AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION

A. PRIMARY: ECONOMICS

B. SECONDARY: AGRICULTURAL ECONOMICS

2. TITLE AND SUBTITLE

AN ANALYSIS OF AGRICULTURAL PRODUCTION IN NICARAGUA

3. AUTHOR(S)

PHILIP F. WARNKEN AND WALTER L. SWENSON

4. DOCUMENT DATE: JUNE 1974

5. NUMBER OF PAGES: 246 PAGES

6. ARC NUMBER: ARC NU-630.97285-W285

7. REFERENCE ORGANIZATION NAME AND ADDRESS

UNIVERSITY OF MISSOURI
DEPT. OF AGRICULTURAL ECONOMICS
COLUMBIA, MISSOURI 65201

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)

9. ABSTRACT

This study presents a benchmark descriptive analysis of agricultural production in Nicaragua. The purpose was to provide an analytical basis whereby priorities for general and specific agricultural policies could be established to further Nicaraguan development objectives in the agricultural sector.

The study was limited to an analysis of principal agricultural products in Nicaragua and included nine crops and two livestock activities. These activities were grouped into three classes of products: (1) basic grains including corn, beans, rice and grain sorghum; (2) export products including cotton, coffee, sugarcane, tobacco and sesame; and (3) livestock activities which included the beef and dairy enterprises. Together, these activities account for over 90 percent of the total value of production from the agricultural sector in 1971. The analysis was further limited to production from the six major regions (Figure 1) which lie in the western half of the country. The two eastern regions bordering the Caribbean were excluded from the study since both are economically unimportant in terms of national agricultural output.

10. CONTROL NUMBER: PN-AAB-010

11. PRICE OF DOCUMENT:

12. DESCRIPTORS

AGRICULTURAL POLICIES, CORN, BEANS, RICE, SORGHUM, COTTON, COFFEE, SUGARCANE, TOBACCO, SESAME, BEEF, DAIRY, ECONOMICS

13. PROJECT NUMBER: 524-11-110-073

14. CONTRACT NUMBER: AID/CM/LA-C-73-21

15. TYPE OF DOCUMENT: SECTOR ANALYSIS

AID 590-1 (4-74)

AN ANALYSIS OF AGRICULTURAL PRODUCTION IN NICARAGUA

Final Report for
AID Contract
AID/CM/1a-C-73-21

by

Philip F. Warnken
Associate Professor
Project Director
With the Assistance of
Walter L. Swenson
Research Associate

Department of Agricultural Economics
Universiy of Missouri
Columbia, Missouri

A.I.D.
Reference Center
Room 1656 NS

June 1974

AN ANALYSIS OF AGRICULTURAL PRODUCTION IN NICARAGUA

Final Report for
AID Contract
AID/CM/1a-C-73-21

by
Philip F. Warnken
Associate Professor
Project Director
With the Assistance of
Walter L. Swenson
Research Associate

Department of Agricultural Economics
University of Missouri
Columbia, Missouri

June 1974

PREFACE

This report was prepared as the final report of the AID/Nicaragua/University of Missouri Sector Analysis Research Project. It represents one part of the University of Missouri effort in assisting the Sector Analysis Unit (UNASEC) of the Government of Nicaragua in a comprehensive agricultural sector analysis. UNASEC assumed responsibility for the total analysis and contracted directly or through AID for sub-sector analyses. The University of Missouri took responsibility for the agricultural production analysis as well as for the animal and animal products marketing analysis. A series of reports were completed in 1973 and early 1974 on specific production and marketing aspects.

This report is not intended as a comprehensive sector analysis, but rather as a sub-sector report on agricultural production. Portions of early versions of this report have been incorporated into the UNASEC comprehensive sector analysis report published in May, 1974.

The senior author wishes to acknowledge the assistance of persons who contributed to the data collection, analysis and writing of the report.

Walter Swenson assumed responsibility for portions of the report, but especially for organizing and writing the production costs and returns analysis, drawing from Professor Robert Finley's production analysis of individual agricultural activities. Professor Finley's contribution to the analysis of factor productivity was also very substantial. Ernesto Valdivia of UNASEC and his assistants were responsible for the collection of data, performed a series of statistical analyses, and aided greatly in the senior author's understanding of production relationships in Nicaraguan agriculture. Also deserving acknowledgement for either direct or indirect assistance with the report are Carl Koone, Rural Development Office of AID/Nicaragua, colleagues at the University of Missouri, and project members, Drs. Durward Brewer, Kenneth Miller, Leonard Voss and Stephen Whitted. Sue Richardson efficiently organized the materials and typed the final manuscript. Sincere appreciation is extended to all who assisted in all phases of the report.

Philip F. Warnken
Columbia, Missouri
June, 1974

CONTENTS

	Page
PREFACE	ii
Chapter	
I. INTRODUCTION	1
Trends in Agricultural Production, Area, Yields and Production Value	4
Production	5
Area	9
Yields	13
Value of Production	24
Implications for Development Strategy	31
II. STRUCTURE OF AGRICULTURAL PRODUCTION AND INCOME	37
Agricultural Production by Farm Numbers	38
Agricultural Production by Farm Size	49
Crop Production by Farm Size	49
Livestock Production and Numbers by Farm Size	58
Production by Region	62
Value of Production	66
Value of Production by Activity	66
Value of Production by Farm Size and Number	72
Value of Production per Capita	74
Implications of the Structure of Nicaraguan Agriculture for Economic Development	79

Chapter | Page

III. FACTORS OF PRODUCTION. 83

Land Use. 84

Changes in Farm Numbers and Sizes. 84

Farm Size and Number by Region 89

Land Resource Distribution by Farm Size and Number. 101

Labor 110

Agricultural Labor--An Overview. 110

Structure of Rural Labor Use 118

Modern Inputs 127

Use of Modern Inputs in Nicaraguan Agriculture. 129

Structure of Modern Input Use. 138

IV. COST OF PRODUCING FARM PRODUCTS. 149

Production Cost Requirements Costs and Returns for Individual Crops:
Cotton 153
Sugarcane. 159
Coffee 162
Tobacco. 178
Rice 181
Corn 191
Beans. 200
Grain Sorghum. 208

Livestock Activities: Beef and Milk . . . 215

V. CONCLUSIONS AND RECOMMENDATIONS. 221

Key Problem Areas of Nicaraguan Agricultural Production. 222

An Outline of Policy Priorities 223

METHODOLOGICAL APPENDIX. 228

ILLUSTRATIONS

Page

Map

1. Nicaragua: Major Producing Regions. 2

2. Nicaragua: Total Area, Agricultural Area, Number of Farms, and Average Farm Size by Region, 1971 90

Figure

1. Relationship Between Farm Numbers and Land Area Occupied In Percent of Totals, Nicaragua, 1971 104

LIST OF TABLES

Trends

Table		Page
1.	Nicaragua: Indicies of Production for Principal Agricultural Activities, 1960-71	6
2.	Nicaragua: Aggregate Indicies of Production, Percent Annual Increase For Principal Agricultural Activities	7
3.	Nicaragua: Indicies of Area for Principal Crops, 1960-71	10
4.	Nicaragua: Aggregate Indicies of Area, Percent Annual Increase for Principal Agricultural Crops, 1960-71	12
5.	Nicaragua: Percent Distribution of Land Area for Principal Crops, 1960-71	14
6.	Nicaragua: Indicies of Yields for Principal Crops, 1960-71	15
7.	Nicaragua: Aggregate Indicies of Yields, Percent Annual Increase for Principal Crops, 1960-71	17
8.	Nicaragua: Yields of Principal Crops, Nicaragua and Other Countries	19
9.	Nicaragua: Average Yields and Percent Change for Principal Crops by Country, 1948-52 and 1967-71	22
10.	Nicaragua: Indicies of Value of Production for Principal Agricultural Activities, 1960-71	25
11.	Nicaragua: Aggregate Indicies of Value of Production, Percent Annual Increase for Principal Agricultural Activities, 1960-71	27

Table | Page

12. Nicaragua: Indicies of Total Agricultural Production and Value of Production, 1960-71 30

13. Nicaragua: Aggregate Indicies of Planted Area, Yields, Crop, Livestock and Total Production, 1960-71. 32

Structure

14. Nicaragua: Distribution of Farm Numbers, Production, Yield and Area of Principal Crops and Animal Activities, 1963 and 1971. 39

15. Nicaragua: Average Production Per Producing Farm of Principal Crops, 1963 and 1971 42

16. Nicaragua: Average Number of Manzanas of Each Principal Crop Per Producing Farm, 1963 and 1971 and Average Head of Livestock Per Producing Farm, 1963 43

17. Nicaragua: Percentage of All Farms Producing Each Principal Crop or Livestock Activity, 1963 and 1971 44

18. Nicaragua: Percent of Total Planted Area and Percent of Total Agricultural Area Per Principal Crop, 1963 and 1971 45

19. Nicaragua: Number of Farms by Size Strata Producing Nine Principal Crops, 1971. 50

20. Nicaragua: Area in Nine Principal Crops by Farm Size Strata, 1971. 51

21. Nicaragua: Production of Nine Principal Crops by Farm Size Strata, 1971. 52

22. Nicaragua: Yields of Nine Principal Crops by Farm Size Strata, 1971 53

23. Nicaragua: Percentage of Farms Producing Each Principal Crop by Size Strata, 1971 55

Table | Page

24. Nicaragua: Percent of Total Production of Nine Principal Crops by Farm Size Strata, 1971 56

25. Nicaragua: Milk Production by Farm Size Strata, 1971 59

26. Nicaragua: Livestock Numbers and Pasture Area, Respective Percentages of Total and Head Per Manzana by Farm Size Strata, 1971. 60

27. Nicaragua: Distribution of National Production by Region and Activity, 1971. . . . 63

28. Nicaragua: Percent Distribution of National Production by Region and Activity, 1971 64

29. Nicaragua: Value of Production by Activity, 1963 and 1971. 67

30. Nicaragua: Percentage Distribution of Value of Production by Activity in Six Major Regions, 1971. 69

31. Nicaragua: Regional Distribution of National Value of Agricultural Production, Absolute and Percentage Changes 1963 to 1971 71

32. Nicaragua: Value of Production Per Farm and Manzana, Accumulated Percentages of Farm Numbers, Area and Production Values, 1971 73

33. Nicaragua: Average Value of Agricultural Production Per Capita, 1963 and 1971, by Region and Nation 76

34. Nicaragua: Distribution of Value of Agricultural Production by Rural Population Groups, 1971. 78

Factors of Production

35. Nicaragua: Number and Percent of Farms by Strata, Absolute and Percent Change, in Six Major Regions, 1963 and 1971. 85

Table | Page

36. Nicaragua: Average Size of Farms by Strata, Absolute and Percent Change in Six Major Regions, 1963 and 1971 . . 87

37. Nicaragua: Area in Farms (Mz), Percent of Total by Strata, Absolute and Percent Change in Six Major Regions, 1963 and 1971 88

