Comparison of two intravaginal progesterone releasing devices in lactating dairy cows: blood progesterone profile and field fertility.
This report summarises the results of the published paper ‘Comparison of two intravaginal progesterone devices in dairy cows: Blood progesterone profile and field fertility’ published in Animal Reproduction Science in 2013. This paper contains 2 experiments:

- **Experiment 1**: circulating progesterone profiles were compared in cows treated with PRID® DELTA and a T-shape device.
- **Experiment 2**: a large field fertility study of lactating cows also comparing use of PRID® DELTA vs T-shape device at a field level.

**Key messages**

- **PRID® DELTA** produced a significantly greater circulating P4 peak compared to the T-shaped device and the area under the curve (AUC) of circulating P4 was greater when cows received PRID® DELTA compared to T-shape device treated cows (653ng/ml vs 583ng/ml \times time, P < 0.05).

- Of cows not conceiving after first synchronised AI, more cows receiving PRID® DELTA during 1st AI were detected in returning oestrus nearly 21d after the synchronised AI as compared to cows that received T-shape device (PRID® DELTA = 28.3%, n = 260 vs T-shaped device = 16.0%, n = 258; P < 0.01).

- Final cumulative P/AI was greater in cows receiving PRID® DELTA (46% vs 37%, P = 0.02) (1) within 21 days after the initiation of AI compared to T-shape device.
Rationale

Systematic reproductive protocols using exogenous compounds that mimic physiological levels of naturally occurring hormones are routinely used in dairy herds world-wide to improve fertility and to decrease the percentage of animals culled at the end of lactation due to reproductive failure.

Progesterone (P4) releasing intravaginal devices are commonly used during these reproductive routines due to their efficacy in treating non-cycling cows. For instance, many research groups have reported that lactating cows need to be exposed to P4 after calving in order to start having normal reproductive cycles. Interestingly, the physiological mechanism blocking anovular cows from having normal reproductive cycles is likely related to lower expression of oestrogen receptors in the hypothalamus, and apparently P4 can successfully resolve this problem in cattle.

Progesterone may also have an important role at oocyte level to improve fertility of lactating cows. For instance, recent findings describe a positive relationship between greater circulating levels of P4 during synchronisation protocols and embryo quality. The exact mechanism by which P4 seems to improve embryo quality is not completely known but it may be related to reduced exposure of the developing oocyte to LH, avoiding its premature maturation.

Therefore, intravaginal devices containing P4 and other combinations of hormones should be strategically used to target greater levels of P4 during synchronisation routines, particularly in high-producing dairy cows that seem to present elevated rates of steroid hormone metabolism in the liver.

The objectives of this study were to compare circulating P4 levels after treating cows with two commercially available intravaginal devices - T-shape device containing 1.38g progesterone and PRID® DELTA containing 1.55g progesterone (Experiment 1), and also to assess possible differences in terms of fertility in lactating dairy cows (Experiment 2, field study).
Experimental design

**Experiment 1** Progesterone profile

Ovariectomised non-lactating Holstein cows were used in a cross-over design (PRID® DELTA, n=6 vs T-shape device, n=6).

Multiple blood samples (around 10 ml) were collected into heparinised tubes throughout the time of device insertion to measure circulating P4 according to the following schedule:

- At D0: Before treatment then T+1h, T+3h, T+6h and T+9h after treatment administration.
- D1 to D6: Twice a day at the same time of the day.
- At D7: Just before withdrawal and at 1h and 2h after withdrawal.

**Experiment 2** Field fertility comparison

Lactating dairy cows (n = 774) from multiple herds meeting the following criteria were included:

- not detected in heat during current lactation
- between 50 to 165 DIM
- lactation number 1-5

Cows were randomised based on ear tag numbers to receive PRID® DELTA or T-shape device for 7 days, *figure 1*:

![Figure 1. Experimental design – field fertility study (PRID® DELTA vs T-shape device).](image-url)
Main results

Circulating progesterone profile
The final circulating progesterone profile comparison between PRID® DELTA and T-shape device is shown in Figure 2. In both treatments blood P4 increased very rapidly to around 4 to 5 ng/mL. Then, progesterone decreases in a fairly steady pattern until device removal 7 days later. Interestingly, PRID® DELTA produced significantly greater circulating P4 levels starting on the day of insertion until day 4 after device insertion. In addition, the area under the curve of circulating progesterone release was also greater for PRID® DELTA compared to the T-shape device, respectively (653 vs 583 ng/ml* time respectively, P<0.01).

Field fertility study
The effect of the type of intravaginal P4 device on pregnancies per AI (P/Al) for 1st postpartum AI is shown in Figure 3. Overall, PRID® DELTA tended (P=0.10) to produce greater P/Al at 1st AI when compared to T-shape device.
After 1\textsuperscript{st} AI, cows were visually monitored for oestrus activity during the expected returning cycle around 21d later. An ultrasound examination was also performed in all cows detected in heat to confirm the absence of an active CL. Thus, out of cows not conceiving after 1\textsuperscript{st} synchronised AI, more cows were detected in returning oestrus when previously treated with PRID\textsuperscript{®} DELTA compared to cows receiving T-shape device (PRID\textsuperscript{®} DELTA= 28.3\% vs T-shape device= 16.0\%, P<0.01 – Figure 4, below). This could be explained by more cows being induced to start cycling normally after the first AI when PRID\textsuperscript{®} DELTA was used. This could be the case particularly in anovular cows before 1\textsuperscript{st} AI, but this observation needs to be confirmed with further studies.

In addition, out of those cows detected in heat around 21d after the previous AI, there was no effect of type of P4 device used in the previous AI on P/AI for second AI (PRID\textsuperscript{®} DELTA = 55.9\% vs. T-shape device = 54.7\%; P = 0.91). It should be noted that the conception rates were remarkably high in both groups for this 2nd AI around 21 days following synchronisation.

Interestingly, because more cows that received PRID\textsuperscript{®} DELTA were detected in heat around 21d after 1\textsuperscript{st} synchronised breeding, use of PRID\textsuperscript{®} DELTA significantly (P=0.02) resulted in a greater percentage of pregnant cows over 1\textsuperscript{st} and 2\textsuperscript{nd} AI, as shown in Figure 5.

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**Figure 4.** Percentage of cows detected in oestrus in the following cycle for cows treated with PRID DELTA (orange bar) and T-shape device (grey bar).

**Figure 5.** Final percentage of pregnant cows (treated with PRID DELTA or T-shape device) after 1\textsuperscript{st} AI and 2\textsuperscript{nd} AI (bred after natural oestrus ~ 21d after 1\textsuperscript{st} AI) in lactating Holstein cows.
Conclusions

PRID® DELTA significantly increased circulating progesterone in blood during the 7 days that a progesterone device was implanted, and tended to increase fertility results in the first postpartum AI when compared to cows treated with T-shape device. In addition, PRID® DELTA also increased the proportion of cows showing signs of natural oestrus behaviour in the following breeding cycle around 21d after 1st AI compared to T-shape device. Importantly, the use of PRID® DELTA significantly increased the final percentage of cows that became pregnant after two breeding cycles. Fertility results presented might be related to greater circulating P4 during the synchronisation program with PRID® DELTA although conception rates seemed very acceptable for both types of P4 devices used.

References


Speak to our Technical Team for advice on reproductive management solutions and to your Ceva Ruminant Territory Manager for further information and support.
The content of this booklet is a summary of the paper ‘Comparison of two intravaginal progesterone releasing devices (PRID® DELTA vs CIDR) in dairy cows: Blood progesterone profile and field fertility’. For further information please refer to the full article.

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