

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

THE EFFECTS OF RESTRICTED SUCKLING AND PREPARTUM  
NUTRITIONAL LEVEL ON REPRODUCTIVE PERFORMANCE OF  
PRIMIPAROUS CROSSBRED BEEF COWS

A thesis presented in partial fulfilment  
of the requirements for the degree  
of Master of Agricultural Science  
in Animal Science  
at Massey University

GUILLERMO de NAVA SILVA

1994

Massey University Library  
Thesis Copyright Form

Title of thesis: The effects of restricted suckling and prepartum nutrition on reproductive performance of primiparous crossbred beef heifers cows

(1) (a) I give permission for my thesis to be made available to readers in Massey University Library under conditions determined by the Librarian.

(b) I do not wish my thesis to be made available to readers without my written consent for ... months.

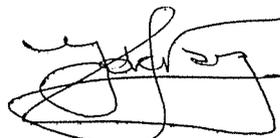
(2) (a) I agree that my thesis, or a copy, may be sent to another institution under conditions determined by the Librarian.

(b) I do not wish my thesis, or a copy, to be sent to another institution without my written consent for ... months.

(3) (a) I agree that my thesis may be copied for Library use.

(b) I do not wish my thesis to be copied for Library use for ... months.

Signed .



Date

18/2/94

The copyright of this thesis belongs to the author. Readers must sign their name in the space below to show that they recognise this. They are asked to add their permanent address.

NAME AND ADDRESS

DATE

*In memory of my uncle Pardo who used to pose  
many of the questions addressed in this  
thesis*

**ABSTRACT**

The objective of this experiment was to study the effect of suckling restriction by fitting nose plates to calves on the reproductive performance of first calving crossbred beef cows managed at two nutritional levels in mid-gestation.

Reproductive activity was recorded in 21 two-year-old Hereford x Friesian and Simmental x Friesian primiparous cows before and after restriction of calf suckling. Cows were allocated two pastures allowances from day 112 to 212 of gestation so that the high nutrition (HN) group gained 0.75 kg/day, whereas the low nutrition (LN) group gained 0.17 kg/day during mid-gestation. Suckling was suppressed for 7 days by fitting nose plates to 46-day-old calves in the restricted suckling (RS) group, whereas the normal suckling (NS) group remained as a control. Ultrasound examinations and blood sampling were carried out at weekly intervals from day 18 and day 25 *post partum*, respectively, to evaluate ovarian activity and serum progesterone concentrations. Calf grazing and suckling activity was observed for 3 h per day on 2, 5 and 3 days before, during and after treatment, respectively.

Dominant follicles (DF) in the ovaries occurred in all cows by day 32 *post partum* and underwent a pattern of growth and atresia before first ovulation. Restricted suckling cows had a mean 18 days shorter interval from calving to conception than NS cows ( $76.0 \pm 5$  vs  $94.1 \pm 6$  days,  $P < 0.05$ ), whereas genotype and nutritional treatment had no effect on interval to conception. However, the beneficial effect of suckling restriction on reproductive performance was apparent only in those cows fed a high pasture allowance in mid-gestation and consequently calved in better condition than NS cows. Restricted suckling calves spent more time grazing during the period of attachment of nose plates and differences in behaviour remained over a further 5 days after nose plates were removed ( $62.4 \pm 7$  vs  $38.6 \pm 7$  minutes spent

grazing;  $P < 0.001$ ), but were lighter at weaning ( $146.7 \pm 3$  vs  $162.4 \pm 3$  kg;  $P < 0.01$ ).

Despite the lower calf liveweight at weaning it is concluded that manipulation of suckling through fitting nose plates to calves can be successfully used to shorten the interval from calving to conception in primiparous cows fed higher pastures allowances during mid-gestation and consequently calved in better body condition.

## ACKNOWLEDGEMENTS

This was not easy. More than two years past before this thesis was ready. Throughout this period, there was a continuous fight to improve academic performance and increase knowledge. In this fight I was not alone, and I wish to thank all who, in one way or another, helped me achieve my goals.

