

AN ECONOMIC ANALYSIS
OF FARMING COFFEE AND TREES AT TURRIALBA, COSTA RICA:
COMPARING SMALL FARMS WITH PORÓ (Erythrina poeppigiana)
ONLY TO THOSE WITH BOTH LAUREL (Cordia alliodora) AND PORÓ

Thesis submitted to the Academic Technical Committee
of the Postgraduate Studies Program in
Agricultural Sciences and Natural Resources at the
Tropical Agricultural Centre of Teaching and Research

to obtain the grade of

MASTER OF SCIENCE

BY

David J. Barker


Centro Agronómico Tropical de Investigación y Enseñanza
Turrialba, Costa Rica

1991


This thesis has been accepted in its present form by the Coordinación del Programa de Estudios de Posgrado en Ciencias Agrícolas y Recursos Naturales Renovables del CATIE and approved by the student's assessment committee as a partial requirement to obtain the grade of:

MASTER OF SCIENCE

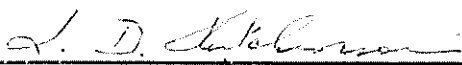
Assessment Committee:



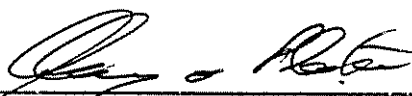
Thomas McKenzie, MSc.
Professor advisor



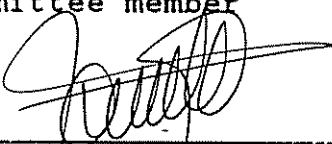
John Beer, MSc.
Committee member



Ian Hutchinson, MSc.
Committee member



Henning von Platen, PhD.
Committee member



Ramón Lastra, PhD.
Coordinador, Programa de Estudios de Posgrado



David J. Barker, B.S.F, R.P.F (Canada)
candidate

BARKER, D.J. 1991. An economic analysis of farming coffee and trees at Turrialba, Costa Rica: comparing small farms with poró (*Erythrina poeppigiana*) only to those with both laurel (*Cordia alliodora*) and poró. Thesis, MSc. CATIE, Turrialba, Costa Rica. 130 p.

key words: agroforestry, coffee, *Cordia alliodora*, economics, *Erythrina poeppigiana*, laurel, poró, shade trees, small farms, valuation.

SUMMARY

This thesis compares the economics of two agroforestry systems: growing coffee in plantations (*Coffea arabica* var. *caturra*), using either poró (*Erythrina poeppigiana*) alone or poró with laurel (*Cordia alliodora*) for shade trees mixed with the coffee bushes. The hypotheses were that: 1) The net present value (NPV) of the coffee/laurel/poró (LAUREL) is better than the NPV of the coffee/poró, (PORO), 2) There will be more firewood accruing from the LAUREL combination, 3) There will be lower labour requirements for pruning in the LAUREL combination and 4) Market risk for coffee is better handled by the LAUREL farmer. An initial survey of 20 small farms in the Turrialba area of Costa Rica was made to describe typical systems in the zone and to derive estimates of farm management costs and coffee yields. A sub-sample of two groups of four farms each was then taken: coffee farms with poró alone and coffee farms with poró and laurel. On each of these eight farms, a questionnaire was given and measurements taken to determine yields, product prices and costs. Results indicated that the LAUREL FARMS had a higher net present value than the PORO FARMS over 25 years, due principally to higher coffee yields. This larger NPV difference, however, may have been affected by the location of the farms. The impact of income from trees was significant only during periods of low coffee prices. PORO farmers had higher per hectare labour costs than LAUREL farmers. Increased firewood from the LAUREL FARMS was trivial. Both types of farms showed management strategies for handling market risk, but the PORO farmers had higher costs using these strategies.

DEDICATION

This thesis is dedicated to:

My wife, Susan Barker, without whose help and support it would never have been initiated nor completed.

My children, Boyd, Ian and Rebecca Barker who helped with the measurements on the farms.

My father, Robert Barker who helped me on farm measurements, often in rainy weather.

My mother, Edna Barker, whose memory will always be with me.

ACKNOWLEDGEMENTS

My most sincere thanks to the following people:

Members of my committee-

Thomas McKenzie
John Beer
Ian Hutchinson
Henning von Platen

Farmers who participated in the detailed survey-

Hugo Aguilar and his sons
Manuel Cespedes
Carlos Delgado
Rolando Esquivel
Gregorio Gomez
Rodrigo Guevarra
Luis Madrigal
Javier Mena

Other farmers who gave much of their time and advice.

The GTZ project for giving me moral support and the use of their computer. Special thanks are due to-

Arnim Bonnemann
Eduardo Somarriba

My fellow students who were patient with my mediocre Spanish.

Centro de Posgrado, especially-

Ramón Lastra

Members of the Economic Studies section of ICAFE in San José.

My many instructors at CATIE.

