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**Effect of pre-mating supplementation with
monopropylene glycol on reproductive
performance of dairy cows**

A field trial

A thesis presented in partial fulfillment of the requirements for the degree of

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Dedicated to my sister, Carolina

Abstract

Tuñon, G. (2005) Efficacy of pre-mating supplementation with monopropylene glycol on reproductive performance of dairy cows. A field trial. *MSc Thesis. Massey University, Palmerston North, New Zealand.*

Low body condition score (BCS) at calving is associated with extended time to resume cycling in dairy cows. Prolonged postpartum anoestrous intervals (PPAI) are the major source of infertility in New Zealand dairy cows. Postpartum supplementation with monopropylene glycol (MPG), under controlled experimental conditions, was previously shown to reduce PPAI in heifers. This experiment tested this treatment in four large commercial dairy herds. During the 6-week period preceding the planned start of mating (PSM; Week 0), cows were drenched either once (MPGx1) or twice (MPGx2) daily with 200 ml MPG, or served as untreated controls (Con). A total of 2,122 cows were included in the analysis. Analyses were confined to the group of cows that were anoestrus at Week - 6 or calved between Week - 6 and Week -4 relative to PSM ($n = 684$ to 714 per treatment). None of the four variables: oestrous behaviour during the treatment period, anoestrous rate one week before PSM, 3-week submission rate or 3-week pregnancy rate were affected by MPG. However, MPG did increase the 6-week and final pregnancy rates ($P < 0.005$), with MPGx1 having higher values (74.6% and 92.1%) than MPGx2 (69.1% and 88.5%) and Controls (67.7% and 88.1%), respectively. MPG-treated cows also produced more milk protein than the control-cows, by 0.01 and 0.017 kg of milk protein per day for MPGx1 and MPGx2, respectively ($P = 0.02$), evidence of a metabolic effect of MPG. Recent studies suggest that diets that are optimal for follicle growth are not necessarily optimal for oocyte quality and subsequent embryo survival. It is hypothesised that MPGx1 had positive effects on the follicle/oocyte through gonadotrophin-independent mechanisms and that MPGx2 had negative effects on the embryo. Probably the gonadotrophin-dependent effects necessary for ovulation could not be exerted in the present study because MPG was not administered for sufficient time to effect the LH surge. Both change in body condition score between Week - 6 and Week - 1, and proportion of cows that were anoestrus at Week -1, were influenced by herd, age and time of calving ($P < 0.05$) but not by treatment ($P > 0.1$). Treatment did not influence the proportion of anoestrous cows, treated with progesterone, which were inseminated after oestrus detection ($n = 263$).

Change in BCS affected both milk yield and pregnancy rates, with cows that gained BCS producing less milk ($P = 0.01$) but showing higher 6-week pregnancy rates ($P < 0.05$). This study highlighted that key factors influencing the percentage of anoestrus at PSM are cow age, time of calving and management of the herd.

Key words: monopropylene glycol; anoestrus; body condition score; pregnancy; dairy cow.

Foreword

The presence of anoestrous cows at the start of the breeding season is a major problem that impairs the reproductive performance of dairy cows in seasonal-calving herds. While these cows can be induced to cycle by hormonal treatments, such treatments cannot eliminate the problems caused by anoestrus. The New Zealand dairy industry urgently needs a solution for the anoestrus problem, a solution that respects the clean, green image of the New Zealand milk in the world market, respects the welfare of the animals, and is feasible. This study and similar previous studies analysing the production and reproduction performance of dairy systems in New Zealand, suggest that there is scope for improvements in all areas to achieve better reproduction without sacrificing the survival of the cows. Logical solutions come from: i) selection of animals that suit the pastoral system, with appropriate emphasis on fertility; ii) effective nutritional management to achieve optimal body condition score (BCS) at calving and maintain high levels of milksolids production and pasture management; iii) effective health management; and iv) decrease error levels in all the areas in which there is human intervention (i.e. oestrous detection). Improving reproductive performance would have a significant impact on milk production (by better fitting the herd's demand to the supply of pasture, by achieving more days in milk, and by an increased ability to selectively cull low producing cows), the rate of genetic gain (by increased ability to selectively rear calves only from high genetic merit cows), and farm costs (by reducing the costs for breeding, induction, anoestrous treatments, and rearing replacements). Manipulation of nutrition seems to be the solution, since hormonal treatments are being highly discouraged by the dairy industry. This thesis is about an on-farm test of a non-hormonal intervention to enhance reproduction of dairy cows.

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List of abbreviations

AI	Artificial insemination
BCS	Body condition score
CIDR	Controlled internal drug release
CL	Corpus luteum
DM	Dry matter
DMI	Dry matter intake
E2	Oestrogen
ELISA	Enzyme-linked immunosorbant assay
FSH	Follicle stimulating hormone
G	Gram
GH	Growth hormone
GHR	Growth hormone receptor
GnRH	Gonadotrophin releasing hormone
H	Hour
ha	Hectare
HF	Holstein Friesian
hp	Horse power
IFN- τ	Interferon tau
IGF	Insulin-like growth factor
IGF-1	Insulin-like growth factor-one
IGBP	Insulin-like growth factor binding proteins
IU	International unit
kg	Kilogram
L	Litre
LH	Luteinising hormone
LIC	Livestock Improvement Corporation
ME	Metabolisable energy
MHz	Mega Hertz
MJ	Mega Joule
ml	Millilitre

mm	Millimetre
MPG	Monopropylene glycol
M	Metre
NEB	Negative energy balance
ng	Nanogram
OAD	Once a day
ODB	Oestradiol benzoate
OTR	Oxytocin receptor
P4	Progesterone
PGF ₂ α	Prostaglandin F ₂ α
PPAI	Postpartum anoestrous interval
PSC	Planned start of calving
PSM	Planned start of mating
RFM	Retained foetal membranes
sem	Standard error of the mean
sec	Second
T	Tonne
TMR	Total mixed ration
TG	Triglyceride
μl	Microlitre
VFA	Volatile fatty acid
wk	Week