptance of progestagen treatments has been the variable and often low conception rates obtained at the synchronized oestrus. However, the recent reduction in duration of treatment from 18-21 days to periods of 7-12 days has resulted in improved and more consistent conception rates (Chupin *et al.*, 1975; Wishart, 1974; Roche, 1974). To achieve adequate synchronization with the short-term treatment it is necessary to inject progestagen and oestrogen at the commencement of treatment (Wiltbank and Gonzalez-Padilla, 1975; Chupin *et al.*, 1974, 1975; Sreenan and Mulvehill, 1975; Roche, 1975).

A major advantage of the progestagen treatments is their ability to assist in overcoming anoestrus when used either alone (Roche,

1976c; Zaied *et al.*, 1976) or in combination with gonadotrophins (Chupin *et al.*, 1975). These treatments provide sufficiently precise synchronization without prior screening of the herd to allow a single insemination on time basis with satisfactory conception rates (Roche *et al.*, 1976; Kaltenbach and Graves, 1975). The time of insemination is about 56 to 60 h after removal of the progestagen treatment but this may have to be advanced to 48 h when treatment is combined with weaning of calves or administration of pregnant mare's serum gonadotrophin or GnRH.

Problems Encountered

(1) *Variable onset of oestrus.* This is generally due to the degree of anoestrus in the herd and development of techniques and management changes to overcome anoestrus should eliminate most of this problem.

(2) *Variable conception.* While the short-term progestagen and prostaglandin treatments can give satisfactory fertility, considerable variability remains. Subtle changes to the synchronization techniques may remove some of this variability, but differences between bulls and inseminators (Kaltenbach and Graves, 1975) are the major variables, and considerably more progress could be achieved by identifying and eliminating the poor bull and poor technician.

(3) *High costs.* This major limitation has been due to the endeavour of the drug companies to recoup the high cost of manufacture of experimental chemicals, compounded by the retail mark-up and treatment costs of the veterinarians. Added to this has been the need for extra semen to cover double inseminations. These costs can and are being reduced because of competition between products, the development of more rational methods of distribution, and changes in the handling and processing of semen.

THE FUTURE

All the current techniques, while allowing timed A.I. at the controlled ovulation, depend upon either oestrus detection for A.I. or back-up bulls for natural mating of those animals that do not conceive to the controlled ovulation. However, current research into methods of early detection of pregnancy either by progesterone determination or by use of a haemagglutination test (Cerini *et al.*, 1976) could enable the identification and re-

synchronization of the non-pregnant animals without the need for oestrus detection. In fact, a system based on 21-day progesterone levels and the use of prostaglandin has been applied in the field in France (P. Mauleon, pers. comm.).

Coupled with this, there is also the need for changes in the handling and packaging of semen. Since it is possible to plan the number of cows to be inseminated on a particular day with a particular semen type in advance then the use of liquid reconstituted deep-frozen semen (K. L. MacMillan, pers. comm.) could be employed with considerable saving in costs in terms of both semen processing and A.I. time, and also allow the production of special preparations of semen for use in synchronized cows if this proves necessary.

CONCLUSIONS

The synchronization of oestrus and ovulation in New Zealand beef herds will, as part of an overall management system, allow the mating of a large proportion of the herd in the early part of a restricted breeding season. This will provide benefits in terms of the weaning performance of the subsequent calves and savings in general management and it will reduce the cost and effort involved in an A.I. programme.

In the future, complete control over the mating period should be possible. However, it cannot be stressed enough that these techniques are aids to good management — not a substitute for it — and are certainly not to be regarded as cures for fertility problems.

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