The University of Wageningen Project, especially-

Hans Bronkhorst

And last, but not least, those people in Canada who cared for our house while we were away and "looked after the bills" and at times, the kids too-

my brothers: Bob and John Barker
Peter and Lois Clarke
Jan O'Neill
Sylvia Wulff

TABLE OF CONTENTS

section	page
1.0 INTRODUCTION	2-7
1.1 <u>Scope of the Work</u>	2
1.2 <u>Thesis Purpose</u>	2
1.3 <u>Problem Definition</u>	2
1.4 <u>Reasons for Choosing the Topic</u>	3
1.5 <u>Coffee and Forests in Costa Rica</u>	4
1.5.1 Background information on the coffee sector	4
1.5.2 Background information on the forest sector	6
1.6 <u>Hypotheses</u>	7
2.0 LITERATURE REVIEW	8-20
2.1 <u>Agroforestry Economics</u>	8
2.2 <u>Coffee</u>	10
2.2.1 Introduction	10
2.2.2 The coffee sector in Costa Rica	10
2.3 <u>Laurel</u>	17
2.3.1 General	17
2.3.2 Distribution and tree description	18
2.3.3 Botanical characteristics	18
2.3.4 Tree growth, yield and tree volume conversion factors	18
2.3.5 Cultivation	19
2.3.6 Log market value	20
3.0 FARM SURVEY	21-30
3.1 <u>Introduction</u>	21
3.2 <u>Methodology</u>	21
3.2.1 Designing the questionnaire	21
3.2.2 Locating appropriate farms	22
3.2.3 Carrying out the survey on the selected farms	24
3.2.4 Analyzing the survey data	24
3.3 <u>Results and Discussion of the Survey</u>	25
3.3.1 Total farmers interviewed	25
3.3.2 The Turrialba coffee region	25
3.3.3 Environment	26
3.3.4 Socioeconomic characterization of the farms	27
3.3.5 Farm management	27
3.3.6 Coffee statistics	28
3.4 <u>Conclusions on the Farms Sampled</u>	29
3.4.1 Farm management and non-coffee crops	29
3.4.2 Coffee cultivation	30
3.4.3 Socioeconomic factors	30
3.4.4 Environmental factors	30

section	page
4.0 SELECTION AND ANALYSIS OF THE EIGHT SAMPLE FARMS	31-76
4.1 <u>Introduction</u>	31
4.2 <u>Methodology</u>	31
4.2.1 Criteria and selection of eight sample farms	31
4.2.2 Detailed farmer questionnaire	32
4.2.3 Collection of on-farm measurements	33
4.2.4 Estimate of discount rate, inflation rate and product prices	34
4.2.5 Estimates of yields	36
4.2.6 Estimates of costs	42
4.2.7 Analysis methods	45
4.3 <u>Results and Analysis</u>	45
4.3.1 Selection of the eight sample farms	45
4.3.2 Details of the eight selected farms	46
4.3.3 Inflation rate and the discount rate	50
4.3.4 Product prices	50
4.3.5 Product yields	56
4.3.6 Costs	70
4.3.7 Economic results	72
5.0 CONCLUSIONS	77
BIBLIOGRAPHY	78-85

LIST OF APPENDICES

I Survey of the 20 Farmers	86-98
Ia: Example of a Completed Survey Form for Farmer 12	
Ib: Survey Forms:Summary	
Ic: Coffee Survey:Locations and Interviews	
Id: List of Respondents to Coffee Survey	
II Detailed Survey of the Eight Selected Farmers	99-108
IIa Detailed Survey of the Eight Farms-Farmer Questionnaire	
IIb Detailed Survey of the Eight Farms-Field Forms	
III Farm Product and Tree Yields and Prices; Inflation Rates	109-116
IIIa Product Yields	
IIIb Product Prices	
IIIc Inflation Rate	
IV Agricultural Product and Tree Yields	117-125
IVa Agricultural Product & Tree Cost Units	
IVb Agricultural Product & Tree Costs/Unit	
V Tree Calculations	126-128
Va: Laurel Tree Statistic Calculation for FARM 6	

section	page
Vb: Comparison of S&B's Projections to Measured Gross and Merchantable Volumes, for Laurel	
VI Net Present Value Analysis	129-130

LIST OF TABLES

table	page
1-1 Distribution of land in Costa Rica in 1982	4
1-2 Agricultural exports from Costa Rica, 1984-88	5
1-3 Selected coffee production and yield statistics 1979-89	5
1-4 National timber and agricultural production and timber import statistics, 1977-89	6
2-1 Coffee yields with and without leguminous shade at three levels of fertilization	14
2-2 Coffee fertilization trial results and recommendations	16
2-3 Reported coffee net revenues per hectare in Costa Rica from 1980 to 1987	17
3-1 Farms surveyed and land use in the five sections of the coffee survey	26
3-2 Environmental data about the 20 farms	26
3-3 Survey summary of socioeconomic factors	27
3-4 Farm management quality and other crops grown	28
3-5 Coffee cultivation and harvest statistics	29
4-1 An example of the per tree calculations for FARM 6	41
4-2 Decision analysis "points" for LAUREL FARM 3	46
4-3 Physical characteristics of the eight sample farms	47
4-4 Socio-economic description of the eight sample farms, (1990)	48
4-5 Real local coffee prices vs New York prices for the years 1978 to 1992	51
4-6 Reported coffee yields for the eight sample farms	56
4-7 Comparison of Barker's vs S&B's age-to-height and diameter projections	59
4-8 Current tree data summaries for the eight sample farms	60
4-9 Projections-tree numbers and wood volume (per ha) available in four and 14 years on the eight sample farms	61
4-10 Laurel harvested from the farms, from 1980-1990; values are per hectare	62
4-11 Area vertically shaded by the trees on the eight farms, compared to stem basal area	63
4-12 Comparison of tree numbers, size and volume from 1979 to 1990, FARM 2	65
4-13 Per hectare yields of other farm products	70

