

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.

**A FRAMEWORK FOR ANALYSING THE ADOPTION
OF NEW ZEALAND PASTORAL FARMING
SYSTEMS IN CENTRAL VERACRUZ STATE, MEXICO.**

**A thesis submitted in partial fulfilment of the requirements
for the degree of Master of Agricultural Science
in Farm Management
at Massey University.**

By:

Alejandro Nicolás Martínez-García

1995

Massey University Library

Thesis Copyright Form

Title of thesis: "A framework for analysing the adoption of New Zealand pastoral Farming Systems in Central Veracruze State, Mexico."

Please delete section not applicable.

- (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 [Signature] Date 14- Dec- 1995

For Readers Only.

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

ABSTRACT

Tropical areas of developing countries have significant potential for increased food production. In the case of Mexico, an important economic activity in the tropics is livestock production based on pasture. Tropical regions represent 25% of the total area of Mexico and support more than 50% of the country's cow production. Historically, however, animal production in Mexican, and other tropical areas, has been low. Low pasture utilisation, and associated poor herbage quality, is one factor that contributes to poor animal performance in the tropics. This situation contrasts with the success of New Zealand pastoral systems, which in comparative terms have been able to obtain high levels of animal production and efficient use of pasture.

Differences in pasture productivity (both in quality and quantity) and social and economic conditions between the Mexican tropics and New Zealand are large. Nevertheless it was proposed that some of the pastoral farming methods used in New Zealand, could be adapted to the conditions of tropical farmers in Mexico, particularly in relation to effective planning and control of the farming system. To test this hypothesis, the consequences of implementing some of New Zealand's pastoral farming techniques under tropical conditions in Central Veracruz State were explored by developing a spreadsheet model to simulate local farming systems. The model included linked sub-models for pasture growth and quality, livestock transactions, milk production and enterprise gross margins. The effect of improved farming systems of milk output and cash returns were evaluated relative to the average levels of performance currently achieved from a medium-sized farm in the Central region of Veracruz State in Mexico. Straight forward changes in the design of the farming system, such as synchronising calving with the pattern of pasture growth rather than year-round calving, would significantly affect milk production and cash returns to the farm family.

The modelling process was seriously constrained by the lack of farm-level data on pasture production and animal performance. Nevertheless, the model framework clearly identifies which data should be collected, and priority should now be given to assembling these data so simulation decision support models such as that developed in this study, can be effectively used to plan improved farming systems.

Keywords: tropical agricultural, Mexico, farming systems, spreadsheet model.

ACKNOWLEDGEMENTS

I want to thank my chief supervisor Prof. Warren James Parker for all the knowledge shared and the help given during the past two years.

Thanks to my second supervisor, Dr. Chris Dàke, for his suggestions and comments.

Thanks to my Mexican supervisor, Dr. José Luis Dávalos Flores, who gave the suggestion, support and data for this work to be done.

Special thanks should be given to Mr. Parry N. P. Matthews, for his generosity in clearly explaining the concepts and principles of New Zealand pastoral systems.

Finally, I wish to thank Mr. Alastair McDonald, Mr. David Grant and Mrs Sharyn Price for the time and knowledge they shared with me.

DEDICATION

To my lovely wife Yadira. Thank you very much for all the support, courage and love you have given me during this time. We are a team, and we did it. I love you.

To my loved children, Yadira and Alejandro. Thank you very much for all the time you have given me to complete my job here. I am in debt to you and I will pay. I love you.

To my mother, Mrs. Cira García Vda. de Martínez. Thanks a lot for all the support and help to accomplish this dream we dreamt together. God bless you.

To Dr. Leopoldo Paasch Martínez and his family. Thank you for the advice, encouragement and help, and for giving me an example to pursue.

To Dr. Roger Purchas, Prof. John Hodgson, Mr. Alan McRae, and Mr. Kevin Lowe.

To Dr. Humberto Troncoso Altamirano, thanks for your advice and help.

To my *sabunim*, José Sámano Hernández, for teaching me that to have a black belt degree should be reflected as an attitude towards life.

In memorium: Mr. Alberto Martínez, Mr. Felix García, Mrs. Hilaria Salazar, Mrs. Socorro García.

To my friends: Alfonso Hernandez, Salvador Espejel, Juan Pablo Martinez, Wagner and Angela Bescow, Alberto Torres, David Pacheco, Mauricio Cunha, Rick and Dee Ann Laird, Majid and Tahere Dehghan, Rob McLaren, and Ken Crawford.

And last but not least, thanks to my Lord.