38. Nicaragua: Number of Farms and Area by Region, 1963 and 1971 92

39. Nicaragua: Average Size of Farms, Percentage Change by Region, 1963 and 1971. 93

40. Nicaragua: Number of Farms by Strata and Region 1963 and 1971 95

41. Nicaragua: Percent Distribution of Farms by Strata and Region 1963 and 1971 96

42. Nicaragua: Percent Distribution of Farms by Size Strata for Six Major Regions 1963 and 1971. 97

43. Nicaragua: Average Size of Farms by Strata and Region 1963 and 1971. 98

44. Nicaragua: Area in Farms by Size Strata and Region 1963 and 1971 100

45. Nicaragua: Number of Farms and Accumulated Percent by Strata 1963 and 1971 102

46. Nicaragua: Area and Accumulated Percent by Strata, 1963 and 1971 103

47. Nicaragua: Coefficients of Concentration of Land Area, 1963 and 1971. . . 106

48. Nicaragua: Total Population and Population of Rural and Urban Sector by Region, 1971. . . 111

49. Nicaragua: Rural Population and Work Force, 1971 113

50. Nicaragua: Man Years Available and Utilized in Agriculture, by Region, 1971 . . . 114

Table | Page

51. Nicaragua: Rural Work Force 1963 and 1971 by Occupational Type 116

52. Nicaragua: Average Salaries Paid to Agricultural Laborers, by Regions, 1971. 117

53. Nicaragua: Average Mandays of Labor Utilized Per Manzana on Surveyed Farms, by Activity, 1971. 119

54. Nicaragua: Mandays Per Year for Principal Agricultural Activities by Region, 1971. 120

55. Nicaragua: Average Manyears of Rural Labor Utilized Per Farm by Farm Size Strata and Region, 1971. 121

56. Nicaragua: Average Manyears Utilized Per Manzana by Farm Size Strata and Region, 1971 122

57. Nicaragua: Value of Imports of Fertilizers, Insecticides, Seed and Agricultural Machinery, 1960-71. 130

58. Nicaragua: Imports of Agricultural Inputs, 1960-71. 132

59. Nicaragua: Percent of Agricultural Chemicals Consumed by Crop Activity, 1960-71. 133

60. Nicaragua: Domestic Consumption of Agrichemicals Per Manzana by Crop, 1960-71. 135

61. Nicaragua: Domestic Production of Improved Seed, 1965-71. 137

62. Nicaragua: Percent of Farms Using Agrichemicals by Farm Size, 1971 139

63. Nicaragua: Percent of Farms Using Agrichemicals by Region, 1971. 140

Table | Page

64. Nicaragua: Technology Levels, Purchased Inputs and Yields for Selected Crops, 1971 142

65. Nicaragua: Marginal Value Products of Labor and Average Wage Rates for Sample Corn and Bean Farms, 1971. 145

66. Nicaragua: Days of Labor Employed and Output Per Manday Under Three Technological Levels for Corn, Beans, Rice and Grain Sorghum, 1971. . . 147

Cost

67. Nicaragua: Number of Farms, Area, Production and Yields for Cotton by Farm Size and Region, 1971. 154

68. Nicaragua: Production Costs for Cotton by Region 156

69. Nicaragua: Production Costs for Cotton by Farm Size. 157

70. Nicaragua: Number of Farms, Area, Production and Yields for Sugarcane by Farm Size and Region, 1971. . . . 160

71. Nicaragua: Production Costs for Sugarcane by Farm Size 161

72. Nicaragua: Number of Farms, Area, Production and Yields for Coffee by Farm Size and Region, 1971 163

73. Nicaragua: Production Costs for Coffee by Region. 164

74. Nicaragua: Production Costs for Coffee by Farm Size 166

75. Nicaragua: Production Costs for Coffee by Levels of Technology. 167

76. Nicaragua: Number of Farms, Area, Production and Yields for Sesame by Farm Size and REgion, 1971 170

Table | Page

77. Nicaragua: Production Costs for Sesame by Region 171

78. Nicaragua: Production Costs for Sesame by Farm Size 174

79. Nicaragua: Production Costs for Sesame by Levels of Technology. 176

80. Nicaragua: Production Costs for Sesame by Levels of Ecology. 177

81. Nicaragua: Number of Farms, Area, Production and Yields for Tobacco by Farm Size and Region, 1971. 179

82. Nicaragua: Production Costs for Tobacco 180

83. Nicaragua: Number of Farms, Area, Production and Yields for Paddy Rice by Farm Size and Region, 1971 183

84. Nicaragua: Number of Farms, Area, Production and Yields for Upland Rice by Farm Size and Region, 1971 184

85. Nicaragua: Production Costs for Paddy Rice by Region and Size. 185

86. Nicaragua: Production Costs for Upland Rice by Region. 187

87. Nicaragua: Production Costs for Upland Rice by Farm Size 188

88. Nicaragua: Production Costs for Upland Rice by Levels of Technology 189

89. Nicaragua: Production Costs for Upland Rice by Levels of Ecology. 190

90. Nicaragua: Number of Farms, Area, Production and Yields for Corn by Farm Size and Region, 1971 192

91. Nicaragua: Production Costs for Corn by Region 194

92. Nicaragua: Production Costs for Corn by Farm Size. 196

Table | Page

93. Nicaragua: Production Costs for Corn by Levels of Technology 198

94. Nicaragua: Production Costs for Corn by Levels of Ecology 199

95. Nicaragua: Number of Farms, Area, Production and Yields for Beans by Farm Size and Region, 1971. 201

96. Nicaragua: Production Costs for Beans by Region. 203

97. Nicaragua: Production Costs for Beans by Farm Size 204

98. Nicaragua: Production Costs for Beans by Levels Of Technology 206

99. Nicaragua: Production Costs for Beans by Levels of Ecology 207

100. Nicaragua: Number of Farms, Area, Production and Yields for Grain Sorghum by Farm Size and Region, 1971. 209

101. Nicaragua: Production Costs for Grain Sorghum by Region. 210

102. Nicaragua: Production Cost for Grain Sorghum by Farm Size 212

103. Nicaragua: Production Costs for Grain Sorghum by Levels of Technology. 213

104. Nicaragua: Production Costs for Grain Sorghum by Levels of Ecology 214

105. Nicaragua: Cattle Population and Pasture Area by Farm Size and Region, 1971 216

106. Nicaragua: Milk Production by Farm Size and Region, 1971. 217

107. Nicaragua: Average Production Costs Per Head of Cattle 218

108. Nicaragua: Production Cost Per Head of Cattle by Type of Activity 220

INTRODUCTION

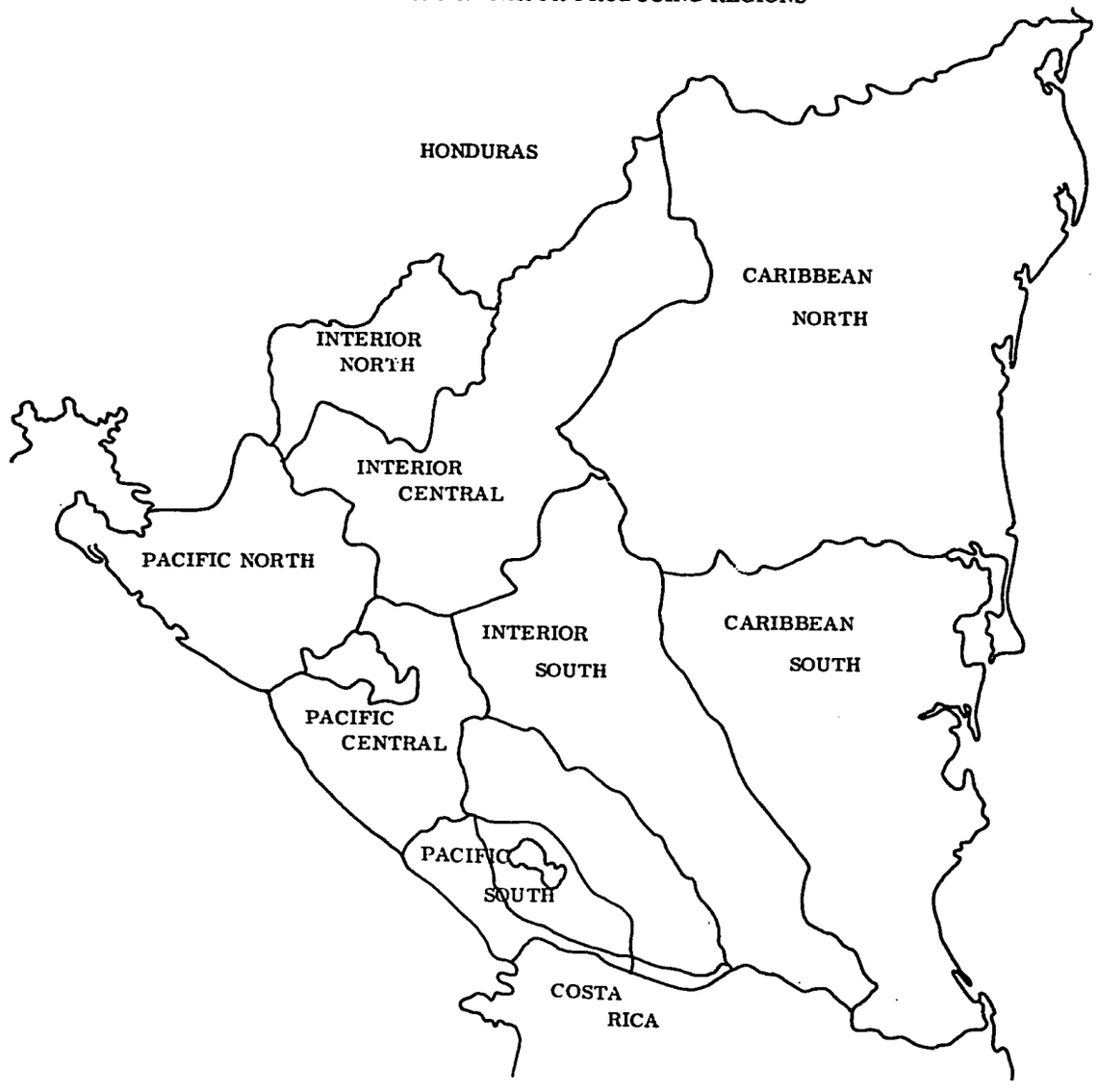
This study presents a benchmark descriptive analysis of agricultural production in Nicaragua. The purpose was to provide an analytical basis whereby priorities for general and specific agricultural policies could be established to further Nicaraguan developmental objectives in the agricultural sector.

The study was limited to an analysis of principal agricultural products in Nicaragua and included nine crops and two livestock activities. These activities were grouped into three classes of products: (1) basic grains including corn, beans, rice and grain sorghum; (2) export products including cotton, coffee, sugarcane, tobacco and sesame; and (3) livestock activities which included the beef and dairy enterprises. Together, these activities account for over 90 percent of the total value of production from the agricultural sector in 1971. The analysis was further limited to production from the six major regions (Figure 1) which lie in the western half of the country. The two eastern regions bodering the Caribbean were excluded from the study since both are economically unimportant in terms of national agricultural output.

Data were derived from three major sources: (1) the 1963 and 1971 National Agricultural Census, (2) the Central

MAP 1

NICARAGUA: MAJOR PRODUCING REGIONS



Bank of Nicaragua, and (3) the National Agricultural Survey conducted by the Sector Analysis Unit (UNASEC) in late 1972. Although data accuracy problems and source incompatibility resulted in a series of analytical difficulties, the information utilized in the study can be considered the best available. In those cases where data limitations were particularly great, a serious effort was made to obtain the knowledge of informed observers of the national agricultural scene. While it must be recognized that data limitations were indeed real, it is unlikely that major conclusions of the study would be substantially different had more and better data been available.

The study is organized into four major sections. The first section analyses changes in production that have taken place since 1960. The second section presents data on the structure and distribution of agricultural production and income. The third section analyzes the primary factors of production used in Nicaraguan agriculture and the fourth section presents the cost structure for the principal activities. Major implications of the findings are discussed at the end of each section and are briefly summarized in the final concluding statement at the end of the study.

I

TRENDS IN AGRICULTURAL PRODUCTION, AREA, YIELDS AND PRODUCTION VALUE

This section analyzes changes in major production measures from 1960 to 1971. Agricultural products are classified into three groups, i.e., basic food grains, export crops and livestock activities. The data source was the National Account statistics of the Central Bank. Although these data vary somewhat from census data utilized in following sections, this was the only source for an extended data series. The following analysis is organized into four major subsections by production, area, yield and production value. A brief discussion of the implications of the analysis for economic development completes the section.

TRENDS

Production

Between 1960 and 1971, aggregate agricultural production in Nicaragua more than doubled, expanding from an index of 90 in 1960 to 190 in 1971 (Table 1). The two major components of the agricultural sector--crop and livestock activities--had comparable growth rates from 1960 to 1971. Livestock output expanded from an index of 96 to 201 while the crop sector increased from an index of 86 to 185.

Analyzing output trends on a somewhat more valid basis, i.e., average production of three year periods of 1960-62, 1964-66, and 1969-71 indicates that the two components of the agric ultural sector had different growth rates between these aggregate three year periods (Table 2). Over the entire period the crop sector grew at an annual rate of 6.5 percent, a notably lesser rate than the 7.2 percent growth rate of the livestock sector. Data in Table 2 also indicate markedly different growth rates during the first and second parts of the entire period. All of the growth in crop output occurred during the first half of the period while livestock production continued to expand evenly throughout the entire period.