I want to express my special appreciation to my family: Father and mother, brothers and sisters, aunts, uncles and cousins. All of them have helped me. I appreciate very much their immense support, giving the words of encouragement I needed. I want to specially thank my wife Monica for having so much patience and understanding. I want to publicly apologise for asking her to help me with the field work during our honeymoon, something I hope she forgets some day. Her comments were also very helpful when writing this thesis.

Special thanks are also due to my friends in Uruguay, who were also always present with me. Gratitude is also extended to the kiwi friends who provided invaluable help. Special acknowledgement is made to the post graduate students and staff in the Department of Animal Science for their friendship and support.

I want to thank Mr Dean Burnham and Dr Jeff Witchell for their continuous help and ideas while the trial was carried out. I appreciate very much the invaluable assistance given to me by Ms Margaret Scott. Special thanks are also due to Dr John Campbell, who directed the hormone assays. Sincere thanks are due to Dr Patrick Morel for his advice and collaboration with the statistical analysis. Thanks are extended to Dr Hugo Varela, who assisted in the graphic presentation and computer programming. Gratitude is expressed to Dr Colin Holmes not only for his invaluable help in many academic aspects but also for his friendship.

The author would like to thank Dr Maurice McDonald and Dr Stephen Morris who had the difficult task of being my supervisors. Their efforts are recognized.

The financial support from the ODA program of the Ministry of External Relationship and Trade is gratefully acknowledged.

This thesis is dedicated to the memory of Jose Amalio Silva Gomez, my beloved uncle Pardo who used to pose many of the questions addressed in the objectives of this thesis. At first, his letters encouraged my studies in New Zealand, then it was his soul. Thank you very much tio Pardo...

Finally, I should say I have enjoyed very much studying in New Zealand, something which was approached with passion and responsibility.

TABLE OF CONTENTS

CHAPTER I: INTRODUCTION . . . . .	1
CHAPTER II: REVIEW OF LITERATURE . . . . .	4
2.1 Setting objectives for commercial breeding herds . . . . .	4
2.2 Sources of reproductive wastage in beef breeding herds . . . . .	9
2.3 Physiology in the postpartum cow . . . . .	14
2.3.1 Uterine involution . . . . .	14
2.3.2 Endocrine pattern . . . . .	16
2.3.3 Follicular dynamics . . . . .	20
2.3.4 Summary . . . . .	26
2.4 Factors influencing the postpartum anoestrous interval . . . . .	27
2.4.1 Nutritional effects . . . . .	27
2.4.2 Suckling . . . . .	35
2.4.3 Season . . . . .	48
2.4.4 Genotype . . . . .	49
2.4.5 Parity . . . . .	50
2.4.6 Dystocia . . . . .	50
2.4.7 Biostimulation . . . . .	52
2.4.8 Miscellaneous . . . . .	57
2.4.9 Clinical treatments . . . . .	58
2.5 Purpose and scope of the investigation . . . . .	61
CHAPTER III: MATERIALS AND METHODS . . . . .	63
3.1 Animals and Treatments . . . . .	63
3.2 Observations on Behaviour and Liveweight of Calves . . . . .	66
3.3 Ultrasonography . . . . .	67
3.4 Blood Sampling and Progesterone Assay . . . . .	68
3.5 Reproductive Performance . . . . .	68
3.6 Statistical Analysis . . . . .	69
3.6.1 Postpartum intervals . . . . .	71
3.6.2 Calf behaviour data . . . . .	71
3.6.3 Size of Follicular Structures . . . . .	72

CHAPTER IV: RESULTS . . . . .	73
4.1 Liveweight Changes . . . . .	73
4.1.1 Cows . . . . .	73
4.1.2 Calves . . . . .	75
4.2 Calf and Cow Behaviour . . . . .	78
4.3 Reproductive Performance . . . . .	83
4.4 Ovarian Structures . . . . .	87
4.5 Progesterone . . . . .	91
CHAPTER V: DISCUSSION . . . . .	96
5.1 Pattern of Ovarian Changes . . . . .	96
5.2 Reproductive Performance . . . . .	98
5.3 Effectiveness of the nose plate to prevent suckling . . . . .	107
5.4 Management benefits and Practical Application . . .	110
5.5 Further Studies . . . . .	113
5.6 Conclusions . . . . .	114
REFERENCES . . . . .	116

