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The Development of a Computer Model
for the Replacement of Dairy Cattle
in Seasonally Calving Herds in
New Zealand

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of Master of Veterinary Studies at Massey University.

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Abstract

A culling model for use in seasonally calving New Zealand dairy herds (CowCHOP) was developed. The model uses information retrieved from an on farm information system (DairyWIN) as well as farmer input to calculate an economic ranking of all animals within the dairy herd. This economic ranking is used to identify those animals that are most and least desirable for retention in the herd. Culling information was obtained from current DairyMAN user herds. This information was analysed using survival analysis to determine the current removal risks of cattle from DairyMAN herds for inclusion in the model. Additional economic information was obtained from the literature and incorporated into the CowCHOP model.

To understand removal risks and rates for culling, herd demographic data was analysed from a study on reproductive performance for the 1993/94 season. The study was limited to spring calving seasonal herds, typical of the New Zealand dairy industry. The New Zealand dairy industry is reliant on a largely pasture based production system which entails that herds calve annually during the spring months (July to September) with a condensed calving pattern to optimise pasture utilisation. Cows are dried off in the late autumn (April to June) for a dry period prior to the onset of calving the next season. This management system results in two periods of the season where cows are at greatest risk for removal, primarily early lactation and drying off.

Rates and risk factors for removal of dairy cattle internationally and nationally are introduced in Chapter 1. The study designs used to investigate the risks and rates of removal are fully summarised in a series of tables comparing the different methodologies and numbers of animals utilised in each of the studies presented. Economic factors associated with the replacement issue are discussed in detail and this is followed by a comprehensive review of the most important models built that investigate the economics of replacement in dairy cattle. Finally a comparison of the differences in removal rates and risk factors between seasonal and non-seasonally based calving systems in New Zealand and Australia are reviewed. The greatest limitation to the application of internationally developed replacement principles is the paucity of information and studies performed using seasonally calving pasture based farming systems for their development.

modelled the economics of replacement in dairy herds. This spreadsheet was modelled in four sections, the Input module, General calculations module, Individual calculations module and the Output module. A detailed description of each of these modules and the formulae used to perform the calculations is given.

Sensitivity analysis of the model was performed by running a series of simulations to determine the sensitivity of the model to a variety of different scenarios. In all cases the model performed similarly to other models developed internationally using the same techniques. An interesting feature of this model is the difference in the relative worth of both milk and beef stock in the New Zealand dairy system. The effect of these price differences means that stock currently in the herd are very desirable and that retention over replacement is the most economical option to dairy farmers. Overall replacement rates in DairyMAN user herds was low compared to international figures but appear to be appropriate given the current economic status of the New Zealand dairy industry.

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Dedication

This thesis is dedicated to my husband Colin.

Thank you.

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Table of Contents

ABSTRACT	III
ACKNOWLEDGMENTS.....	VII
DEDICATION	IX
TABLE OF CONTENTS	XI
LIST OF FIGURES.	XV
LIST OF TABLES	XVII
LIST OF EQUATIONS	XIX
INTRODUCTION.....	1
CHAPTER 1.....	3
LITERATURE REVIEW.	3
INTRODUCTION.....	5
VOLUNTARY AND INVOLUNTARY CULLING.	6
INTERNATIONAL REMOVAL REASONS AND RISK FACTORS.....	8
<i>Culling Reasons and Rates.</i>	8
<i>Risk factors for the removal of cows.</i>	14
Age.	20
Timing of removal.	20
Mastitis.	20
Infertility.	21
Production.....	21
General Health Events.....	21
<i>Seasonal vs Non Seasonal production systems.</i>	21
THE ECONOMICS OF DAIRY COW REPLACEMENT DECISIONS.	24
<i>Marginal Net Revenue approach.</i>	24
DAIRY CATTLE CULLING COMPUTER MODELS.	28
<i>Marginal Net Revenue</i>	28
<i>Dynamic Programming.</i>	30
<i>Profit Equations</i>	40
NEW ZEALAND AND AUSTRALIAN CULLING.....	43
<i>Descriptive culling analysis in Australia and New Zealand.</i>	44
<i>New Zealand rates of removal and risk factors.</i>	45
<i>New Zealand modelling of replacement theory.</i>	46
<i>Australia rates of removal and risk factors.</i>	48
CONCLUSION.	50
REFERENCE LIST.....	52
CHAPTER 2	59
DESCRIPTIVE DATA ANALYSIS OF THE DAIRYMAN DATABASE.	59
INTRODUCTION.	61
MATERIALS AND METHODS	62
<i>Materials.</i>	62
<i>Methods.</i>	63
Data validation	63
Analyses.....	64
DEMOGRAPHIC ANALYSIS OF THE DAIRYMAN HERDS.	66
<i>Herd Size</i>	66