As of 1964-66, the aggregate crop output index had reached 177, the same as in 1966-71. During the first half of the period, crop output expanded at a very rapid rate of 15.3 percent annually due primarly to the rapid rise in

TABLE 1

NICARAGUA: INDICIES OF PRODUCTION FOR PRINCIPAL AGRICULTURAL ACTIVITIES, 1960-71*

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Total Crops	86	96	117	134	156	195	179	180	186	180	166	185
Export Crops	86	96	117	142	169	217	190	189	191	178	160	157
Cotton	73	85	142	184	237	316	281	292	261	237	175	201
Sugar Cane	93	100	107	115	128	133	104	105	149	173	194	212
Coffee	95	105	110	111	118	151	129	100	133	121	135	152
Sesame	118	105	76	93	60	74	82	108	86	93	95	86
Tobacco	95	100	105	110	124	148	167	239	348	262	320	363
Basic Grains	90	93	117	113	125	138	149	160	175	182	186	198
Corn	87	104	109	110	125	139	150	155	178	190	205	208
Beans	87	88	126	133	127	142	154	165	173	175	180	176
Sorghum	103	66	131	129	109	124	130	128	136	152	153	160
Rice	92	97	110	105	133	138	152	180	194	193	192	230
Livestock	96	100	104	113	117	124	137	142	157	172	190	201
Milk	99	99	102	107	109	122	124	127	139	156	170	189
Beef	87	102	110	127	129	123	143	150	171	193	226	229
Poultry	90	99	111	126	142	165	197	250	250	219	271	334
Pork	114	97	89	101	111	139	186	185	215	236	250	252
Eggs	96	100	104	109	113	117	122	127	132	137	143	149
Total Agriculture	90	96	112	126	142	170	164	167	175	176	175	190

*Laspeyres Index, 1960-62 = 100

Source: UNASEC. Cuentas Nacionales Banco Central De Nicaragua

TABLE 2

NICARAGUA: AGGREGATE INDICIES OF PRODUCTION, PERCENT ANNUAL INCREASE FOR PRINCIPAL AGRICULTURAL ACTIVITIES, 1960-71*

	1960-62	1964-66	1969-71	Percent Annual Increase 1960-62 1964-66	1964-66 1969-71	1960-62 1969-71
Total Crops	100	177	177	15.3	0	6.5
Export Crops	100	192	165	17.7	-9.7	5.7
Cotton	100	278	204	29.1	-6.0	8.2
Sugar Cane	100	122	193	5.1	9.6	7.6
Coffee	100	132	136	7.2	0.6	3.5
Sesame	100	72	91	-7.8	4.8	-1.0
Tobacco	100	146	315	9.9	16.6	13.6
Basic Grains	100	137	188	8.2	6.5	7.3
Corn	100	138	201	8.4	7.8	8.0
Beans	100	141	177	9.0	4.6	6.5
Sorghum	100	121	155	4.9	5.1	5.0
Rice	100	141	205	9.0	7.8	8.3
Livestock	100	126	187	5.9	8.2	7.2
Milk	100	118	172	4.2	7.8	6.2
Beef	100	132	216	7.2	10.3	8.9
Poultry	100	168	274	13.8	10.3	11.8
Pork	100	145	246	9.7	11.1	10.5
Eggs	100	121	143	4.9	3.4	4.0
Total Agriculture	100	158	180	12.1	2.6	6.7

*Laspeyres Index, 1960-62 = 100
Source: UNASEC. Cuentas Nacionales Banco Central De Nicaragua

export crop output which increased at an annual rate of 17.7 percent. During the same period (1960-62 to 1964-66) basic grain crop output grew at a lesser rate of 8.2 percent. However, during the latter half of the period, export crop output declined absolutely while production of the basic grain crops increased at an even lower rate than during the first half of the period. Thus, since 1964-66, the crop sector has stagnated while the livestock sector has become even more dynamic. During the first half of the period, livestock output grew by 5.9 percent annually compared to a 8.2 percent per year increase during the latter half of the period. The growth of the livestock sector is therefore responsible for all of the increase in total Nicaraguan agricultural output since 1964-66.

The production indicies for individual crop and livestock activities in Table 2 indicate the impact of cotton and to a lesser extent coffee on the aggregate crop index as well as the total agriculture output index. Other than these two crops, the production of all crops expanded at annual rates exceeding four percent. Particularly notable is the case of tobacco with a 16.6 percent annual rate of increase. Over the entire period, the total output of cotton, rice, and corn more than doubled, while tobacco production was more than three times greater than in the base period. Sesame had the poorest record with output falling to an index of 91 of the base period.

There was a rather marked difference in the rate of growth of individual crops when the first and second parts of the period are analyzed. The growth in output of cotton, rice, coffee, beans, and corn was considerably less in the second half of the period than during the first half. Sesame, sugar cane, grain sorghum and tobacco, however, showed increases in annual rates of output during the latter half of the entire period.

Annual growth in output of four of the five principal livestock activities exceeded six percent, with the exception of eggs which had a four percent annual increase. The output increases for beef and pork were greater during the second half of the period than during the first half while poultry and egg production declined during the latter half of the period. The rate of annual increase for milk production nearly doubled during the 1964-66 to 1969-71 period as compared to the 1960-62 to 1964-66 period. However, over the entire period, milk production increased annually by 6.2 percent versus 8.9 percent for beef, 10.5 percent for pork and 11.8 percent for poultry. These annual rates of increase are reflected in the respective 1969-71 output indicies of 216, 246, and 274 as compared to the base period.

Area

The expansion of cultivated area paralleled the rise in crop production (Table 3). From a base index of 100 in 1960-62, total planted area expanded rapidly until 1968

TABLE 3

NICARAGUA: INDICIES OF AREA FOR PRINCIPAL CROPS, 1960-71*

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Total Crops	97	95	106	110	114	126	135	139	146	148	146	144
Export Crops	98	95	107	118	127	141	145	153	150	144	132	122
Cotton	100	86	113	141	174	202	214	227	221	198	164	144
Sugar Cane	92	99	109	114	130	134	106	120	128	155	164	182
Coffee	94	101	105	109	102	107	110	111	111	108	106	103
Sesame	118	102	79	61	51	62	63	90	73	78	84	72
Tobacco	96	100	103	105	87	101	149	201	232	206	225	244
Basic Grains	96	96	108	105	106	129	130	131	144	152	158	160
Corn	94	97	107	104	119	129	145	146	168	179	190	191
Beans	96	92	112	104	104	113	127	136	142	144	142	149
Sorghum	102	95	103	105	78	90	101	95	98	104	106	105
Rice	94	97	108	102	97	102	104	105	107	107	114	114

*Simple Index, 1960-62 = 100

Source: UNASEC. Cuentas Nacionales Banco Central De Nicaragua

when it remained generally unchanged for four years. The peak year of the period was in 1968 representing a 48 percent increase over the base period.

Of the total increase in land area used for all crops, over three fourths (77 percent) of the increase was accounted for by the expansion of land devoted to the basic grain crops. Basic grain cropland increased 70 percent from the base years compared to a 22 percent increase for cropland devoted to export crops. It should be noted that land area in the basic food crops generally increased throughout the entire 1960-71 period while export cropland rose 53 percent by 1967 then decreased 25 percent by 1971.

Table 4 provides land area indicies for individual crops for the three different periods as well as average annual rates of change between periods. Changes in the indicies as well as average annual rates of change generally approximate those for production as shown in Table 2. This implies that a very high correlation exists between changes in planted area for each crop and changes in the production of the same crop. As can be observed, land area devoted to sesame and cotton declined in the same periods in which production declined. Conversely land area utilized for all other crops increased between periods as did production except for the case of sorghum. During the first half of the total period sorghum land area declined at an annual rate of 2.6 percent while production increased at an annual rate of 4.9 percent. Although the direction of change was identical

TABLE 4

NICARAGUA: AGGREGATE INDICIES OF AREA, PERCENT ANNUAL INCREASE FOR PRINCIPAL CROPS, 1960-71*

	1960-62	1964-66	1969-71	Percent Annual Increase 1960-62 1964-66	1964-66 1969-71	1960-62 1969-71
Total Crops	100	125	147	5.7	3.3	4.4
Export Crops	100	138	133	8.4	-0.7	3.2
Cotton	100	195	167	18.2	-3.1	5.9
Sugar Cane	100	123	167	5.3	6.3	5.9
Coffee	100	106	105	1.5	-0.2	0.5
Sesame	100	59	78	-12.3	5.7	-2.7
Tobacco	100	112	225	2.9	15.0	9.4
Basic Grains	100	122	157	5.1	5.2	5.1
Corn	100	131	187	7.0	7.4	7.2
Beans	100	115	145	3.5	4.7	4.2
Sorghum	100	90	105	-2.6	3.1	.5
Rice	100	101	112	0.2	2.1	1.3

*Laspeyres Index 1960-62 = 100

Source: UNASEC Cuentas Nacional Banco Central De Nicaragua

for all crops (except sorghum between 1960-62 and 1964-66) the average annual rate of change in land area in each case was lower. This implies that yields were increasing for all crops over the entire period.

Table 5 provides a data series on the land area distribution of each crop as a percentage of total land area devoted to all principal crops. There was a small but notable shift in the percentage of land devoted to the two crop groups over the 12 year period. Export crops declined from 42.2 percent to 36.0 percent between 1960 and 1971 due to a relative reduction in coffee acreage as well as a marked increase in the percentage of land devoted to corn, the basic grain crop that was, over the entire period, the single most important crop in terms of land area. Corn land area increased from 30.5 percent of the total land area to 41.4 percent. Cotton, the next most important crop in terms of land area use, showed little change when comparing 1960 with 1971, but during the years of 1964 through 1968, this crop was grown on an average of 24 percent of the country's cropland.

Yields

Aggregate crop yield indicies provide considerable insight into the rate of modernization for the agriculture sector. Aggregate crop yields in Nicaragua have increased from an index of 98 in 1960 to 119 in 1971 (Table 6). Based on the averages of the 1960-62 base period and the last three years in the series, yields increased by 17 percent or 1.8

TABLE 5

NICARAGUA: PERCENT DISTRIBUTION OF LAND AREA
FOR PRINCIPAL CROPS, 1960-71

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Export Crops	42.2	41.6	41.7	45.0	46.5	46.5	44.7	46.0	42.9	40.5	37.6	36.0
Cotton	15.8	13.8	16.3	19.7	23.4	24.5	24.3	25.0	23.1	20.6	17.1	15.3
Sesame	3.9	3.4	2.3	1.8	1.4	1.6	1.5	2.1	1.6	1.7	1.8	1.6
Sugar Cane	4.1	4.4	4.4	4.5	4.8	4.5	3.4	3.7	3.7	4.5	4.8	5.4
Coffee	18.3	19.9	18.6	18.9	16.8	16.1	15.4	15.0	14.3	13.5	13.7	13.5
Tobacco	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Basic Grains	57.8	58.4	58.3	55.0	53.5	53.2	55.3	54.0	57.1	59.5	62.4	64.0
Corn	30.5	31.8	31.4	29.6	32.3	31.6	33.4	32.7	35.9	37.9	40.4	41.4
Beans	9.4	9.2	9.9	8.9	8.6	8.6	8.9	9.2	9.2	9.3	9.2	9.6
Sorghum	12.9	12.2	11.8	11.8	8.3	8.8	9.1	8.3	8.2	8.6	8.9	8.9
Rice	5.0	5.2	5.2	4.7	4.3	4.2	3.9	3.8	3.8	3.7	3.9	4.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: UNASEC Cuentas Nacionales Banco Central De Nicaragua

TABLE 6

NICARAGUA: INDICIES OF YIELDS FOR PRINCIPAL CROPS, 1960-71*

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Total Crops	98	101	101	103	104	105	102	118	117	114	118	119
Export Crops	100	101	99	102	101	103	100	118	117	112	118	119
Cotton	74	100	127	131	138	158	132	130	119	120	108	141
Sugar Cane	100	100	98	100	99	99	98	118	116	111	118	117
Coffee	102	104	95	102	117	141	117	91	121	113	128	152
Sesame	101	103	96	153	125	120	130	121	121	121	113	121
Tobacco	99	99	102	104	137	139	120	119	153	128	143	146
Food Crops	90	107	104	105	113	114	111	116	117	119	118	116
Corn	91	108	101	106	105	107	104	106	105	106	107	108
Beans	92	96	112	112	125	128	124	124	125	125	125	120
Sorghum	90	96	114	109	126	122	155	120	123	131	128	133
Rice	98	100	102	102	136	135	146	172	180	181	169	135

*Laspeyres Index 1960-62 = 100

Source: UNASEC Cuentas Nacionales Banco Central De Nicaragua

percent per year. Observing the data in Table 7, it is evident that crop yields did not rise significantly until 1967 when the aggregate index rose from 102 in 1966 to 118 in 1967. After 1967, there was little change through the end of the period. Observing the indicies for both components of the crop sector indicate that the aggregate yields in 1971 compared to 1960 rose at similar rates. The yield indicies however are subject to certain limitations in that all crops are weighted proportionate to the relative importance in the respective volumes of production.

