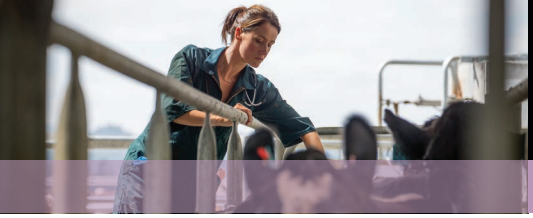

USE OF EQUINE CHORIONIC GONADOTROPIN (ECG) IN NON-CYCLING COW REPRODUCTIVE PROGRAMS IN NZ

What is eCG?

Equine chorionic gonadotropin (eCG) was formerly known as pregnant mare serum gonadotropin (PMSG). It is produced by the endometrial cups of the chorionic girdle in the placenta, from day 40 to day 130 of a mare's pregnancy. In the mare, the eCG that is produced during this period has an LH effect, and results in ovulation and luteinisation of follicles to create secondary corpora lutea (CL) on the ovaries. These secondary CLs produce progesterone in combination with the primary CL, to maintain the pregnancy until the placenta takes over all progesterone production around day 150.

eCG was discovered more than 80 years ago and is now collected from pregnant mares, sterilised and freeze dried for use in reproductive programs in cattle and other species.

Mode of action

eCG has dual action, binding to both FSH and LH receptors. In cattle, eCG has a half-life of 3-5 days. This is much longer than endogenous gonadotropins which have half-lives of around 20 minutes.

FSH effect

Binding to FSH receptors on the dominant follicle has a trophic effect on the follicle, resulting in a larger follicle. This larger follicle produces more oestrogen, improving the uterine environment and promoting the LH surge which drives ovulation. The ovum that ovulates from this follicle has matured under additional gonadotrophic support, so the ovum is healthier and consequently conception rate is higher.

The subsequent CL from the larger follicle is a more effective progesterone 'pump'. This CL is less likely to undergo regression during early pregnancy, which improves conception rates and reduces early embryonic loss.

LH effect

eCG binding to LH receptors on the dominant follicle during proestrus provides additional gonadotrophic support to the maturing follicle. The binding of eCG to LH receptors on the CL after ovulation supports the progesterone production function of the CL, resulting in reduced early embryonic loss.

Overall effect

In studies where eCG has been used as part of a synchrony program of cattle, plasma progesterone levels are higher in the eCG treated animals. The progesterone levels remain higher than untreated animals for several weeks (Martinez 2013, Figure 1). Higher progesterone levels support early embryonic survival until maternal recognition of pregnancy occurs.

PLASMA PROGESTERONE FOLLOWING ECG PROGRAM

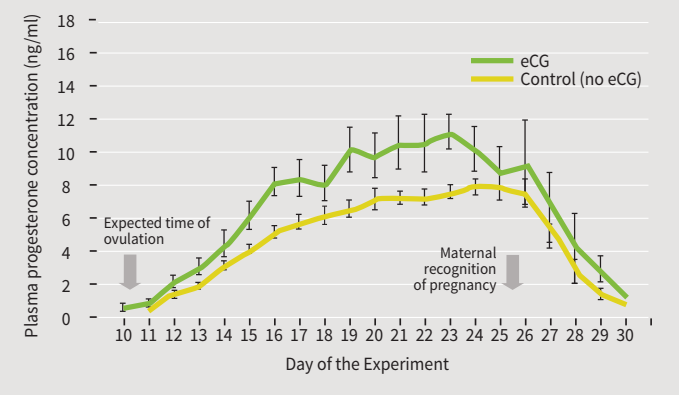

Figure 1. Plasma progesterone in cows treated and not treated with eCG as part of a synchrony program (Martinez et al 2013).

In this study eCG was administered on day 3 of a 6 day P4-GPG program.

The stronger luteal function and higher progesterone levels resulting from eCG treatment also results in fewer 'phantom' cows, with non-pregnant cows more likely to return to heat and undergo subsequent insemination or natural mating. This is likely due to the higher progesterone levels dropping sharply after lysis of the CL, stimulating the subsequent follicle maturation and ovulation.

What results can be expected?

A study involving 2,000 non-cycling cows from 15 herds across NZ in spring 2010 assessed the administration of 400IU of Novormon eCG in a DIB-Synch Plus program, compared to standard progesterone programs (DIB-Synch and CIDR-Synch), and a GPG program (Shephard 2013).