<i>Materials</i>	155
<i>Methods</i>	155
Variable description.....	155
Variable Selection.....	156
Model Building.....	157
<i>Results</i>	158
DISCUSSION.....	161
REFERENCE LIST.....	165
CHAPTER 5	167
MODEL DEVELOPMENT	167
INTRODUCTION.....	169
<i>Marginal net revenue approach to replacement theory</i>	169
Dairy Cattle Replacement Policy Development.....	172
MODEL DEVELOPMENT.....	174
<i>Model Objective</i>	174
<i>Model Structure</i>	174
<i>DairyWIN farm management system</i>	176
COWCHOP MODEL.....	177
<i>Module 1: Data Entry</i>	177
<i>Module 2: General Calculations</i>	179
<i>Module 3: Individual calculations</i>	187
<i>Module 4: Output</i>	190
RESULTS FROM THE COWCHOP MODEL SIMULATION RUNS.....	192
SENSITIVITY ANALYSIS.....	197
DISCUSSION.....	200
REFERENCE LIST.....	201
CHAPTER 6	203
CONCLUSION	203
INTRODUCTION.....	205
ANIMAL HEALTH AND CULLING IN NEW ZEALAND DAIRY HERDS.....	206
COMPUTER MODELLING.....	211
DIRECTIONS FOR FUTURE RESEARCH.....	212
REFERENCE LIST.....	215
APPENDIX	I
APPENDIX 1.....	III
COWCHOP SPREADSHEET MODEL.....	III
<i>Module 1: Input Data</i>	iii
<i>Module 2: General Calculations</i>	vi
<i>Module 3: Individual Calculations</i>	xi
<i>Module 4: Output</i>	xiv

List of Figures.

Figure 1 Marginal Net Revenue Curve	25
Figure 2 Relationships between present and future values	26
Figure 3: Pie chart of the proportion of DairyMAN herds by region.	66
Figure 4: Histogram of herd size distribution of DairyMAN herds.	67
Figure 5 Average herd size in DairyMAN herds stratified by region.	68
Figure 6 Distribution of cows in DairyMAN herds stratified by parity	69
Figure 7 Planned start of calving for DairyMAN herds stratified by region	70
Figure 8 Planned start of mating in DairyMAN herds stratified by region	70
Figure 9 Average production (L) per herd test in DairyMAN herds.	72
Figure 10 Breeding Indices stratified by region for DairyMAN herds	73
Figure 11 Proportion of breeds in DairyMAN herds.	74
Figure 12 Breed summary stratified by region for DairyMAN herds	75
Figure 13 Period of risk for calving assistance in DairyMAN herds	77
Figure 14 Period of risk for metabolic events in DairyMAN herds	78
Figure 15 Period of risk for a reproductive event in DairyMAN herds	80
Figure 16 Period of risk for removal of empty cows in DairyMAN herds	81
Figure 17 Period of risk for a mastitis event in DairyMAN herds	82
Figure 18 Period of risk for a lameness event in DairyMAN herds	83
Figure 19 Period of risk for a sickness event in DairyMAN herds.	84
Figure 20 Comparison of the periods of risk for all animal health events in DairyMAN herds	85
Figure 21 Fate of cows from DairyMAN herds.	98
Figure 22 Distribution of removal risk in DairyMAN herds.	99
Figure 23 Average replacement risk in DairyMAN herds stratified by region, including standard errors.	99
Figure 24 Temporal pattern of cow removal risk during the 1993/94 Season	100
Figure 25 Risk and timing of removal stratified by fate for the 1993/94 season.	101
Figure 26 Animal health events recorded in cows which died, stratified by month, 1993/94	101
Figure 27 Animal health events recorded in cows removed by sale, stratified by month 1993/94.	102
Figure 28 Animal health events recorded in cows removed by culling stratified by month, 1993/94.	103
Figure 29 Percentage-accumulated risk of removal for each parity.	104
Figure 30 Contribution of various animal health events to the removal pattern.	105
Figure 31 Time plot for comparison of the risk of removal and incidence of lameness events	107
Figure 32 Time plot for comparison of the risk of removal and incidence of reproductive events.	108
Figure 33 Time plot of monthly risk of removal and the incidence of cows requiring calving assistance.	109
Figure 34 Time plot of monthly risk of removal and cumulative incidence of metabolic events	109
Figure 35 Time plot of monthly removal risk and cumulative incidence of sickness events.	110
Figure 36 Time plot of monthly removal risk and cumulative incidence of mastitis events	111

