

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.

AN INVESTIGATION INTO THE EFFECT OF RUMINAL
AND POST-RUMINAL ADMINISTRATION OF CASEIN
ON MILK YIELD AND COMPOSITION

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

Neville James CHANDLER

December, 1971.

ACKNOWLEDGEMENTS

I wish to acknowledge my gratitude to the following people, who made the presentation of this thesis possible.

Professor R.E. Munford, for providing facilities that enabled the trial to run smoothly, for interest and guidance during the study, organising the production testing, and for his participation in, and advice on, the statistical analysis.

Mr. A.W.F. Davey for his encouragement and guidance throughout the experiment and during the preparation of the thesis.

Mr. W.B. Currie, my friend and colleague, who extracted the milk fat samples, and showed much understanding and gave encouragement during many hours of conversation.

Dr. R.M. Greenway who made the Auto Analyser available and gave guidance in methodology.

Mr. N. Thomson, Miss. M. Olsen, Mr. J. Raven and Mrs. S. Playne, who provided skilled technical assistance at various times throughout the experiment.

Dr. B. Goulden and Dr. M. Rex for their participation in the operations to establish partial exteriorisations of the abomasum.

ALFA-LAVAL (N.Z.) PTY. LTD. for designing and providing the milking machine equipment used in the trial.

Professor D.S. Flux and the staff of the Dairy Husbandry Department who made facilities available and provided useful discussion during the experiment.

My wife Diane, who devoted many hours typing and assisting in the preparation of drafts of this thesis and for her continued encouragement throughout the duration of this study.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	1
SECTION I	
Review of Literature	2
Introduction	3
Proteolysis	3
Metabolism of Amino Acids and Peptides	7
Biosynthesis of Amino Acids by Ruminal Micro-organisms	11
Synthesis of Microbial Protein	12
Quality of Microbial Protein	17
The Amino Acid Requirements of the Lactating Ruminant	21
Effect of Dietary Protein on Milk Yield and Composition	30
Aim of the Experiment	33
SECTION II MATERIALS AND METHODS	
1. Animals and Experimental Design	36
2. Milk Yield and Composition	41
3. Nitrogen Balance	44
4. Blood Metabolites	45
5. Rumen Parameters	47
6. Statistical Methods	50
SECTION III RESULTS	
(a) Milk Yield	56
(b) Milk Composition	57
(c) Nitrogen Balance	66
(d) Rumen Characteristics	67
(e) Blood Metabolites	77
(f) Milk Fat Fatty Acids	84
SECTION IV DISCUSSION	
(1) Volatile Fatty Acid Proportions and Concentrations	91

	Page
(2) Rumen Ammonia	93
(3) Nitrogen Balance	94
(4) Blood Metabolites	95
(5) Yield of Milk and Milk Components	100
(6) Yield of Milk Fat Fatty Acids	104
Conclusions	105
APPENDICES	108
REFERENCES	126

LIST OF FIGURES

Figure 1.	Adjusted milk yield vs periods	58
Figure 2.	Adjusted FCM yield vs periods	59
Figure 3.	Adjusted milk fat yield vs periods	60
Figure 4.	Adjusted protein yield vs periods	61
Figure 5.	Adjusted lactose yield vs periods	62
Figure 6.	Adjusted fat percent vs periods	63
Figure 7.	Adjusted protein percent vs periods	64
Figure 8.	Adjusted lactose percent vs periods	65
Figure 9.	(a) Acetic acid concentration vs time after feeding	71
	(b) Propionic acid concentration vs time after feeding	71
	(c) Butyric acid concentration vs time after feeding	71
Figure 10.	(a) Isovaleric acid concentration vs time after feeding	72
	(b) Valeric acid concentration vs time after feeding	72
Figure 11.	Rumen ammonia-nitrogen concentration vs time after feeding	74
Figure 12.	Total VFA concentration vs time after feeding	75
Figure 13.	pH vs time after feeding	76
Figure 14.	Plasma glucose vs periods	80
Figure 15.	Plasma urea nitrogen vs periods	82
Figure 16.	Plasma amino nitrogen vs periods	86
Figure 17.	Treatment vs time for plasma amino nitrogen	87
	(a) 2nd experimental period	
	(b) 1st experimental period	