Effect of premating 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

Master of Science

in

Animal Science

at Massey University, Turitea, Palmerston North,

New Zealand

Gonzalo Enrique Tuñon

2005

Dedicated to my sister, Carolina

Abstract

Tuñon, G. (2005) Efficacy of premating 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 werw 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.

Acknowledgements

Massive thanks to the Ministry of Foreign Affairs of New Zealand. I will deliberately forget people but there are some which I need to especially thank.

Colin Holmes. I met Colin working at Number one dairy farm at Massey, also as a professor and as supervisor. Colin taught me what it means to be 'focused', to be more effective, and the principles of dairy farming. Thanks Colin, I am taking with me your high moral standards, decency and principles, as well as the friendship of you and Dorothy.

Tim Parkinson is a brilliant scientist, a 'living encyclopaedia'. I have been always impressed by his suggestions, always very incisive and very scientist. Thanks Tim.

Lucia Chagas generously accepted me in her team, for which I will be always grateful and honoured. Working in her project and presenting a paper at the conference has been an unforgettable, challenging and invaluable experience, thanks Lucia.

Viliami Taufa taught me the art of condition scoring, malo elelei my friend. Chris Burke, thanks for your suggestions and patient explanations, always very useful and practical. Thanks also to the farmers involved in the trial.

Barbara Dow has been incredibly patient and helpful. Thanks people from Dexcel! Especially Chris Glassey, Kevin Macdonald, Gwyneth Verkerk, John Roche, Garry Waghorn, Suzanne Meier, Eric Kolver, Bruce Thorrold, Penny Back, Penny Aspin, Jo Sheridan... Spending some time at the Greywood centre in Hamilton has been a great experience, thanks for your friendship Tony, Craig, Father Ron and Padre Antonio!
My Waikato Argentine friends Jose Rossi, Sonia, Martin (Pelusa) and Dominic. Also to Edgardo and Clara Beacon and the girls! Thanks for the hospitality, asados and support.

At Massey, I had the pleasure of assisting to classes of Ian Brookes, Patrick Morel, Bruce McKay, Sam Peterson, Simone Hoskin, thanks very much. Thanks also Nicolas

Lopez Villalobos for sharing a bit of your huge brain and heart with me. My office mates, Carlos Ramirez Restrepo, always fun to have around you and your beautiful family. My great friend, Tuluta, sai aubito, also to my office mates Claudio Machado, John Alawneh, Mohammed Abdalla, Martin Situmbeko, a pleasure sharing the office with you. Thanks Javier and Federico for the 'Sinergia agro-acuatica' great "mate" moments.

Thanks Mrs. Alain Scott for looking after me in IVABS, Andrew Rowatt for helping with my computer. Thanks Julia and Mark from the Students Counselling Service, Sue Flynn and Silvia Hooker, thanks for you patience and support. Yumiko, Natilene and Louis from the Student Learning Centre, great help! Rae Kendall from the Library. My friends from Agricultural Services, especially Martin Chesterfield and Gareth Evans.

Tato and Marcela, always helpful and keen, and ready to cook argentine barbeques.

My kiwi flatmates/brothers Hamish comando Wolland, Michael Chapman and Dominic Bambry, good on you mates. Laureline and Mikaep (my frenchy friends) always with a smile, my great new old friend Federico Riet. My parents in New Zealand, Phill and Sue Wolland.

Natalia Benquet and Alexis Perez, Klelia Silva, Victor Rojas, Virginia and Gonzalo Carracelas, Carolina and Andres Reider, Cecilia and Manuel Bermudez, great to have you near me in these long months. Carolina and Alan Bannister, Ana and Javier Baudracco, Elisa and Matias Peluffo, Victoria Jauregui, Maca and Rene Pinochet, a wonderful experience being together on the boat with you! I will always keep you in a special place in my heart. A especial mention to the "foro de lecheria", one step into the real world of dairying, in honour of what it is to come, far from home, sharing high ideals, Matias and Javier became solid friends of mine for ever.

Thanks Aotearoa. Haere ra.

Professor Angel Coppo is a giant, I love the animal physiology because of your passionate teachings, always grateful. Yani Garcia, a source of inspiration, thanks for encouraging me to study more.

x

From Argentina, always in my heart and thoughts, my friends/brothers of life, David, Chipa, Anibal, Tucu, Charlie, Valen, Seba, Pablo, Dulce.

A last note to the people I love the most, Caro, Willy, Juanma, Juani, Tati, Tuti and Delfi, Jorge, Ada... MAMI, PAPI, all the virtues together and multiplied.. I love you, I am what I am because of you .. Thanks GOD.

Gonzalo

Contents

List of tables

List of figures

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
$PGF_2\alpha$	Prostaglandin $F_2\alpha$
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