Export crop yields remained virtually unchanged until 1967 when the index rose from 102 in 1966 to 118 in 1967. This increase is explained by a sharp rise in sugarcane yields from 719.6 hundredweight in 1966 to 865.1 hundredweight in 1967 as shown in Central Bank data series.

Table 7 provides yield indicies and annual rates of changes during three periods for each principal crop. Although yields of all crops increased more than 1.6 percent per year between the base period and the average of last three years of the series, all crops except sugarcane had higher yield increases during the first half of the period. This implies that modernization of the nation's crop sector has not improved over time. In fact quite the opposite has occurred. Further, the slowing of yield rate increases is consistent with the lower rates of increase for both production and planted area (Tables 2 and 4). These facts provide an additional basis for

TABLE 7

NICARAGUA: AGGREGATE INDICIES OF YIELDS, PERCENT ANNUAL INCREASE FOR PRINCIPAL CROPS, 1960-71*

	1960-62	1964-66	1969-71	Percent Annual Increase 1960-62 1964-66	1964-66 1969-71	1960-62 1969-71
Total Crops	100	104	117	1.0	2.4	1.8
Export Crops	100	102	116	0.5	2.6	1.6
Cotton	100	143	123	9.4	-3.0	2.3
Sugar Cane	100	99	115	-0.3	3.0	1.6
Coffee	100	124	130	5.5	0.9	2.9
Sesame	100	125	118	5.7	-1.0	1.8
Tobacco	100	132	139	7.2	1.0	3.7
Food Crops	100	113	118	3.1	0.9	1.9
Corn	100	106	107	1.5	0.2	0.7
Beans	100	124	121	5.5	-0.5	2.1
Sorghum	100	121	131	4.9	1.6	3.0
Rice	100	139	161	8.6	3.0	5.4

*Laspeyres Index 1960-62 = 100

Source: UNASEC Cuentas Nacionales Banco Central De Nicaragua

the previous statement that Nicaragua's crop sector has stagnated during the last half of the 1960-71 period.

Over the entire period, yield increases for individual crops varied from a low of seven percent for corn to a high of 61 percent for rice. The average weighted yield increase for all crops as noted previously was 17 percent or 1.8 percent per year. While these figures are not necessarily unsatisfactory by international standards, they do imply that the rate of modernization of the crop sector has, by no means, been rapid. Further, significant yield increases occurred only in the case of rice with a somewhat more moderate increase for tobacco. Excluding these two crops from the aggregate yield index would result in a marked reduction in the index. This is of considerable concern since it implies that new technology has not been applied either evenly or consistently to the crop sector.

Table 8 shows yield data for Nicaraguan crops compared to other selected countries. These data were calculated on a basis of hundredweight per manzana. Only in the case of cotton and to a more limited extent, sugarcane, has technology reached a relatively high level. Cotton yields in Nicaragua rank second in Central America. However, cotton yields are 22 percent lower and sugarcane yields 15 percent lower than those in neighboring El Salvador. Yields of the other export crops in Nicaragua are significantly less than in other Central American countries. Coffee yields in Costa Rica are over 200 percent higher than Nicaraguan coffee yields, and

TABLE 8

NICARAGUA: YIELDS OF PRINCIPAL CROPS,
NICARAGUA AND OTHER COUNTRIES*

Tobacco		Sugar Cane		Sesame	
U.S.A.	35.8	U.S.A.	1447.0	El Salvador	18.4
Columbia	28.9	P. Rico	1094.0	Guatemala	15.7
Mexico	28.5	El Salvador	1065.0	Honduras	12.5
El Salvador	26.6	Mexico	956.0	Columbia	10.8
P. Rico	23.7	Nicaragua	919.0	Mexico	10.3
Nicaragua	20.5	R. Dominicana	872.0	Nicaragua	9.8
Brasil	.3	Guatemala	314.0	R. Dominicana	9.0
Honduras	9.0	Panama	807.0	Brasil	8.8
		Costa Rica	769.0	Costa Rica	8.8
		Columbia	767.0	U.S.A	8.8
		Brasil	706.0		
		Honduras	431.0		

Corn		Rice		Beans	
U.S.A.	78.6	U.S.A.	78.0	U.S.A.	21.4
R. Dominicana	26.5	El Salvador	55.8	El Salvador	18.8
El Salvador	25.6	Columbia	48.4	Costa Rica	14.1
Brasil	21.7	Mexico	39.4	R. Dominicana	13.7
Mexico	18.6	Nicaragua	38.9	Nicaragua	12.6
Columbia	18.1	R. Dominicana	38.7	Cuba	10.1
Guatemala	15.7	Cuba	36.3	Brasil	9.8
P. Rico	15.1	Costa Rica	31.4	Columbia	9.7
Costa Rica	14.1	Guatemala	26.1	P. Rico	9.2
Nicaragua	14.0	Honduras	25.2	Mexico	7.9
Honduras	14.0	Brasil	22.2	Honduras	7.7
Panama	13.4	Panama	20.7	Guatemala	5.9
Cuba	9.6			Panama	4.5

*Based on average 1969-71 yield in hundred weight per manzana

Source: 1971 Production Yearbook, FAO, Vol. 25

TABLE 8 (Continued)

NICARAGUA: YIELDS OF PRINCIPAL CROPS,
NICARAGUA AND OTHER COUNTRIES*

Cotton		Coffee		Grain Sorghum	
El Salvador	13.0	Costa Rica	18.9	U.S.A.	51.8
Nicaragua	10.6	El Salvador	14.7	Mexico	40.4
Guatemala	9.7	Guatemala	10.4	Columbia	35.7
Honduras	8.2	Brasil	9.0	Costa Rica	25.4
Columbia	7.9	Mexico	8.2	Honduras	23.1
R. Dominicana	7.7	Nicaragua	6.03	El Salvador	18.2
U.S.A.	7.6			Cuba	17.8
Costa Rica	6.2			Nicaragua	16.9
Cuba	4.5			Guatemala	15.1

*Based on average 1969-71 yield in hundred weight per manzana

Source: 1971 Production Yearbook. FAO, Vol. 25

sesame yields in El Salvador exceed those of Nicaragua by 87 percent. Tobacco yields in Nicaragua are also about 30 percent below those in El Salvador.

The data indicate that seed varieties and cultural practices are available in Central America to significantly increase the yields of basic grain crops. Corn yields in Nicaragua are 14 hundredweight per manzana compared to 25.6 hundredweight in El Salvador. Rice yields, while relatively high by Central American standards, appear to be somewhat overestimated. The rice yield data includes both paddy and upland rice. Paddy rice yields in Nicaragua are three times higher than yields of the upland varieties. Bean and grain sorghum yields have the potential to be increased by 50 percent in Nicaragua; however there has been less research in variety testing and development of these two crops in Central America.

A continuation of yield analysis offers further insight into the rate of modernization of Nicaraguan agriculture. Table 9 presents inter-county comparison of yield increases with other Latin American countries. These data are based on five year averages of 1948-52 and 1967-71.

Cotton yields, while relatively high, averaging 10.7 hundredweight over the 1967-71 period, increased at a lower rate than yields in Honduras, El Salvador and Guatemala. Between the two five year periods sesame yields registered an 11.5 percent increase while sesame yields in El Salvador increased 57 percent. The percentage change of tobacco yields in Nicaragua was also significantly less than the change in El Salvador.

TABLE 9

NICARAGUA: AVERAGE YIELDS AND PERCENT CHANGE
FOR PRINCIPAL CROPS BY COUNTRY,*
1945-57 and 1967-71

	COTTON			SESAME		
	1948 1952	1967 1971	Percent Change	1948 1952	1967 1971	Percent Change
Nicaragua	5.9	10.7	81.4	8.7	9.7	11.5
Costa Rica	-	4.7	-	12.1	8.2	-47.6
El Salvador	5.6	12.1	160.7	11.0	17.3	57.3
Guatemala	5.0	11.8	136.0	7.9	10.1	27.8
Honduras	4.3	9.5	209.3	10.8	12.3	13.9
Mexico	5.1	7.7	51.0	-	-	-
Peru	7.9	9.3	17.7	-	-	-
Columbia	3.1	8.3	167.7	-	-	-
Panama	-	-	-	-	-	-
Cuba	-	-	-	-	-	-
R. Dominician	-	-	-	-	-	-
Jamaica	-	-	-	-	-	-
P. Rico	-	-	-	-	-	-

	RICE			BEANS		
	1948 1952	1967 1971	Percent Change	1948 1952	1967 1971	Percent Change
Nicaragua	21.5	36.9	71.6	11.2	12.8	14.3
Costa Rica	22.0	35.8	62.7	6.3	11.3	79.4
El Salvador	26.2	51.1	95.0	12.6	15.3	21.4
Guatemala	18.3	26.9	47.0	4.7	5.9	25.5
Honduras	25.4	25.3	-0.4	7.3	7.3	0
Panama	20.6	20.0	-3.0	8.4	4.8	-75.0

*Average Yields Based on Hundred Weight Per Manzana

Source: Production Yearbook, FAO, Various Years.

TABLE 9 (CONTINUED)

NICARAGUA: AVERAGE YIELDS AND PERCENT CHANGE
FOR PRINCIPAL CROPS BY COUNTRY,*
1945-52 and 1967-71

	SUGAR CANE			TOBACCO		
	1948 1952	1967 1971	Percent Change	1948 1952	1967 1971	Percent Change
Nicaragua	621.0	867.0	39.6	10.4	19.9	91.3
Costa Rica	606.0	760.7	25.5	13.2	17.7	34.1
El Salvador	910.0	1039.0	14.2	10.0	25.7	157.0
Guatemala	538.0	816.0	40.0	9.1	18.5	103.3
Honduras	318.0	442.0	32.7	7.9	9.5	20.2
Mexico	795.0	949.0	19.4	15.5	26.0	67.7
Peru	-	-	-	-	-	-
Columbia	-	-	-	-	-	-
Panama	319.0	798.0	150.1	2.9	13.9	379.3
Cuba	-	-	-	9.6	12.7	32.3
R. Dominician	739.0	839.0	13.5	17.0	16.4	-3.7
Jamaica	900.0	1086.0	20.6	10.8	15.4	42.6
P. Rico	1052.0	1077.0	2.4	13.8	24.0	73.9

	CORN			GRAIN SORGHUM		
	1948 1952	1967 1971	Percent Change	1948 1952	1967 1971	Percent Change
Nicaragua	16.0	13.8	-15.9	22.0	16.7	-31.7
Costa Rica	20.4	19.5	-4.6	-	25.5	-
El Salvador	16.3	22.8	39.9	19.2	17.5	-9.7
Guatemala	12.6	15.2	20.6	9.4	13.1	39.4
Honduras	11.3	14.3	26.5	12.9	22.8	76.7
Panama	14.9	13.0	-14.6	-	-	-

*Average Yields Based on Hundred Weight Per Manzana

Source: Production Yearbook, FAO, Various Years.