table	page
4-14 Reported farm labour amounts, per ha for 1990	71
4-15 Coffee picking rates reported from the survey, 1987-91	71
4-16 Mean NPV results between LAUREL and PORO FARMS at a discount rate of 10%, all values per ha	72
4-17 Comparison of crop vs tree net revenue between LAUREL and PORO FARMS for five periods	73
4-18 NPV results between LAUREL and PORO FARMS at a discount rate of 5%	74
4-19 Distribution of costs on the eight farms (000 colones/ha/yr)	75

LIST OF FIGURES

figure	page
1-1 Two examples of coffee with shade trees	1
2-1 Study area within coffee growing regions in Costa Rica	11
3-1 Map of Turrialba environs showing coffee study farms and limits of study area	23
4-1 Comparison of Barker's and S&B's measurement methods	38
4-2 Coffee prices, 1978-92: real prices, Turrialba vs New York	49
4-3 Laurel prices, 1989-91: Turrialba, "La Cecilia"	53

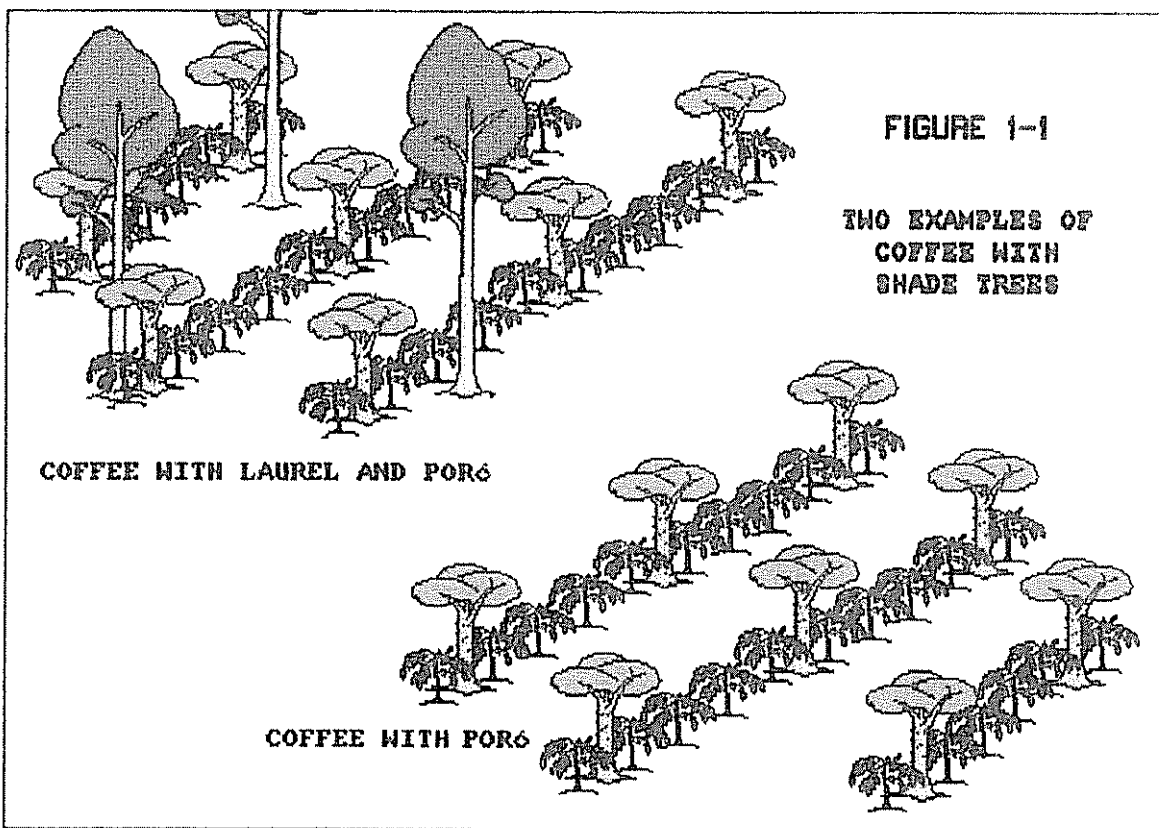


FIGURE 1-1

TWO EXAMPLES OF
COFFEE WITH
SHADE TREES

COFFEE WITH LAUREL AND PORO

COFFEE WITH PORO