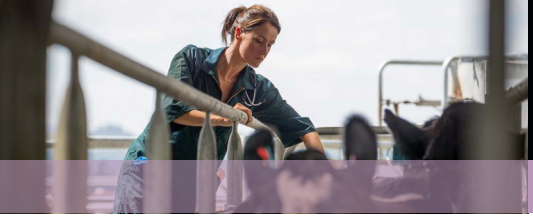

EVALUATION OF PROSTAGLANDIN DOSE IN NON-CYCLING COWS IN NZ

Background

Dairy cows that have not shown visible oestrus (NVO) prior to the planned start of mating (PSM) have improved reproductive results when treated with a 10 day program including progesterone, gonadotrophin releasing hormone (GnRH), prostaglandin ($PGF_{2\alpha}$), and equine chorionic gonadotropin (eCG). This combination of injectable hormones and a progesterone releasing device is often referred to as GPG+P4+eCG. Improving the submission rate and conception rates for NVO cows treated with this program can reduce reproductive wastage, and increase return on investment for artificial insemination for dairy farmers.

The commonly used 10 day program uses a 500µg dose of cloprostenol on day 7 to cause luteolysis and regression of the corpus luteum (CL). The CL is present either as a result of ovulation during the previous follicle wave, or from ovulation of a dominant follicle induced by GnRH injection administered on Day 0 of the program. Incomplete luteolysis and persistence of a CL will result in higher circulating levels of progesterone (P4) close to the time of artificial insemination (AI), which results in reduced fertility (Wiltbank 2014). Failure of luteolysis following GPG synchrony programs in dairy cows in the USA has been shown to range between 5 – 30%, and is higher in multiparous compared to primiparous cows. The risk of incomplete luteal regression is higher for cows undergoing shorter treatment programs (such as 5-day ovsynch) compared to 7-day programs, as a young CL developing after ovulation on day 0 of the program is refractory to the effects of $PGF_{2\alpha}$ for up to five days (Santos 2010).

Two strategies have been reported to increase the success of luteolysis in 5 and 7-day GPG synchrony programs in the USA. The first strategy involves an additional dose of $PGF_{2\alpha}$ given 24 hours after the first dose. The second strategy is to increase the dose of $PGF_{2\alpha}$ administered on day 7. This is more practical as it negates any additional yarding and administration requirement, with the only additional cost being that of the larger $PGF_{2\alpha}$ dose.

The effect of additional $PGF_{2\alpha}$ administration or dose on luteal regression or pregnancy outcomes has not been investigated in New Zealand dairy cows treated with either GPG or P4 + GPG ±eCG programs.

Objective

To investigate the reproductive outcomes of cows treated with a single increased dose of $PGF_{2\alpha}$ on day 7 of a 10 day non-cycling cow treatment program administered prior to PSM.

Materials and methods

The study was undertaken in 21 dairy herds from across New Zealand. The study enrolled 2,278 lactating mixed-age cows that had not been detected in oestrus 10 days prior to each herd's planned start of mating.

Cows were body condition scored (BCS) and treated with DIB-h, and 2mL Gonasyn (100µg GnRH) at the start of the study. Seven days later the DIB-h was removed and all cows were treated with 2mL Novormon eCG (400IU eCG). Enrolled cows were randomly assigned to two treatment groups. Group 1 cows were treated with 2mL Cyclase (500µg cloprostenol) and Group 2 cows were treated with 3mL Cyclase (750µg cloprostenol), refer to Figures 1 and 2.

Any cows detected in oestrus from this time were submitted for AI at the next opportunity. Two days later all remaining cows that had not yet been inseminated, were administered 2mL Gonasyn (100µg GnRH), and then submitted for set-time AI (STAI) 8-20 hours after this dose. Ultrasound pregnancy testing was undertaken to determine pregnancy status and the date of conception. Cow information (age, breed, calving date) information was extracted from the electronic herd records.

