The effect of pre-mating injection of an analogue of gonadotrophin-releasing hormone (GnRH) on pregnancy rates to first insemination in dairy cattle

E. D. FIELDEN and K. MOLLER

Department of Veterinary Clinical Sciences
Massey University

ABSTRACT

Seven trials were conducted during 3 breeding seasons where half the animals in each trial herd received a subcutaneous injection of 10 μg GnRH analogue (Receptal, Hoechst A.G.) 0 to 6 hours before insemination while the other half were injected with a placebo. In 4 of the trial herds animals were divided into 2 further sub-groups depending on the time they were observed in oestrus relative to the time of insemination.

Cows to be mated each day were paired within sub-groups within trials for age and condition score; 1 of each pair was treated with the drug the other with the placebo. The same batch of semen and the same technician were used within each trial herd on any particular day.

Pregnancy rates to first insemination for 655 Receptal treated cows were 5.9% higher than for 647 placebo treated cows ($P < 0.05$). Herd differences in pregnancy rates were observed ($P < 0.001$) but no significant interactions between either herd and treatment or between time when the cows were seen in oestrus and treatment were noted. Present results suggest that should this regime be used to enhance pregnancy rates to first matings all cows should be treated.

Keywords First service; pregnancy rates; dairy cattle injected GnRH analogue

INTRODUCTION

During the breeding season in 1980 the subcutaneous injection of 10 μg of a GnRH analogue (Receptal, Hoechst A.G.) 0 to 6 hours before first insemination was shown to be associated with a 9.3% improvement in first service pregnancy rates (Moller and Fielden, 1981). While this result appeared conclusive and substantiated earlier overseas reports, the trials did not demonstrate how the improved pregnancy rates were brought about.

It has been well established that GnRH injection leads to a rapid release of luteinising hormone (LH) from the anterior pituitary gland into the bloodstream and that LH plays a key role in bringing about ovulation in cattle. Thus it seems reasonable to assume that the fertility augmenting effect of the drug occurs by shortening the time between insemination and ovulation in some cases, ensuring that spermatozoa and the ovum are in contact more quickly in these individuals than they otherwise would have been. If this is the case the most beneficial effects of administering the drug should be seen in those animals which have relatively recently come into oestrus and hence are many hours away from ovulation; conversely the drug should have little influence on those animals that are either going out of or are out of standing oestrus and are relatively near the time of ovulation.

Where once-a-day insemination is carried out, as is the usual practice in dairy herds in this country, the possibility of examining this proposition in a normal farm situation exists. A small series of trials conducted with this in mind form the substance of this paper.

MATERIALS AND METHODS

The method followed was a modification of that developed for the 1980 trials (Moller and Fielden, 1981). Two hundred and eighteen milking cows, predominantly Friesian and Friesian-cross cattle, were selected for the 1981 trial from a herd where breeding management and record keeping were known to be excellent; 203 cows from this same herd were used in 1982 together with 158 cows of similar breed from a second herd in the Opiki area of the Manawatu and 147 cows from the Ruakura No. 2 herd. Mating began in October/November.

Milking staff identified cows observed to be in oestrus into 2 groups, the 'p.m.' cows (those that were recognised in oestrus during the afternoon and evening of the day prior to mating) and the 'a.m.' cows (those which came into oestrus during the night and were seen in oestrus just before or at the morning milking). Livestock Improvement Association technicians carried out inseminations during the morning of each day with cows presented on any 1 day being inseminated by the same person, using ambient tem-

perature semen containing approximately 2 million spermatozoa per insemination. Within each herd the batch of semen used was the same for all inseminations that day.

Zero to six hours before insemination each day, cows within each sub-group (a.m. and p.m.) were paired for age and condition score. One of each pair was injected subcutaneously with 2.5 ml of solution 1, the other with 2.5 ml of solution 2. One of these solutions contained 10 μg of Receptal (Hoechst A.G.), the other sterile pyrogen-free water. Neither the veterinarian (or technician), nor the owner, knew which solution contained the drug until matings had been completed and pregnancy examinations were being carried out.

At the time of injection the individual cows, identified by ear tags, were recorded as either 'a.m.' or 'p.m.' cows, and as having been given solution 1 or solution 2. The results of manual pregnancy examinations carried out 7 to 12 weeks after first insemination, together with records of both mating dates and 23 day milk progesterone levels, provided the basis for calculating first-mating pregnancy rates for the Receptal-treated and placebo-treated groups respectively.

RESULTS

The results for all trials over the 3-year period are summarised in Table 1. Animals treated with Receptal 0 to 6 hours before mating achieved 5.9% more pregnancies to first insemination than those treated with a placebo ($P < 0.05$). There were significant differences between trials (herds) ($P < 0.001$) but no interaction between trials and treatment. When herds were examined on an individual basis, in only 1 instance (D, 1981) were treatment effects significant ($\chi^2 = 4.84$, 1 d.f., $P < 0.05$). This herd had high overall pregnancy rates to first mating (73.0% and 67.5% for 1981 and 1982 respectively).