The basic grain crop yields also increased at a lower rate than yields of the respective crops in neighboring countries. Rice yields in Nicaragua increased from 21.5 to 36.9 hundredweight for an increase of 71.6 percent over the entire period. However, rice yields in El Salvador increased 95 percent, from 26.2 to 51.1 hundredweight. Bean yields, while relatively high in the 1948-52 period, increased only 14.3 percent in 1966-71, compared to a 79.4 percent increase in Costa Rica. As shown by these data, corn and grain sorghum had an absolute decrease in yields by 15.9 and 31.7 percent respectively.

These percentage increases on an annual basis over the entire period would indicate that tobacco yields increased 3.4 percent annually, cotton 3 percent, rice 2.6 percent and sugar cane 1.7 percent, while the remaining crops increased at an annual rate of less than 1 percent and in the case of corn and sorghum, in fact, declined.

Judging from the preceeding data in Tables 8 and 9, it is evident that, while technology is available and tested in Central American agriculture to improve crop yields, efforts to increase yields at an acceptable rate in Nicaragua have been slow and in the case of some individual crops have apparently been virtually nonexistent.

Value of Production

From 1960 to 1971, the value of total agricultural production more than doubled from an index of 89 in 1960 to 194 in 1971 (Table 10). Looking at the index of the value of

TABLE 10

NICARAGUA: INDICIES OF VALUE OF PRODUCTION
FOR PRINCIPAL AGRICULTURAL ACTIVITIES,
1960-71*

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Total Agriculture	89	98	113	132	151	163	166	178	173	186	183	194
Export Crops	85	94	121	149	180	195	188	207	185	191	172	189
Cotton	72	86	141	183	235	303	280	288	233	234	175	199
Sesame	119	106	75	70	81	59	25	58	112	93	72	63
Sugar Cane	93	100	107	117	127	114	138	150	171	189	202	210
Coffee	94	100	106	124	139	106	108	138	135	145	161	172
Tobacco	76	79	146	128	201	216	306	660	1085	1100	1376	1524
Basic Grains	90	105	105	118	126	139	150	159	168	194	201	197
Rice	91	105	104	123	145	159	184	200	202	283	310	287
Corn	98	100	102	117	120	137	141	158	173	193	193	195
Beans	80	116	104	116	130	141	151	159	161	160	162	164
Sorghum	93	93	115	117	102	110	112	100	120	137	135	137
Total Crops	86	97	117	141	166	181	178	194	180	192	209	191
Livestock	95	100	105	113	118	127	140	143	159	173	189	201
Cattle	93	101	106	115	120	127	135	142	159	176	192	206
Swine	111	94	95	106	113	142	179	165	183	198	220	218
Poultry	95	100	105	109	115	118	137	136	140	143	125	163

*Laspeyres Index 1960-62 = 100

Source: UNASEC. Cuentas Nacionales Banco Central De Nicaragua

production for the three year averages of 1960-62, 1964-66, and 1969-71 in Table 11 indicates that the total value of production increased from an index of 100 in the base period to 188 in 1969-71. This was an annual increase of 7.3 percent over the entire period. The value of production for each component of the agricultural sector rose at a fairly consistent rate over the entire period. The basic grain crop sector registered an overall growth rate of 7.8 percent annually with the livestock sector and export sector growing at an annual rate of 7.3 percent and 7.0 percent respectively.

In the 1969-71 period, export crops accounted for 49.4 percent of the total value of production while food crops contributed 18.8 percent and livestock 31.8 percent. This percentage contribution varied only slightly from the 1960-62 period. However, during the 1964-66 period, export crops accounted for 51.9 percent of the total value of production and livestock and the basic grains contributed 25.4 and 15.5 percent respectively to the total production value.

Based on data in Table 11, each component of the agriculture sector had different growth rates between the two halves of the entire period. During the first half, the rate of increase for the total value of production equaled 12.5 percent, but declined to 3.3 percent during the latter part of the period. This decline was due to the absolute decrease in the value of export crops. The rate of growth in the value of the basic

TABLE 11

NICARAGUA: AGGREGATED INDICIES OF VALUE OF PRODUCTION, PERCENT ANNUAL INCREASE FOR PRINCIPAL AGRICULTURAL ACTIVITIES, 1960-71*

	1960-62	1964-66	1969-71	Percent Annual Increase 60-62/64-66	64-66/69-71	60-62/69-71
Total Agriculture	100	160	188	12.5	3.3	7.3
Export Crops	100	188	184	17.1	-0.4	7.0
Cotton	100	273	203	28.5	-6.1	8.2
Sesame	100	55	76	-16.1	6.7	-5.6
Sugar Cane	100	126	200	5.9	9.7	8.0
Coffee	100	118	159	4.2	6.1	5.3
Tobacco	100	241	1333	24.6	40.8	33.3
Basic Grains	100	138	197	8.3	7.4	7.8
Rice	100	163	293	13.0	12.4	12.7
Corn	100	133	194	7.4	7.8	7.6
Beans	100	141	162	9.0	2.8	5.5
Sorghum	100	108	136	0.2	4.7	3.5
Total Crops	100	175	197	15.0	2.4	7.8
Livestock	100	128	188	6.4	8.0	7.3
Cattle	100	127	191	6.2	8.5	7.5
Swine	100	145	212	9.7	7.9	8.7
Poultry	100	123	144	5.3	3.2	4.1

*Laspeyres Index 1960-62 = 100
Source: UNASEC. Cuentas Nacionales Banco Central De Nicaragua

grain crops slowed from 8.3 percent annually to 7.4 percent annually while the value of livestock production increased from a rate of 6.4 percent in the first half of the period to 8.0 percent in the latter half.

The absolute decline in the value of production in the export sector was caused by the decrease in the value of cotton production. Between the 1960-62 and 1964-66 periods the value of cotton production rose from an index of 100 to 273 for an annual rate of increase of 28.5 percent but declined in the second half of the period at a rate of 6.1 percent. For the individual crops, tobacco registered the highest rate of increase over the entire period, increasing from an index of 100 in the base period to 1,333 in 1969-71, for an annual rate of increase of 33.3 percent. With the exception of cotton, the value of export crops increased at a higher rate during the second half of the period than in the first half. Sesame, however, declined by 16.1 percent in the first half of the period.

The value of both rice and corn production increased at a fairly consistent rate over the entire period with an annual rate of increase of 12.7 and 7.6 percent respectively. The value of bean production decreased from a growth rate of 9.0 percent to 2.8 percent annually between the two periods and grain sorghum value increased 4.7 percent annually after a nominal 0.2 percent increase from 1960-62 to 1964-66.

The steady growth rate of the value of production in the livestock sector is indicated by the 7.5 percent annual increase in the value of cattle production. Swine, although the least important in terms of total value of livestock production, increased by 8.7 percent annually. The annual rate of increase in the value of production for both swine and poultry declined slightly between the first and second halves of the entire 1960-71 period.

The indicies of the value of production followed a pattern similar to the indicies of agricultural production (Table 12). Total agricultural production increased from an index of 90 to 190 or 111 percent while the value of production increased from an index of 89 to 194 during the same period for an increase of nearly 118 percent. Comparing data in Table 2 (Indicies of Production) and Table 10 (Indicies of the Value of Production) indicates that total production and the value of production had similar changes for each component of the agricultural sector as well as for the aggregate three year periods of 1960-62, 1964-66, and 1969-71.

Total agricultural production increased at an annual rate of 6.7 percent between 1960-62 and 1969-71 while the value of production increased by a slightly higher annual rate of 7.3 percent. Production and the value of production of basic grain crops increased at a comparable rate of 7.3 and 7.8 respectively. However, the value of export crops increased at a 1.3 percent higher annual rate than did total

TABLE 12

NICARAGUA: INDICIES OF TOTAL AGRICULTURAL PRODUCTION AND VALUE OF PRODUCTION, 1960-71*

	Production	Value of Production
1960	90	89
1961	96	98
1962	112	113
1963	126	132
1964	142	151
1965	170	163
1966	164	166
1967	167	178
1968	175	173
1969	176	186
1970	175	183
1971	190	194

*Laspeyres Index 1960-62 = 100

Source: UNASEC Cuentas Nacionales Banco Central De Nicaragua

production. During the 1964-66 to 1969-71 period, total export crop production decreased by 9.7 percent annual rate and total value of production declined by only 0.4 percent annually. Although total production of export crops declined, the value of export crops was maintained by the higher rate of increase in the value of production of tobacco and to some extent coffee. During the second half of the period tobacco production increased at a 16.6 percent annual rate while the value of production increased 40.8 percent annually. Coffee production increased by only 0.6 percent during this same period while the value of production increased 6.1 percent annually.

Implications for Development Strategy

The preceeding section discussed individually four major data series related to agricultural production: (1) physical production, (2) planted land area, (3) crop yields and (4) value of production. This section very briefly analyses the inter-relationships between the first three series and denotes the implications of these interrelationships.

Table 13 presents aggregate indices for planted area, yields, and crop, livestock and total production for the 12 year period of 1960-1972. Although these aggregate indices have obvious limitations as precise indicators for analysis, they provide insights that are both useful and valid for the general analysis discussed in this section.

TABLE 13

NICARAGUA: AGGREGATE INDICIES OF PLANTED AREA, YIELDS, CROP, LIVESTOCK AND TOTAL PRODUCTION, 1960-1971*

	Area	Yield	Crop Production	Livestock Production	Total Production
1960	97	98	86	96	90
1961	95	101	96	100	96
1962	107	100	117	104	112
1963	110	103	134	113	126
1964	114	104	156	117	142
1965	126	105	195	124	170
1966	135	102	179	137	164
1967	139	118	180	142	167
1968	146	117	186	157	175
1969	148	114	180	172	176
1970	146	118	166	190	175
1971	144	119	185	201	190

*Laspeyres Index, 1960-62 = 100

Source: UNASEC. Cuentas Nacionales Banco Central De Nicaragua

As noted in the previous sections, the respective percentage increases over the 1960-62 to 1969-71 period in the five series shown in Table 13 were: area 4.4 percent, yield 1.8 percent; crop production 6.5 percent; livestock production 7.2 percent; and total production 6.7 percent. On the surface, the increase over the period of the three production indices appears to be quite satisfactory. By international standards the increases must, in fact, be considered relatively satisfactory. However, considering the other two aggregate indices--planted area and yield in conjunction with the production indices, the picture is much less satisfactory when viewed from the standpoint of the rate of modernization of Nicaraguan agriculture during the 1960-71 period.

Since 1965, the crop sector has stagnated. Total agricultural production has risen since 1965 only because the livestock sector has been highly dynamic. From 1961 to 1965, the output of the crop sector expanded sharply because planted area increased rapidly. Yield, however, also increased at a rapid rate during this period except for sugar cane. After 1965, the rate of increase in both area and yield (again excepting sugar cane) declined. The net result was a stagnation of the output from the crop sector. Throughout the entire 1960 to 1971 period, however, the increase or decrease in total planted area was the predominant influence on total crop production. In fact, approximately 85 percent of the

total variance in crop output can be explained by changes in planted area alone. This directly implies that over the past twelve years, the change in planted area was the overwhelming factor explaining changes in total crop production. This is of considerable concern because:

1. Agriculture which is undergoing modernization becomes increasingly less dependent on increases in planted area to bring about increases in total production. Although changes in production are related to changes in planted area, increases in crop yields become an increasingly more important influence on total production in agriculture undergoing modernization.
2. Total crop production in modern agriculture typically does not decline with small declines in planted area. Instead, production typically remains relatively unchanged because producers tend to produce crops on their better land and apply relatively more inputs to the smaller area.
3. Although considerable variation may occur in individual crops, the rate of change in aggregate yields typically increases rather substantially over time in agriculture undergoing modernization.

These three points are never universally true nor are they by any means comprehensive indicators of agricultural

modernization. However, all three are certainly important factors and significant measures of whether or not the crop sector of a given agricultural economy is undergoing modernization.