LIST OF TABLES

<u>Table</u>	<u>Page</u>
2.1: Relationships between herd numbers, calving percentages and number of calves marked over a 5 year period on 7 farms	7
2.2: Sources of losses affecting reproductive performance in beef breeding herds	11
2.3: Effect of once or twice daily suckling on reproductive performance of cattle	39
2.4: Effect of temporary calf removal on reproductive performance in cattle	42
2.5: Effect of suckling manipulation by fitting nose plates to calves on reproductive performance in beef herds	45
2.6: Effect of biostimulation on postpartum intervals in suckled beef cows	53
3.1: Observations made on assistance given at calving	64
3.2: Number of heifers allocated to treatment groups	66
3.3: Periods when observations of calves' behaviour were recorded	67
4.1: Effect of nutritional treatment on liveweight, body condition score of cows and calf birth weight	75
4.2: Effect of suckling treatment on liveweight and liveweight gain of calves	78
4.3: Effect of suckling restriction by fitting nose plates to calves on time spent idling, grazing, suckling or attempting to suckle from 06.00-09.00 h on selected days	80
4.4: Interaction between suckling and nutritional treatments on reproductive performance	86
4.5: Size of the largest ovarian follicle at different stages of the experiment	88
4.6: Effect of suckling treatment and days after calving on size of corpus luteum	90

4.7: Effect of nutritional treatment in mid-gestation and days after calving on size of corpus luteum	90
4.8: Correlation coefficients between serum progesterone levels and size of the corpus luteum at different days <i>post partum</i>	91
4.9: Effect of genotype, nutrition and suckling treatment on serum progesterone levels <i>post partum</i>	92

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1.1: An outline of some of the basic elements affecting beef breeding herd production under grazing conditions	2
2.1: A model for the occurrence of dominant follicles and resumption of ovarian cycles during the postpartum period in dairy (milked) and suckled beef cows not nutritionally stressed	22
2.2: Factors affecting postpartum infertility	28
2.3: Effect of postpartum nutritional level and body condition score at calving on interval from calving to first oestrus	31
3.1: Nose plates used on restricted suckling calves to temporarily inhibit suckling activity	65
3.2: Crown-rump measurement and equation used in the present trial to estimate fetal age and conception date	70
4.1: Effect of high nutrition vs low nutrition from day 112 to day 212 of pregnancy on prepartum and postpartum liveweight of cows	74
4.2: Effect of restricted suckling vs normal suckling from day 46 to 53 of lactation on liveweight of calves	77
4.3: Effect of suckling treatment on calf behaviour before, during and after fitting nose plates to calves	81
4.4: Effect of suckling treatment on percentage of pregnant cows at day 85 <i>post partum</i> and one cycle later	85
4.5: Serum progesterone profiles found in the postpartum cows	95

**LIST OF ABBREVIATIONS**

BC	Body condition
CIDR	Controlled internal drug release
CL	Corpus luteum
cm	Centimetre
DF	Dominant follicle
DM	Dry matter
FSH	Follicle-stimulating hormone
GH	Growth hormone
GnRH	Gonadotrophin releasing hormone
h	Hour
ha	Hectare
HN	High nutrition
HxF	Hereford x Friesian
ICC	Interval from calving to conception
IGF1	Insulin-like growth factor 1
IU	International Units
kg	Kilogram
LH	Luteinizing hormone
LN	Low nutrition
LWG	Liveweight gain
ME	Metabolisable energy
MJ	Megajoules
mg	milligram
min	minute
ml	millilitre
mm	millimetre
NEFA	Non esterified fatty acids
ng	nanogram
NS	Normal suckling
PCLI	Interval from calving to occurrence of first corpus luteum
PMSG	Pregnant mare serum gonadotrophin
PPAI	Interval from calving to resumption of ovarian cyclic activity

RS	Restricted suckling
sem	Standard error of the mean
SxF	Simmental x Friesian
vs	Versus
ug	microgram

### Statistical terms

The following symbols have been used throughout the text to indicate various levels of significance:

SYMBOL	LEVEL OF SIGNIFICANCE
***	$P < 0.001$
**	$0.001 < P < 0.01$
*	$0.01 < P < 0.05$
†	$0.05 < P < 0.10$
ns	$0.10 < P$