CUMULATIVE PREGNANCY RATES - ALL NON-CYCLING COWS

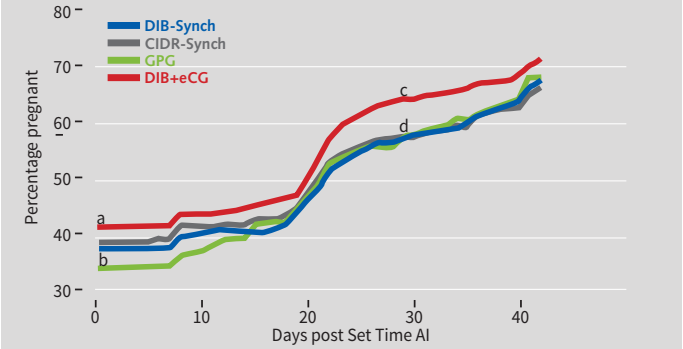

Figure 2. Cumulative pregnancy curve by treatment group - all non-cycling cows. Data points with different labels are significantly different; (a,b p=0.02; c,d p<0.05)

The addition of eCG to the progesterone program improved the set-time AI pregnancy rate compared to standard progesterone programs and GPG programs. Overall the 28 day pregnancy rate increased by 7% compared to the other treatments.

The improvement in pregnancy rates with eCG in the program, compared to no eCG, were higher when cows had been calved for at least 6 weeks prior to mating (i.e. 33 days calved prior to progesterone device insertion).

These results are consistent with those from other New Zealand anoestrous cow studies. For instance, Bryan et al (2013) demonstrated an improvement in 7 day pregnancy rate of 5%, as well as a 6% increase in the 28-day in-calf rate, when eCG was added to a progesterone insert + GPG anoestrous dairy cow treatment program.

Shephard (2013) also reported on the tight pattern of return to oestrus from eCG treated cows. The eCG group had fewer cows exhibit short returns (cows returning to oestrus less than 18 days from set time AI) compared to the GPG and progesterone treated cows. In addition, fewer eCG treated cows experienced long returns (cows returning to oestrus more than 24 days from set time AI) compared to the standard progesterone program cows. These eCG return to oestrus trends are shown in Figure 3 (below).

CUMULATIVE RETURN TO OESTRUS FOR COWS NOT PREGNANT TO FTAI BY TREATMENT GROUP

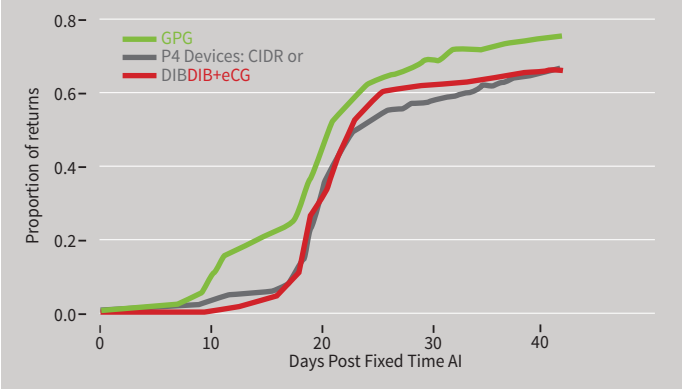

Figure 3. Cumulative return to oestrus

Studies in Australia where eCG has been added to ovsynch programs used for herd synchrony demonstrated a 6% increase in first service conception rate (p=0.11) and 11% improvement in six week in calf rate (p=0.001) compared with no eCG (Malmo, 2011). When eCG was added to ovsynch programs for non-cycling cows, the improvement in first service conception rate was 6% (p=0.03) and six week in calf rate 7% (p=0.02).

Conclusions

eCG supports the developing follicle and its inclusion in a reproductive program results in a more effective CL following ovulation. More circulating progesterone in the oestrus cycle after eCG improves conception rates, reduces early embryonic loss and reduces the incidence of 'phantom' cows.

eCG improves pregnancy rates when used as part of a non-cycling cow treatment program in New Zealand dairy herds.

Financial Implications

The additional treatment cost for eCG in the overall 'Plus eCG' program is far outweighed by the additional milk income, as summarised in Table 1.

PARTIAL BUDGET ANALYSIS	DIB-SYNCH TREATMENT	DIB-SYNCH PLUS ECG TREATMENT
Extra days in milk	15	19
Milksolids per day	1.5	1.5
$/kg milksolids	$6.50	$6.50
Additional milk income	$146.25	$185.25
Treatment cost	-$40	-$45
Return on investment	$106.25	$140.25

Table 1: Return on investment compared to no treatment, per anoestrous cow treated with a DIB-Synch program, and a DIB-Synch Plus eCG program, when treated prior to PSM.

Key

GnRH = Gonadotropin Releasing Hormone (eg gonadorelin)
GPG = GnRH – PG – GnRH oestrus sychrony program
CIDR-Synch = CIDR + GPG
DIB-Synch = DIB-V progesterone insert + GPG
DIB-Synch Plus = DIB-Synch + eCG

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