In general terms, not one of these three factors has been true for Nicaraguan agriculture between 1960 and 1971. First, the nation's crop output has become more, not less, dependent on changes in planted area in order to bring about changes in total production. Second, production has remained constant since 1965 instead of increasing as planted area rose. Third, the rate of increase in yields has generally fallen, not increased, over the 1960-71 period. In sum, the Nicaraguan crop sector has not modernized over time. Rather it appears that precisely the opposite has occurred; the rate of modernization has slowed with the obvious attendant impact on production.

Agricultural modernization is a complex process. However, research during the past few years has shown that of all the factors influencing the rate of modernization--one factor is key to the process. This is in order to modernize, agriculture requires a continuous flow of new technology and knowledge in the form of higher yielding and disease resistant plants, plus fertilizers and soil correctives, herbicides, pesticides and other chemicals, improved managerial and production techniques and et cetera. New technology is derived from research, both basic and applied. Research, in turn, requires public and private investment. Investments in agricultural research

have, in the past, yielded higher returns to both the public and private sectors than have any other types of investment in the agricultural sector. Rates of return exceeding 100 percent per year are not uncommon and many examples can be cited of such returns throught the world's agriculture.

Nicaraguan agriculture needs significantly larger inputs of new technology if it is to modernize. This new technology must be profitable and it must be adapted to local conditions. Although considerable new technology can be imported, and in fact has been, the need for local adaptive research cannot be minimized. Much of the imported technology is neither profitable or feasible for producers unless it is first adapted to local conditions.

Over the future, increases in Nicaraguan crop production will be largely dependent upon increases in planted area unless significantly larger amounts of new technology are injected into the agricultural sector. Livestock, especially beef production increases will also to a great extent depend upon increased land use for pastures. This suggests that a developmental strategy for increased agricultural production must take into account the trade-offs between a more intensified technologically-based agriculture and a land extensive agriculture.

II

STRUCTURE OF AGRICULTURAL PRODUCTION AND INCOME

This section is concerned with an analysis of the structure and distribution of production and income of Nicaraguan agriculture. The production analysis is broken into three parts, production by farm number, farm size, and region. The second part of this section deals with the value of agricultural production by activity, by farm size and number as well as estimates of per capita production value by different classifications of the rural population. A concluding discussion briefly sets out the developmental implications of the structural distribution of production and income.

II. STRUCTURE

Agricultural Production by Farm Numbers

Relatively detailed data on agricultural production by farm numbers were available for nine different crops for the census years of 1963 and 1971. Together, these nine crops accounted for an estimated 90 percent of the total value of production from the crop sector in 1971. Data for the livestock sector were more limited. Although production information for cattle, swine and poultry were available for both census years, there was no census information on dairy output nor on numbers of farms that produced livestock in 1971.

Before opening discussion on the distribution of agricultural production by farm numbers, it should be noted that some data presented in this section may differ from that in preceeding sections. In the former case the Central Bank was the data source while in this section, most of the data were derived from the two agricultural census' of 1963 and 1971.

Table 14 presents data for 1963 and 1971 on the number of farms producing each of the nine principal crops and the production, area, and yield of these farms. Total production for livestock activities are also shown for 1963 and 1971 although data on the number of farms engaged in livestock production are presented only for 1963.

The total number of farms producing export crops changed only slightly from 1963 to 1971 although the number

TABLE 14

NICARAGUA: DISTRIBUTION OF FARM NUMBERS, PRODUCTION, YIELD, AND AREA OF PRINCIPAL CROPS AND ANIMAL ACTIVITIES, 1963 AND 1971

	Farm Numbers			Production QQ		
	1963	1971	% Δ	1963	1971	% Δ
Export Crops						
Cotton	3,676	2,888	-21.4	1,496,463	1,736,523	16.4
Sugarcane	4,616	3,883	-15.8	20,223,360	39,695,800	96.2
Coffee	15,793	17,483	10.7	604,506	711,700	50.8
Sesame	2,799	3,168	13.1	72,656	146,052	100.1
Tobacco	225	340	51.0	13,058	58,789	350.2
Food Crops						
Corn	77,727	80,601	3.7	3,260,493	4,258,352	30.6
Beans	37,094	38,381	3.5	522,282	590,370	13.0
Sorghum	27,527	15,522	-43.6	804,589	744,601	7.4
Rice	11,155	6,165	-44.7	504,238	806,150	59.8
Animal Activities						
Beef	50,327	--	--	1,251,763	2,148,600	71.6
Swine	79,873	--	--	422,598	648,400	53.4
Poultry	102,814	--	--	2,253,091	3,076,000	36.5

Source: Censo Nacionales Agropecuaries 1963, 1971

TABLE 14 (CONTINUED)

NICARAGUA: DISTRIBUTION OF FARM NUMBERS, PRODUCTION, YIELD, AND AREA OF PRINCIPAL CROPS AND ANIMAL ACTIVITIES, 1963 AND 1971

	Yield: QQ/Mz.			Area En Mz.		
	1963	1971	%	1963	1971	%
Export Crops						
Cotton	10.9	12.7	16.5	137,151	136,286	-.64
Sugarcane	701.0	857.5	22.3	28,827	46,294	60.6
Coffee	4.5	6.0	33.3	135,509	150,027	10.7
Sesame	7.5	10.4	38.6	9,706	14,000	44.0
Tobacco	18.1	22.8	20.6	689	2,578	274.0
Food Crops						
Corn	13.0	15.0	15.3	247,260	281,612	13.9
Beans	9.0	8.2	-8.9	57,090	72,395	26.8
Sorghum	17.0	14.4	-15.2	46,921	54,623	10.0
Rice	18.5	21.0	13.5	27,213	38,634	42.0
Animal Activities						
Beef	.49	.80	63.2	--	--	--
Swine	--	--	--	--	--	--
Poultry	--	--	--	--	--	--

Source: Censo Nacionales Agropecuaries 1963, 1971

of farms producing each crop changed considerably. For cotton and sugar cane, the number of producers fell by 21.4 and 15.8 percent respectively, while the number of producers growing coffee, sesame and tobacco increased respectively by 11, 13 and 51 percent. Some care must be taken in interpreting the data for sugar cane and coffee. In both cases, a large number of farmers produce not for the export market but for on-farm consumption. Sugar cane is widely grown for animal forage and/or panela (crude sugar). Too, many farms grow a few coffee trees for direct home consumption of coffee.

For each of the export products, total production, yield and area expanded with the exception of a small decline in cotton acreage. Overall, this resulted in average per farm production increases ranging from 48 percent in the case of cotton to nearly 200 percent in the case of tobacco (Table 15). The increase in average per farm production was due both to yield increases as well as the expansion in area (Table 16.) In general, between half and three-fourths of the per farm change in production can be explained by area expansion with the exception of coffee. For this crop, although the number of producing farms increased by nearly 11 percent, average production per farm expanded due to yield increases alone.

Of all farms in Nicaragua, the change in the percentage of those producing export crops varied only slightly from 1963 to 1971 (Table 17). Likewise as Table 18 indicates,

TABLE 15

NICARAGUA: AVERAGE PRODUCTION PER PRODUCING FARM OF PRINCIPAL CROPS, 1963, 1971

Crop	Average Production Per Producing Farm 1963	1971	% Δ 1963 - 1971
Export Crops			
Cotton	407.1	601.3	47.7
Sugarcane	4,381.1	10,223.0	133.3
Coffee	38.3	52.1	36.0
Sesame	26.0	46.1	77.3
Tobacco	58.0	172.9	198.1
Food Crops			
Corn	41.9	52.8	26.0
Beans	14.1	15.4	9.2
Sorghum	29.2	48.0	64.4
Rice	45.2	130.8	189.4

Source: Censo Nacionales Agropecuaries 1963, 1971

TABLE 16

NICARAGUA: AVERAGE NUMBER OF MANZANAS OF EACH PRINCIPAL CROP PER PRODUCING FARM, 1963 AND 1971, AND AVERAGE HEAD OF LIVESTOCK PER PRODUCING FARM, 1963

Activity	Av. No. Mz/Hd. Per Producing Farm		% Δ 1963 - 1971
	1963	1971	
Export Products			
Cotton	37.3	47.2	26.5
Sugarcane	6.3	11.9	90.7
Coffee	8.6	8.6	0.0
Sesame	3.5	4.4	27.4
Tobacco	3.1	7.6	147.7
Food Crops			
Corn	3.2	3.5	9.7
Beans	1.5	1.9	22.7
Sorghum	1.7	3.3	95.9
Rice	2.4	6.3	157.0
Animal Activities			
Beef	24.9	--	--
Swine	5.3	--	--
Poultry	21.9	--	--

Source: Censo Nacionales Agropecuaries 1963, 1971.

TABLE 17

NICARAGUA: PERCENTAGE OF ALL FARMS PRODUCING EACH PRINCIPAL CROP OR LIVESTOCK ACTIVITY, 1963 AND 1971

Activity	1963	1971
Export Crops		
Cotton	3.6	2.8
Sugarcane	4.5	3.7
Coffee	15.4	16.8
Sesame	2.7	3.0
Tobacco	.2	.3
Food Crops		
Corn	76.0	77.4
Beans	36.3	36.9
Sorghum	26.9	14.9
Rice	10.9	5.9
Livestock Activities		
Beef	49.2	--
Swine	78.1	--
Poultry	100.0	--

Source: Censo Nacionales Agropecuaries 1963, 1971.

TABLE 18

NICARAGUA: PERCENT OF TOTAL PLANTED AREA* AND PERCENT OF TOTAL AGRICULTURAL AREA, PER PRINCIPAL CROP, 1963 AND 1971

Crop	Percent of Planted Area		Percent of Agri. Area	
Export Crops	1963	1971	1963	1971
Cotton	19.9	17.2	2.50	1.90
Sugarcane	4.2	5.8	.53	.65
Coffee	19.6	18.9	2.50	2.10
Sesame	1.4	1.8	.18	.20
Tobacco	.1	.3	.01	.03
Food Crops				
Corn	35.8	35.5	4.50	3.97
Beans	8.3	9.1	1.00	1.02
Sorghum	6.8	6.5	.86	.73
Rice	3.9	4.9	.50	.54

* Planted Area = Sum of planted area of all principal crops.

Source: Censo Nacionales Agropecuaries 1963, 1971.

there was relatively little change in the percentage of planted or total agricultural area occupied by each of the export crops. Coffee, in 1971 occupied more land area than did cotton. In fact, there has been an absolute and percentage (of total and planted area) decline in the area devoted to cotton versus nearly an 11 percent increase in total coffee area between 1963 and 1971.

Over five times the number of farms produced basic grain crops in 1971 as did export crops. Data indicate, however, that 8.4 percent fewer farms produced basic grains in 1971 than in 1963. This was due to the sharp decline in the number of farms that produced sorghum and rice. Farms producing corn and beans increased, but only by 3.7 and 3.5 percent respectively.

Of all farms in Nicaragua, over three fourths produced corn in 1971. This crop occupied nearly twice as much land area as did the second ranking crop (coffee) as well as 35.5 percent of the total planted land (Tables 17 and 18). Between the two census years, corn output grew due to near equal increases in both area and yield. Together these two factors accounted for the 30.6 percent increase in total corn production.

The case of beans, a major food crop in the country, has been considerably less optimistic. Although production

increased by 13 percent between the two census years, this was the result of a 27 percent increase in area. Yields declined by nearly 9 percent (Table 14). As of 1971, beans were grown on 37 percent of the nation's farms and occupied 9.1 percent of the total planted area.

The number of farms producing sorghum and rice declined sharply between 1963 and 1971. Census data indicate a 15 percent decline in sorghum yields which is at very considerable variance with Central Bank data. Informed agriculturalists believe that the census data must be subject to some question, given that sorghum is often produced under relatively higher levels of technology than other basic grain crops.

Although the basic data presented in Table 14 may be subject to certain errors, it does provide some general insights into the nature of the structure of agricultural production in the country and the relative changes that have taken place between the two census years. Data in Tables 15 and 16 are particularly of interest. As can be noted, the average farm producing export crops in 1971 had a considerably larger per crop acreage than did the average farm producing basic grain crops. In 1971, farms producing basic grains planted an average of 3.2 manzanas versus 12.6 manzanas for the average farm producing export crops.

