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**SYNCHRONIZATION OF FOLLICULAR DEVELOPMENT,
OESTRUS AND OVULATION USING OESTRADIOL
BENZOATE AND PROGESTERONE IN DAIRY CATTLE**

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GENERAL ABSTRACT

The aim of oestrus synchronisation in cattle is to achieve a close synchrony of oestrus and ovulation with high submission rates. The status of follicular wave development at the time of treatment has been responsible for a large portion of the variability in ovarian response to treatments employed. The control of oestrus and ovulation require firstly that the life span of the corpus luteum is reduced, and secondly that follicular wave emergence is synchronized so that a healthy, oestrogen active dominant follicle is present at the end of the treatment.

A clinical trial was conducted to determine the effective dosage of oestradiol benzoate in combination with progesterone on follicular dynamics, oestrous behaviour and time of ovulation when treatment was administered intravaginally. Intravaginal treatment with 2 mg or 7 mg oestradiol benzoate and progesterone on day 3 of the oestrous cycle was effective in inducing atresia of the dominant follicle and a new cohort of follicles began to emerge, on average, 2.5 ± 0.93 days after treatment. However, the IBD Onsett12™ drug administration device failed to maintain the required progesterone output and plasma concentrations during the treatment period. This resulted in failure to synchronize oestrus and ovulation.

IBD Onsett12™, as a single application intravaginal drug delivery device for the purpose of controlling the oestrus cycle in cattle, was further evaluated in cycling and non-cycling cows and compared to the CIDR oestrus synchronization program. A total of 350 Friesian

or Friesian cross cows in five herds were involved in the trial. The retention rate for the IBD Onsett 12™ was significantly lower than the CIDR (65.12% vs. 99.44%, $\chi^2 = 73.528$, $P = 0.001$), and the synchronized conception rate from the CIDR protocol was significantly higher than the IBD Onsett 12™ among cycling and non-cycling cows ($\chi^2 = 15.087$, $P = 0.02$). The IBD Onsett 12 oestrus synchronization program was effective in inducing fertile synchronized oestrus in some cycling and non-cycling cows, but resulted in a low synchronized conception rate.

Manipulation of follicular development and controlling the oestrous cycle length will synchronize oestrus more precisely and control the time of ovulation more exactly to allow a single fixed-time insemination. Controlling the time of new follicular wave emergence and synchronizing the follicular wave status in dairy cows at random stages of the oestrous cycle would provide a more practical and less variable method of synchronization than those of the past.

A clinical trial was conducted to control both follicular development and luteal function. Twenty randomly cycling, non-lactating dairy cows were randomly assigned to two treatments; 1) 2 mg oestradiol benzoate injected intramuscularly and 200 mg of progesterone subcutaneously, 9 days before prostaglandin (500 μg cloprostenol) and a second injection of 1 mg oestradiol benzoate 24 hours after prostaglandin treatment (ODB, $n = 10$). 2) 10 μg buserelin injected 7 days before prostaglandin (500 μg cloprostenol) and a second injection of 10 μg buserelin 48 hours after prostaglandin treatment (GnRH, $n = 10$). An acute short-acting treatment with progesterone and oestradiol benzoate or buserelin was effective in inducing atresia of the dominant follicle.

A new follicular wave emerged earlier in the GnRH treated group than in the ODB treated group (2.22 ± 0.15 vs. 3.60 ± 0.22 days, $P = 0.001$). An LH surge occurred earlier after a second buserelin treatment on day 9 than after a second oestradiol benzoate treatment on day 10 (4.0 ± 1.0 vs. 22.80 ± 1.20 hour, $P = 0.001$). The mean time of ovulation after the second oestradiol benzoate or buserelin treatment was not significantly different between the ODB and the GnRH group (1.70 ± 0.30 vs. 1.56 ± 0.18 , $P = 0.692$). The proportion of cows that were observed in oestrus was higher in the ODB group than the GnRH group (100% vs. 55.6%, $\chi^2 = 5.630$, $P = 0.018$).

In conclusion, progesterone and oestradiol treatment intravaginally or intramuscularly was effective in synchronizing follicular wave emergence. Administration of oestradiol benzoate 24 hours after prostaglandin given 9 days after an initial progesterone and oestradiol treatment produced the oestrus synchrony, induced an LH surge and provide a degree of synchrony in the time of ovulation. This program showed potential in manipulating follicular development and luteal function and has the possibility allowing fixed-time insemination. However, the efficacy of the IBD Onsett12™ as a single application intravaginal drug delivery device to control the oestrous cycle or as progesterone-releasing device in cattle did not demonstrate satisfactory results when used in these trials. This might arise from the complexity of the drug delivery system. Nevertheless, the concept of delivering multiple drugs at different rates and times may have many benefits to the end user when current design and use problems are resolved.

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LIST OF ABBREVIATIONS

CIDR	Controlled internal drug release
FSH	Follicle stimulating hormone
gm	Grams
GnRH	Gonadotrophin-releasing hormone
IBD	Intelligent breeding device
LH	Luteinizing hormone
mg	Milligrams
MHz	Megahertz
ml	Millilitres
ng	nanograms
No.	Number of
ODB	Oestradiol benzoate
P ₄	Progesterone
PGF _{2α}	Prostaglandin F _{2α}
PRID	Progesterone-releasing intravaginal device
SD	Standard deviation
SEM	Standard error of mean
μl	Microlitres