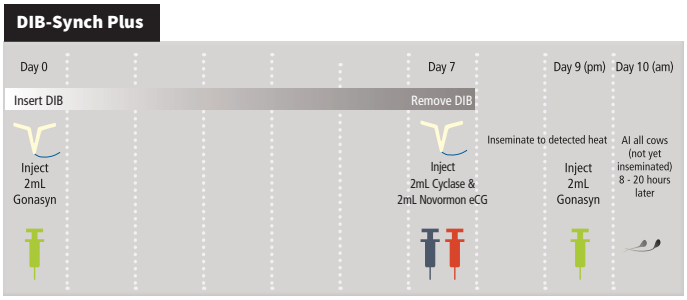

Figure 1 - Group 1 program - 2mL Cyclase and Novormon eCG on day 7

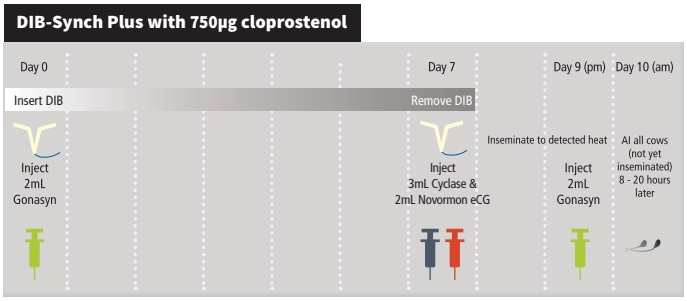

Figure 2 - Group 2 program - 3mL Cyclase and 400IU Novormon eCG on day 7

Data was collated and analysed to assess the effect of treatment group on pregnancy rate (STAI, four-week, six-week and final), and other variables were included such as herd, age, breed, BCS and interval between calving and treatment.

Results

Of the 2,278 enrolled cows, 96 cows were excluded from the analysis because they did not follow the treatment protocol, had other disease at the time of treatment, died or were culled prior to pregnancy testing, or had incomplete records. The remaining 2,182 cows were included in the analysis of STAI and four-week pregnancy rates. A further 24 cows were omitted from the analysis of 42d and final pregnancy rates as pregnancy test results were not available.

The two treatment groups had very similar age, breed, days calved and body condition score (Table 1).

Treatment group – cloprostenol dose		500µg	750µg
Total n included in analysis		1101	1081
Age group	2 year	357	340
	3 year	289	284
	4-8 year	400	416
	>8 year	55	41
Average age (years)		3.8	3.8
Breed	Friesian	539	542
	Crossbred	464	456
	Jersey	98	83
Interval calving to treatment (mean days)		71	69
BCS group	≤3.5	258	265
	4.0	390	363
	≥ 4.5	453	453
BCS (mean; 1-10 scale)		4.2	4.2

Table 1. Descriptive statistics for treatment groups

The results for STAI, four-week, six-week and final proportion pregnant are presented in Table 2. The higher dose of cloprostenol tended to increase the proportion pregnant compared to the lower PG dose at STAI 28 days and 42 days.

The final proportion pregnant was significantly higher for the 750µg cloprostenol treatment group compared to the 500µg treatment group.

Pregnancy rate	500µg	750µg
STAI	0.43 (0.015)	0.46 (0.015)
Four-week	0.62 (0.014)	0.65 (0.016)
Six-week	0.71 (0.013)	0.75 (0.013)
Final	0.82 (0.011)	0.85 (0.011)

Table 2. Proportion pregnant (sem) for the treatment groups

Overall, there was a positive effect of both breed (in favour of crossbred cows) and body condition score (in favour of higher score), and a positive effect of longer weeks calved at time of treatment on pregnancy rate. There was no significant treatment by farm interaction, although pregnancy outcomes differed by farm due to other factors. (Table 3).