In terms of production, no direct comparisons can be made between farms producing for export and those producing for internal consumption. However, it is obvious that the gross value of production per manzana for farms producing export crops is markedly greater than that for basic grain producing farms. Even at present high price levels for basic grains, the average farm producing corn derives less than C$2,000 of gross income from this crop. For beans and sorghum, the situation is even less favorable.

Although average per farm acreage and production for farms producing export crops and farms producing basic grains has increased, the higher proportional increase has obviously taken place on the former group of farms. This implies that in terms of total crop output, basic grain producers were relatively worse off in 1971 as compared to 1963.

Many farms, of course, produce both export and basic grain crops as well as livestock. Hence, it is not valid to conclude that all farms can be neatly divided into two groups. However, the 1971 census data indicate that in broad terms, a relatively small proportion of all farms commercially produce export crops. Since beef production tends to be concentrated on large farm units, the evidence is very strong that a high proportion of all farms produce only for the internal market. Coupled with the farm number--land area data presented in a later section, average production and gross value of production for those farms is very low, lower in fact than the averages shown in Table 15.

What these data indicate is a dual economy within the agricultural sector. On the one hand, a relatively small proportion of all producers are oriented to the export market, operate relatively large units and produce their product (with the exception of coffee) under relatively high technology levels. On the other hand, a very high proportion of all producers produce for the domestic market on very small units utilizing very low technology levels.

Agricultural Production by Farm Size

The 1971 Agricultural Census provided data on production by farm size for nine principal crops. Similar data were available for milk and cattle numbers although other livestock production by farm size could not be determined from census information. This section briefly analyses available data, giving emphasis to the crop sector of the agricultural economy.

Crop Production by Farm Size

Tables 19 through 22 provide basic data on numbers of farms, area, production and yields by farm size strata for the nine principal crops (ten activities including both dryland and paddy rice). It should be noted that these data may vary somewhat from those presented elsewhere in this report. These differences are due to two reasons: (1) all annual crop data are for the first planting, while other tables reflect aggregates of both first and second

TABLE 19

NICARAGUA: NUMBER OF FARMS BY SIZE STRATA
PRODUCING NINE PRINCIPAL CROPS, 1971

Farm Size Strata / Crop	Export Crops					Basic Grains				
	Cotton	Sugar Cane	Coffee	Sesame	Tobacco	Corn	Beans	Grain Sorghum	Dryland Rice	Irrig. Rice
<1	22	41	3314	13	2	841	248	125	95	--
1 - 5	341	280	9663	1200	90	15672	4882	3612	1304	60
5 - 10	427	247	2053	710	73	8166	2793	1906	693	34
10 - 20	500	361	1188	159	36	9143	3140	2213	793	51
20 - 50	534	984	848	171	53	13121	4858	2813	1151	77
50 - 100	342	929	388	73	19	8316	3109	1350	932	41
100 - 200	296	562	213	--	11	3964	1437	545	463	34
200 - 500	278	302	72	29	14	1885	672	286	109	37
500 - 1000	94	68	4	--	8	456	128	83	60	21
1000 - 2500	44	44	1	--	--	191	41	25	18	12
> 2500	10	18	--	--	--	61	10	22	8	6
Total	2888	3836	17744	2355	306	61816	21318	12980	5707	373

Source: Censo Nacional Agropecuario, 1971

TABLE 20

NICARAGUA: AREA IN NINE PRINCIPAL CROPS
BY FARM SIZE STRATA, 1971
(EXPRESSED IN MANZANAS)

	Export Crops					Basic Grains				
	Cotton	Sugar Cane	Coffee	Sesame	Tobacco	Corn	Beans	Grain Sorghum	Dryland Rice	Irrigated Rice
<1	22	17	2,354	3	3	227	67	35	25	---
1 - 5	631	194	19,716	2928	147	26,338	6,415	4,343	1,621	90
5 - 10	1,492	252	12,873	2821	143	18,032	41,189	3,120	1,321	60
10 - 20	3,317	385	14,996	149	91	25,286	5,899	4,062	1,699	127
20 - 50	6,444	1,513	24,413	1778	333	41,241	8,708	5,943	2,769	294
50 - 100	10,106	2,211	25,467	748	456	40,709	10,497	4,387	2,419	140
100 - 200	19,556	2,683	26,751	--	244	33,135	4,807	4,080	3,313	509
200 - 500	44,917	4,413	19,237	1134	69	27,621	3,006	4,861	3,444	1,054
500 - 1000	25,283	2,935	2,846	--	116	11,353	549	3,398	590	2,637
1000 - 2500	16,042	7,595	1,374	--	--	7,031	54[illegible]	3,011	1,621	1,653
> 2500	8,476	24,120	---	--	--	5,374	91	1,896	1,211	4,857
Total	136,286	46,318	150,027	9561	1602	236,347	44,802	39,136	19,033	11,421

Source: Censo Nacional Agropecuario, 1971.

TABLE 21

NICARAGUA: PRODUCTION OF NINE PRINCIPAL CROPS
BY FARM SIZE STRATA, 1971
(EXPRESSED IN HUNDREDWEIGHT)

	Export Crops					Basic Grains				
	Cotton	Sugar Cane	Coffee	Sesame	Tobacco	Corn	Beans	Grain Sorghum	Dryland Rice	Irrigated Rice
<1	169	12,568	2,354	22	42	3,007	441	502	281	
1 - 5	3,902	91,773	19,716	24,384	2,907	237,820	45,481	53,712	15,440	1,302
5 - 10	11,679	133,856	12,873	27,520	2,966	256,007	33,083	39,220	12,690	754
10 - 20	24,755	187,331	14,996	1,462	2,312	319,393	46,831	53,838	16,886	2,033
20 - 50	51,970	919,788	24,413	20,761	12,655	532,787	67,617	76,496	26,684	3,594
50 - 100	77,648	1,296,232	25,467	8,553	11,744	637,280	76,765	52,663	26,136	1,290
100 - 200	227,064	2,007,932	26,751	---	6,672	501,221	32,847	52,702	27,593	27,528
200 - 500	602,777	3,746,290	19,237	20,837	2,747	535,816	23,102	58,217	26,531	27,174
500 - 1000	307,010	2,650,647	2,846	---	3,355	163,531	4,374	38,262	6,243	79,115
1000 - 2500	246,456	6,389,118	1,374	---	---	122,527	4,456	46,948	24,019	37,432
> 2500	183,093	21,528,815	---	---	---	139,762	763	25,294	9,539	160,332
Total	1,736,523	38,964,450	927,935	103,539	45,400	3,539,151	335,760	497,854	192,094	340,554

Source: Censo Nacional Agropecuario, 1971.

TABLE 22

NICARAGUA: YIELDS OF NINE PRINCIPAL CROPS
BY FARM SIZE, STRATA, 1971

	Export Crops					Basic Grains				
	Cotton	Sugar Cane	Coffee	Sesame	Tobacco	Corn	Beans	Grain Sorghum	Dryland Rice	Irrigated Rice
<1	7.7	939.3	5.3	7.3	14.0	13.3	6.6	14.3	11.2	--
1 - 5	6.1	473.0	5.1	8.3	19.8	12.5	7.1	12.4	9.5	14.5
5 - 10	7.8	531.2	6.8	9.8	20.7	14.2	7.9	12.6	9.6	12.6
10 - 20	7.4	486.6	7.8	9.8	25.4	12.6	7.9	13.3	9.9	16.0
20 - 50	8.0	607.9	6.8	11.7	38.0	12.9	7.8	12.9	9.6	12.2
50 - 100	7.6	586.3	6.5	11.4	25.8	15.6	7.3	12.0	10.8	9.2
100 - 200	11.6	748.4	6.5	--	27.3	15.1	6.8	12.9	11.9	54.1
200 - 500	13.4	848.9	5.4	18.4	39.8	19.4	7.9	12.0	7.7	25.8
500 - 1000	12.1	903.1	4.1	--	28.9	14.4	8.0	11.3	10.6	30.0
1000 - 2500	15.3	841.2	9.2	--	--	17.4	7.8	15.6	14.8	22.6
> 2500	21.6	892.6	--	--	--	26.0	8.4	13.3	7.9	33.0
National Average	12.7	841.2	6.2	10.8	28.3	15.0	7.5	12.7	10.0	29.8

Source: Censo Nacional Agropecuario, 1971.

plantings, and (2) the disaggregation of crop data required that subjective criteria be applied due to the methodology employed in compiling census information. It should also be emphasized that these data are recognized as being "best estimates" of the production structure by farm size rather than direct census data.*

In terms of general relationships that can be derived from data in Tables 19 through 24, three relationships stand out rather clearly. First, the bulk of 1971 export crop production was produced on a relatively small number of medium to large size farms. Second, the bulk of basic grain production was derived from a relatively large number of small to medium size farms. Third, yields tended to be higher on larger farms. Although there were exceptions to these relationships, in general they characterized the structure of Nicaraguan agricultural crop production.

Turning to a crop by crop analysis, the respective examples of sugarcane and corn sharply illustrate the above noted relationships. In the case of sugarcane, nearly 90 percent of total national production was derived from some 426 farms greater than 200 manzanas. These farms represented

---

*The 1971 Nicaraguan Agricultural Census utilized conceptual methodology developed by FAO. This methodology resulted in the collection of information by the number of crop activities by size of planted area, rather than by farm size. For example, the census output provided the total number of fields of corn by size, however it was not possible to directly determine whether one manzana corn fields were located on farms of one manzana, 100 or 2,500 manzanas. To locate each field of each crop on its respective farm required extensive data processing which in turn required that subjective criteria be applied at certain steps in the processing.

TABLE 23

NICARAGUA: PERCENTAGE OF FARMS PRODUCING EACH PRINCIPAL CROP BY SIZE STRATA, 1971

	Export Crops					Basic Grains				
	Cotton	Sugar Cane	Coffee	Sesame	Tobacco	Corn	Beans	Sorghum	Dryland Rice	Irrigated Rice
<1	.76	1.07	18.68	.55	.65	1.36	1.16	1.19	1.66	--
1 - 5	11.81	7.30	54.46	50.96	29.41	25.35	22.90	27.83	22.85	16.09
5 - 10	14.79	6.44	11.57	30.15	23.86	13.21	13.10	14.68	12.14	9.12
10 - 20	17.31	9.41	6.70	6.75	11.76	14.79	14.73	17.05	13.90	13.40
20 - 50	18.49	25.65	4.78	7.26	17.32	21.23	22.79	21.67	20.17	20.64
50 - 100	11.84	24.22	2.19	3.10	6.21	13.45	14.58	10.40	16.33	10.99
100 - 200	10.25	14.65	1.20	--	3.59	6.41	6.74	4.20	8.11	9.12
200 - 500	9.63	7.87	.41	1.23	4.58	3.05	3.15	2.97	3.33	9.92
500 - 1000	3.25	1.77	.02	--	2.61	.74	.60	.64	1.05	5.63
1000 - 2500	1.52	1.15	.01	--	--	.31	.19	.19	.32	3.22
> 2500	.35	.47	--	--	--	.10	.05	.17	.14	1.61

Source: Censo Nacional Agropecuario, 1971.

TABLE 24

NICARAGUA: PERCENTAGE OF TOTAL PRODUCTION OF NINE PRINCIPAL CROPS BY FARM SIZE STRATA, 1971

	Export Crops					Basic Grains				
	Cotton	Sugar Cane	Coffee	Sesame	Tobacco	Corn	Beans	Sorghum	Dryland Rice	Irrigated Rice
1	.01	.03	1.35	.02	.09	.08	.13	.10	.15	--
1 - 5	.22	.24	10.87	23.55	6.40	9.26	13.55	10.79	8.04	.38
5 - 10	.67	.34	9.38	26.58	6.53	7.23	9.85	7.88	6.61	.22
10 - 20	1.43	.48	12.64	1.41	5.09	9.02	13.95	10.81	8.79	.60
20 - 50	2.99	2.36	17.95	20.05	27.87	15.05	20.14	15.37	13.89	1.06
50 - 100	4.47	3.33	17.88	8.26	25.87	18.01	22.86	10.58	13.61	.38
100 - 200	13.08	5.15	18.93	--	14.70	14.16	9.78	10.59	14.36	8.08
200 - 500	34.71	9.61	8.39	20.12	6.05	15.14	6.88	11.69	13.81	7.98
500 - 1000	17.68	6.80	1.27	--	7.39	4.62	1.30	7.69	3.25	23.23
1000 - 2500	14.19	16.40	1.35	--	--	3.46	1.33	9.43	12.50	10.99
2500	10.54	55.25	--	--	--	3.95	.23	5.08	4.97	47.08

Source: Censo National Agropecuario

only 11 percent of all farms producing sugarcane. Ten farms (.47 percent of all sugarcane producing farms) produced over 55 percent of all Nicaraguan sugarcane. These ten farms were all greater than 2,500 manzana units. Further, the average weighted yield for the 426 large farms was more than a third higher than for the 2,462 farms of less than 200 manzanas that also produced sugarcane.