TABLE OF CONTENTS

| | Page |
|---|-------------|
| Abstract | i |
| Acknowledgements | ii |
| Dedication | iii |
| Chapter One: Introduction | 1 |
| 1.1 Introduction | 1 |
| Thesis objectives | 2 |
| 1.2 Background | 2 |
| 1.2.1 Role of pasture farming in tropical areas of Mexico | 2 |
| 1.2.2 Characteristics of Central Veracruz State | 3 |
| 1.2.3 Climate, soils and productivity of tropical pastoral farming systems in Central Veracruz State | 8 |
| 1.2.3.1 Animal production | 15 |
| 1.3 The Agricultural Community | |
| 1.3.1 Farmer characteristics | 16 |
| 1.3.2 Land tenure | 18 |
| 1.4 Differences between animal production in New Zealand and Mexico | 26 |
| 1.4.1 Summary of New Zealand-Mexico comparisons | 35 |
| 1.5 New Zealand pastoral production systems | 36 |
| 1.5.1 Summary of New Zealand grazing techniques | 43 |
| 1.6 Conclusions to Chapter One and Thesis Outline | 44 |

| | Page |
|---|-------------|
| Chapter Two: Literature Review: Farm Management and Computer Modelling | 46 |
| 2.0 Introduction | 46 |
| 2.1 Farm management processes | 46 |
| 2.2 Data required for feed budgeting | 48 |
| 2.3 Computer models as a decision support tool | 54 |
| 2.3.1 Introduction | 54 |
| 2.3.2 Purpose of modelling | 55 |
| 2.3.3 Different types of models | 56 |
| 2.3.4 Strengths and weaknesses of modelling | 57 |
| 2.3.5 Model evaluation | 58 |
| 2.3.6 Summary | 59 |
| 2.4 Decision Support Systems (DSS) | 59 |
| 2.5 Spreadsheets for designing farming systems | 61 |
| 2.6 Farming Systems Research (FSR) | 62 |
| 2.6.1 Farm systems research and modelling | 64 |
| 2.6.2 Farming Systems Research applied to Central Veracruz State | 66 |
| 2.7 Conclusions | 67 |

| | Page |
|--|-------------|
| Chapter Three: Technical and financial feasibility of improving grazing systems in Central Veracruz State, Mexico | 69 |
| 3.0 Introduction | 69 |
| 3.1 Method | 69 |
| 3.1.1 Spreadsheet model | 70 |
| 3.1.2 Case farm | 79 |
| 3.1.3 Comparative analysis of the systems modelled | 83 |
| 3.2 Discussion | 86 |
| 3.3 Conclusions | 89 |
| | |
| Chapter Four: Conclusions | 91 |
| | |
| References | 94 |

| TABLES | Page | |
|---------------|---|----|
| Table 1.1 | Herd size distribution in Central Veracruz State | 5 |
| Table 1.2 | Cattle production systems in Central Veracruz State, Mexico | 6 |
| Table 1.3 | The size of farms (ha) in Central Veracruz State | 7 |
| Table 1.5 | Most frequent animal production problems in Central Veracruz State, Mexico | 13 |
| Table 1.6 | Land tenure in Mexico | 20 |
| Table 1.7 | Farm size in the Central Veracruz State | 22 |
| Table 1.8 | Technical advice requested by cattle farmers from the Central Veracruz State, Mexico | 24 |
| Table 1.9 | Basic characteristics of New Zealand and Mexico | 28 |
| Table 1.10 | Attributes of animal production in New Zealand and Central Veracruz State | 30 |
| Table 1.11 | Pasture production differences between New Zealand and Central Veracruz State, Mexico | 31 |
| Table 1.12 | Farm size (ha) in New Zealand and Central Veracruz State | 33 |
| Table 2.1 | Feed supply and demand in a pastoral livestock system | 51 |

| | Page |
|---|-------------|
| Table 3.1 Assumptions for the three farming systems explored with the model | 81 |
| Table 3.2 Assumed herd composition on 1 June for the three farming systems studied for Central Veracruz State | 81 |
| Table 3.3 End uses of milk produced by the three farming systems studied with the model | 84 |
| Table 3.4 Physical and financial characteristics of the three farming systems for Central Veracruz State estimated with the model | 87 |

| FIGURES | Page | |
|----------------|--|----|
| Figure 1.1 | Map of Mexico and location of Central Veracruz State | 4 |
| Figure 1.2 | Average monthly rainfall and temperature in Central Veracruz State | 9 |
| Figure 1.3 | Average pasture growth rate in the Central Veracruz State, Mexico | 11 |
| Figure 1.4 | Proportion of dry matter (DM%), digestible organic matter (% True DOM) and Crude Protein (CP%) per month for pasture of average composition in Central Veracruz State, Mexico. | 12 |
| Figure 2.1 | Schematic representation of steps followed in studying farming systems. | 49 |
| Figure 3.1 | The Central Veracruz State farm systems model; sub-models and their inter-relationships | 72 |
| Figure 3.2 | Animal liveweights through the year for the three systems analysed | 80 |
| Figure 3.3 | Animal liveweights through the year for the three systems analysed | 86 |