	STAI	4 week	6 week	Final
Farm	<0.001*	<0.001*	<0.001*	<0.001*
Age group	0.94	0.22	0.23	0.09
Breed group	0.70	0.03*	0.004*	0.006*
BCS group	0.49	<0.001*	0.001*	0.09
Weeks calved	<0.001*	<0.001*	<0.001*	<0.001*
Cloprostenol dose	0.12	0.11	0.08	0.04*
Farm x cloprostenol dose	0.21	0.42	0.09	0.48
Age x cloprostenol dose	0.32	0.49	0.54	0.54

Table 3. Generalised linear regression outcomes for variables on pregnancy rates
** Statistical significance is declared at p ≤0.05*

CULMULATIVE PREGNANCY BY TREATMENT GROUP

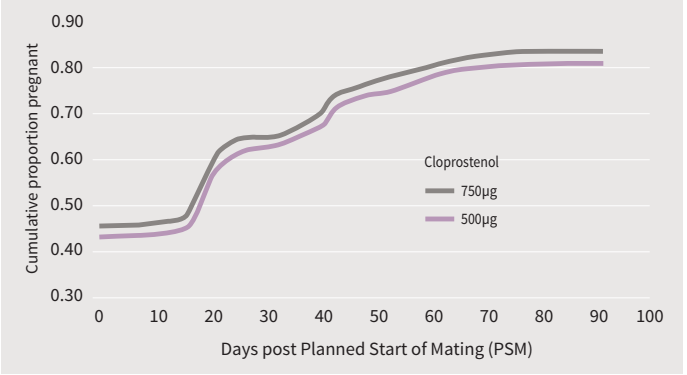

Figure 3. Cumulative pregnancy by treatment group

Discussion

This study showed an improvement of 3% in pregnancy rate for the 750µg cloprostenol dose compared to the traditional 500µg dose. An economic analysis shows that the additional cost of a higher dose of cloprostenol given on day 7 of the treatment program is far outweighed by the higher final pregnancy rate shown in this study.

Partial budget	Description	Value
Additional Cyclase cost	Extra Cyclase dose	-$300
3% increase in final in-calf rate	every 1% increase in final pregnancy rate is worth $10*	$3,000
Net farmer financial benefit		$2,700

*Table 4. Partial budget analysis (for treatment of 100 non-cycling cows with additional cloprostenol). * Ref. DairyNZ In-calf book*

The dose of prostaglandin used in modern synchrony and non-cycler treatment programs was established in the 1970s by administering $PGF_{2\alpha}$ to cycling beef cows or dairy heifers, as single or multiple doses and with or without other combinations of reproductive treatments (Lauderdale 1972, Rowson 1972, Odde 1990, Lauderdale 2009). Efficacy of the treatments was determined by measuring the success of behavioural oestrus and subsequent pregnancy.

The label dose of 500µg cloprostenol was established prior to registration of the pioneer cloprostenol product in the United States by the Food and Drug Administration agency in 1982.

Some animals used in these studies were not lactating dairy cattle, and of unknown body condition score so the physiology of the cattle at the time of testing may be different to that of a lactating New Zealand dairy cow. Therefore the current prostaglandin dose may not be appropriate for our dairy cattle, particularly those that are not already showing normal oestrus activity as is the case of the NVO cows commonly treated in New Zealand dairy herds.

The results in this study support those of Giordano (2013) where 29 day pregnancy rates were significantly increased when administering a dose of 750µg cloprostenol on day 7 of a synchrony program. It has been shown by other authors that either a higher dose, or multiple doses of cloprostenol administered 24 hours apart, improved luteolysis and subsequently increased pregnancy rates in cattle synchrony programs.

Although not directly measured in this study, it is our hypothesis that the mechanism for the increased pregnancy rate is via increased luteolysis in cattle treated with the higher dose of cloprostenol. This study is the first investigation of the cloprostenol dose in NVO lactating dairy cows farmed under New Zealand management systems. Further research is required to understand the physiological mechanism which results in increased pregnancy rates following the administration of the higher dose of cloprostenol.

Conclusion

Treatment of no visible oestrus cows with a DIB-Synch Plus eCG program using 750µg of cloprostenol on day 7 resulted in more pregnant cows at the end of the mating period compared with the traditional 500µg dose. The administration of a higher dose of cloprostenol for non-cycler cow treatment programs is practical and of low incremental cost, and could easily be routinely implemented by veterinarians on NZ dairy farms.

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This study was conducted under approval 14284 of the Ruakura Animal Ethics Committee.