TABLE 1 First mating pregnancy rates for cows injected with Receptal at the time of insemination and of cows injected with placebo.

Herd/Year		Receptal treated n	Receptal treated % pregnant	Placebo treated n	Placebo treated % pregnant
A)		132	52.3	128	44.5
B)	1980	117	63.2	116	51.7
C)		43	62.8	40	55.0
D	1981	110	78.2	108	67.6
D)		99	63.6	104	71.2
E)	1982	82	58.5	76	60.5
F)		72	65.3	75	52.0
	Total	655	63.2	647	57.3

Treatment effect $\chi^2 = 4.67$, 1 d.f., $P < 0.05$
Herd effect $\chi^2 = 32.91$, 6 d.f., $P < 0.001$
Treatment × Herd $\chi^2 = 10.00$, 6 d.f., n.s.

A two-tailed χ^2 test was applied with 7 herds treated as 7 trials since treated and control groups are balanced in each trial.

Results for the 4 trials where animals were subdivided before pairing for Receptal or placebo injections into 2 groups (a.m. and p.m.) according to the time they were observed in oestrus are summarised in Table 2. While overall differences in favour of treatment were again observed these effects were not significant; neither was there any significant interaction between treatment effect and the time the animals were seen in oestrus.

The distribution of return intervals to first service for herds D, E and F (the records were no longer available for A, B and C) were: 4.8% short returns (2

TABLE 2 Relationship between time cows were first recognised in oestrus before mating and first mating pregnancy rates for animals injected with either Receptal or a placebo at the time of insemination.

Herd/Year	Time observed in oestrus	Receptal treated n	Receptal treated % pregnant	Placebo treated n	Placebo treated % pregnant
D	a.m.	66	80.3	66	69.7
1981	p.m.	44	75.0	42	64.3
D	a.m.	54	59.3	56	69.6
1982	p.m.	45	68.9	48	72.9
E	a.m.	53	60.4	46	60.9
1982	p.m.	29	55.2	30	60.0
F	a.m.	52	69.2	47	53.2
1982	p.m.	20	55.0	28	50.0
Totals	a.m.	225	68.0	215	64.2
	p.m.	138	65.9	148	63.5

No significant treatment effects or interactions with time.

to 17 days), 58.5% normal returns (18 to 24 days) and 36.7% long returns (> 25 days) for the Receptal treated animals (n = 124) compared with 10.5%, 72.2% and 17.3% for the placebo treated group (n = 133).

DISCUSSION

The results from these trials demonstrate that significantly higher first service pregnancy rates can be achieved when dairy cattle are injected with 10 μg of a GnRH analogue such as Receptal in the period just before insemination. Nevertheless consistently favourable results cannot be expected in every herd so treated (see Table 1); whether there is any particular factor, or set of factors that act to produce this variation is at present unknown. The results achieved with Herd D, where reproductive performance was remarkably high, provide an excellent illustration of this. In 1981 animals treated with Receptal in this herd had first service pregnancy rates 10.6% higher than controls (χ^2 = 4.84, 1 d.f., $P < 0.05$); the following year this same herd, managed the same as before, appeared to produce the opposite response (7.6% fewer pregnancies in treated compared with control cows). In the second instance, it should be noted, the difference is not significant (χ^2 = 1.21, 1 d.f.).

No clear distinction was demonstrated between 'a.m.' and 'p.m.' cows and their response to treatment (Table 2). While these results cannot be taken to mean that the timing of the injection has no influence on the final outcome of the subsequent mating, it does seem clear that the effect is not exclusive to animals which are in relatively early oestrus. The responses obtained have not clarified whether Receptal is having a beneficial effect by shortening the time between insemination and ovulation in treated cows —the possibility still remains that some other mechanism exists, perhaps operating through an enhanced development and functioning of the corpus luteum as suggested by K. L. Macmillan and referred to in our earlier paper (Moller and Fielden, 1981). Evidence that Receptal does influence CL function is accumulating (K. L. Macmillan, per. comm.); it could explain the relatively high incidence of long returns to service noticed in animals treated with Receptal which were not diagnosed pregnant in these trials.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the assistance of colleagues Tony Day, David Hayman, Graham Morris and Peter Wilson for assisting with pregnancy examinations, Pauline Howard and technical staff at Ruakura No. 2 Dairy for helping with treatments, and Dr K. L. Macmillan for the statistical analyses. We also thank Hoechst New Zealand Ltd for financial assistance and the drug, and the co-operating farmers who so willingly gave us access to their herds.

REFERENCE

Moller K.; Fielden E. D. 1981. Pre-mating injection of an analogue of gonadotrophin releasing hormone (GnRH) and pregnancy rates to first insemination. *New Zealand veterinary journal* **29**: 214-215.