List of Tables

<i>Table 1 Summary of studies investigating removal reasons.</i>	10
<i>Table 2 Changes in removal reasons over time.</i>	12
<i>Table 3 Comparison of the reasons for culling.</i>	13
<i>Table 4 Summary of studies investigating the risks associated with culling.</i>	16
<i>Table 5 Summary of the variables used to investigate risks associated with culling.</i>	18
<i>Table 6 Risk of removal for commonly described diseases.</i>	19
<i>Table 7 Culling rates and reasons in seasonal calving herds.</i>	22
<i>Table 8 Culling rates and reasons in non-seasonal calving herds.</i>	23
<i>Table 9 Summary of Marginal Net Revenue calculations.</i>	25
<i>Table 10 Summary of key features of some Dynamic Programming models.</i>	32
<i>Table 11 Summary of culling reasons in New Zealand and Australia.</i>	44
<i>Table 12 Data available for DairyMAN herds</i>	62
<i>Table 13 Average herd size by region.</i>	67
<i>Table 14 Planned start of calving for DairyMAN herds</i>	69
<i>Table 15 Planned start of mating for DairyMAN herds</i>	71
<i>Table 16 National average milk production per cow</i>	71
<i>Table 17 Average lactation to date production (L) for DairyMAN herds</i>	71
<i>Table 18 Average milk fat production (kg) for DairyMAN herds by region</i>	72
<i>Table 19 Average protein production (kg) for DairyMAN herds by region</i>	73
<i>Table 20 Calf fate in DairyMAN herds</i>	76
<i>Table 21 Fate of single and twin calves born in DairyMAN herds.</i>	76
<i>Table 22 Summary of reproductive disorders</i>	79
<i>Table 23 Summary of the risk of animal health events in DairyMAN herds</i>	85
<i>Table 24 Comparison of current work with previous reported disease incidence</i>	89
<i>Table 25 Data tabulation for relative risk calculation</i>	97
<i>Table 26 Monthly percentage-accumulated risk of removal stratified by parity</i>	103
<i>Table 27 Relative risk of removal for cows with an animal health event</i>	106
<i>Table 28 Chi Square analysis of the fate distribution for specific animal health events</i>	107
<i>Table 29 Summary of univariate survival analysis comparing production levels.</i>	129
<i>Table 30 Summary of univariate survival analysis for animal health disorders</i>	132
<i>Table 31 Cumulative hazard for removal of cows with an animal health disorder stratified by parity.</i>	133
<i>Table 32 Summary of univariate survival analysis results for management factors</i>	146
<i>Table 33 Cumulative hazard for removal of cows during the lactation stratified by parity.</i>	151
<i>Table 34 Variables considered for inclusion in the model.</i>	158
<i>Table 35 Summary table of the variables included in the model at each step.</i>	158
<i>Table 36 Regression coefficients for variables included in the final model.</i>	159

List of Equations

<i>Equation 1 Survival probability density function.</i>	122
<i>Equation 2 Survivor function.</i>	122
<i>Equation 3 Hazard function.</i>	122
<i>Equation 4 Cox proportional hazards model.</i>	153
<i>Equation 5 Survival calculation</i>	180
<i>Equation 6 Average herd age (HA)</i>	180
<i>Equation 7 Herd parity structure (PS)</i>	180
<i>Equation 8 Parity structure of removed cows (PSR)</i>	180
<i>Equation 9 Average parity of calved cows (AP)</i>	180
<i>Equation 10 Gross milk income (GMI)</i>	182
<i>Equation 11 Gross calf income (GCI)</i>	182
<i>Equation 12 Slaughter value</i>	183
<i>Equation 13 Supplementary feed costs (SF)</i>	184
<i>Equation 14 Additional cost of removal (RC)</i>	184
<i>Equation 15 Marginal net revenue (MNR)</i>	185
<i>Equation 16 Marginal net revenue including discounting.</i>	185
<i>Equation 17 Marginal net revenue including discounting and survival</i>	185
<i>Equation 18 Average net revenue per year</i>	186
<i>Equation 19 Retention payoff (RPO)</i>	190

Introduction

There have been many computer programs developed that investigate the economics of replacement in dairy cattle both internationally and nationally. However none of these programmes have been used commercially by farmer as tools for the selection of replacement animals.

A wealth of information on replacement in dairy cattle has been published in the literature over the last 30 to 40 years yet the risk factors and rates of removal remain essentially the same. With the development of more sophisticated techniques it is possible to extract more useful information about the timing and the effects of removal on the economics of the dairy herd.

While the development of computer programs based on the economics of replacement in New Zealand dairy herds have been fairly abundant there has been no comprehensive analysis of the risk factors and rates of removal in dairy cattle during the last ten years.

This thesis hopes to redress the balance and provide some useful facts and figure about the New Zealand dairy industry in particular aspects of replacement risks reasons and rates. A survey of DairyMAN user herds provided information on which this study was based, and can be considered as a starting point for future research. This information was combined to develop a replacement model that is to be incorporated into DairyWIN in the near future.