Although corn producing farms varied in size from less than one manzana to over 2,500 manzanas, nearly 74 percent of the total corn production took place on farms of less than 200 manzanas. Of the 61,816 farms producing corn, only 4 percent were larger than 200 manzanas and the average area of corn planted on these farms was only 71 manzanas. While corn does not appear to be a major crop for farms larger than 200 manzanas, it should be noted that yields on these few large producing units were significantly higher than smaller corn producing farms. The 26 farms greater than 2,500 manzanas that produced corn had average yields of 26 hundredweight per manzana, more than double the yields of farms of less than 50 manzanas.

Cotton and beans also reflect the differing structural characteristics previously noted. Over 77 percent of the cotton was produced on only 15 percent of all cotton growing farms. These few farms all exceeded 200 manzanas in size. Beans on the other hand were grown predominantly on farms of less than 100 manzanas. However, bean yields on larger

farms were not markedly higher than on smaller farms, a sharp contrast to the case of cotton.

For the remaining crops, the previously noted relationships were somewhat less evident. In fact, coffee, an export crop, tended to be grown on small to medium size farms. A similar situation was true for sesame and tobacco. Grain sorghum and upland rice production had structural characteristics very similar to corn and beans although paddy rice was a major exception to the general structural relationships of export and basic grain crops. Only six farms greater than 2,500 manzanas produced 47 percent of all paddy rice and 90 percent of the crop was produced on 76 farms. These farms obtained yields considerably higher than did the smaller farms that produced paddy rice.

Because no significant differences existed in the structural production characteristics when comparisons were made at the national or regional levels, no regional analysis has been presented. Some insights on regional crop production may be obtained in other sections of this report dealing with regional production and resource use trends.

Livestock Production and Numbers by Farm Size

As noted previously, only limited data were available on livestock production by farm size. Table 25 summarizes data for milk production and Table 26 provides information

TABLE 25

NICARAGUA: MILK PRODUCTION
BY FARM SIZE STRATA, 1971

	Milk Production (in gallons/yr.	% of Total	Gallons of milk /Hd./Yr.*
< 1	205,773	.20	492
1 - 5	3,756,326	3.67	280
5 - 10	3,996,394	3.91	188
10 - 20	5,857,548	5.73	100
20 - 50	14,355,287	13.95	65
50 - 100	14,782,726	14.48	48
100 - 200	16,940,829	16.59	50
200 - 500	21,025,610	20.58	43
500 - 1000	10,971,750	10.73	31
1000 - 2500	6,339,636	6.20	16
> 2500	4,023,997	3.94	6
Total	102,255,876	100.00	36

*Calculated by dividing total milk production per size strata by total cattle numbers per size strata (see Table 32).

Source: Censo Nacional Agropecuario, 1971.

TABLE 26

NICARAGUA: LIVESTOCK NUMBERS AND PASTURE AREA, RESPECTIVE PERCENTAGES OF TOTAL AND HEAD PER MANZANA BY FARM SIZE STRATA, 1971

	Cattle Numbers	% Cattle Numbers of Total	Pasture Area Mz.	% Pasture Area of Total	Head Per Mz.
1	418	.01	351	.02	.8
1 - 5	13,402	.47	36,337	1.75	2.7
5 - 10	21,201	.74	58,700	2.83	2.7
10 - 20	58,116	2.04	118,038	5.69	2.0
20 - 50	219,533	7.69	331,267	15.97	1.5
50 - 100	303,537	10.64	290,525	14.00	.9
100 - 200	340,807	11.94	280,395	13.52	.8
200 - 500	486,330	17.04	350,541	16.90	.7
500 - 1000	352,743	12.36	226,324	10.91	.6
1000 - 2500	377,773	13.24	179,134	8.63	.5
2500	680,150	23.83	202,984	9.78	.3
Total*	2,854,010	100.00	2,074,596	100.00	0.7

*Total excludes an estimated 461,348 cattle in Eastern Regions of the country and an estimated 161,472 manzanas of pasture in these regions.

Source: Censo Nacional Agropecuario, 1971.

on total cattle numbers by farm size. Since relatively few farms in Nicaragua specialize in either milk production or beef production but produce both milk and beef from the same herds, it is useful to analyze both activities together. This however, is not a totally valid approach in that: (1) it disregards those units that specialize in either beef or milk production and (2) it does not take into account cheese and butter production. However, it does provide some general insights into the milk/beef sector.

Data in Table 26 indicate that one-half of the nation's total livestock numbers are located on farms larger than 500 manzanas. Intensity of milk production, however, is relatively low on these large units in that only about 21 percent of all milk is produced on farms larger than 500 manzanas. It is likely, however, that a high proportion of the dairy output is marketed in the form of cheese and butter in the case of the larger farms since they tend to be located at greater distances from urban areas.

Milk production is most heavily concentrated on farms ranging from 200 to 500 manzanas. Of interest however, is that the smallest farms have sharply higher outputs of milk per head of livestock. There is, in fact, a notable inverse correlation between herd size and milk output per head. Farms of less than one manzana produced 429 gallons per head, versus 6 gallons per head for farms of 2,500 manzanas

or more. While in part this may be due to higher proportional marketings of fluid milk from small farms as compared to butter and cheese on larger farms, it may also reflect a higher proportion of dairy stock to beef stock on smaller farms.

Smaller farms also carried considerably higher levels of cattle per manzana of pasture than did larger farms. This is not unexpected since it may reflect not only land capability, but also differing dairy/beef stock ratios as noted above.

In summary, it appears that farms larger than 500 manzanas predominate in beef production, produce beef under extensive conditions and market limited quantities of fluid milk. Farms from 1 to 20 manzanas produce both beef and milk under the most intensive conditions, but account for only a small percentage of total national output of either beef or milk. Farms in the 50 to 500 manzana stratas appear to be the backbone of the fluid milk industry, and produce a significant proportion of total beef output, but at levels of intensity intermediate between the smallest and largest farms.

Production by Region

The distribution of the national production of the major crops and livestock activities for each of the six major producing regions are given in Table 27 with the percent distribution of production given in Table 28.

TABLE 27

NICARAGUA: DISTRIBUTION OF NATIONAL PRODUCTION
BY REGION AND ACTIVITY, 1971

Activity/Region	Pacific North	Pacific Central	Pacific South	Interior North	Interior Central	Interior South	Total
Basic Grains[1]							
Corn	659,782	494,501	73,559	430,074	787,580	1,094,722	3,530,218
Beans	6,100	44,014	14,481	47,835	175,662	47,668	335,760
Rice (paddy)	25,007	69,886	33,169	68	47,173	164,594	339,897
Rice (upland)	5,440	80,043	57,024	7,551	4,885	31,580	186,523
Sorghum	160,516	109,200	2,868	30,981	149,247	45,042	497,854
Export Crops[1]							
Cotton	1,519,126	195,507	--	502	21,387	--	1,736,522
Coffee	6,018	392,904	8,124	139,269	327,304	54,020	927,639
Sugarcane	27,435,340	6,607,200	3,077,740	195,340	1,475,160	173,620	38,964,400
Sesame	66,580	15,595	15,095	8	5,027	834	103,139
Tobacco	--	1,500	11,521	24,210	8,102	67	45,400
Livestock							
Cattle[2]	356,079	143,487	159,431	89,461	440,869	885,269	143,487
Milk[3]	15,625,334	22,205,596	6,560,744	3,754,095	15,180,051	38,930,056	102,255,876

[1] Production in hundredweight
[2] Head
[3] Production in gallons
Source: Censo Nacional Agropecuario, 1971.

TABLE 28

NICARAGUA: PERCENT DISTRIBUTION OF NATIONAL PRODUCTION BY REGION AND ACTIVITY, 1971

Activity \ Region	Pacific North	Pacific Central	Pacific South	Interior North	Interior Central	Interior South	Total
Basic Grains							
Corn	18.69	14.01	2.08	11.90	22.31	30.01	100.00
Beans	1.82	13.11	4.31	14.25	52.32	14.20	100.00
Rice (Paddy)	7.36	20.56	9.76	---	13.88	48.83	100.00
Rice (Upland)	2.92	42.90	30.56	4.05	2.62	16.93	100.00
Sorghum	32.24	21.93	.58	6.22	29.99	9.05	100.00
Export Crops							
Cotton	87.48	11.25	---	.03	---	1.23	100.00
Coffee	.64	42.35	.87	15.02	35.28	5.82	100.00
Sugarcane	70.41	16.95	7.89	.50	3.78	.44	100.00
Sesame	64.55	15.12	14.64	---	4.87	.81	100.00
Tobacco	---	3.30	25.37	53.32	17.84	.14	100.00
Livestock							
Cattle	14.61	12.86	6.64	8.41	21.00	36.47	100.00
Milk	15.28	21.71	6.41	3.67	14.84	38.07	100.00

Source: Censo Nacional Agropecuario, 1971.

Cotton, the major cash crop in Nicaraguan agriculture is primarily grown in the Pacific North region. Over 1.5 million hundredweight or 87 percent is grown in this region. The Pacific North also accounts for 70.4 percent of total sugar cane production and 64.5 percent of the total sesame production. Coffee is primarily grown in areas of higher elevation, with the Pacific and Interior Central regions accounting for 42 percent and 35 percent respectively. The Interior North also accounts for 15 percent of the coffee produced. Over one-half (53.3 percent) of the tobacco is grown in the Interior North with the Pacific South (25.4 percent) and the Interior Central (17.9 percent) contributing significantly to total coffee production.

Corn is the most important grain crop in terms of land area and volume of production. The Interior South region is the most important area in terms of total corn production accounting for 30 percent, followed by the Interior Central and the Pacific North with 22.31 percent and 16.69 percent respectively. Over half of the bean production is in the Interior Central region. Paddy rice is grown primarily in the Interior South while the upland rice varieties are concentrated in the Pacific Central and Pacific South. The Pacific North and Interior Central regions each account for about 30 percent of the grain sorghum production with another 22 percent grown in the Pacific Central.

Over 65 percent of the cattle population is in the Interior Regions with the Interior Central accounting for 885,269 head or 36.47 percent of the nation's total. The Interior Central also accounts for slightly over 38 percent of the total milk production.

Value of Production

This section analyzes gross value of agricultural production by crop, farm size, region as well as by averages per farm and per manzana. In addition, some data are discussed relating to distribution of gross income on a per capita and per worker basis. All data included in this analysis refer to the gross value of production rather than to net or disposable income. Furthermore, these data are not based on the income concept of gross cash sales since many farm products are consumed on farms where they are produced. No attempt was made to derive net income data. An indication of net income can be determined from a review of production costs and returns by activity in a later section. However, these figures must be interpreted with some care since home consumption of basic grain crops is significant. Also, these data were not collected by random sampling, but most likely represent national costs and returns.

Value of Production by Activity

Table 29 reports value of production data by activity and product groups for the census years of 1963 and 1971.

TABLE 29

NICARAGUA: VALUE OF PRODUCTION BY ACTIVITY
1963 AND 1971 (1,000,000 CORDOBAS)

Activity	1963 Value	1963 Percent	1971 Value	1971 Percent	Percent Change in Value, 1963-71
Basic Grains	124.2	15.0	224.8	13.4	81.0
Corn	54.1	6.5	120.8	7.2	123.3
Beans	28.9	3.5	36.1	2.2	24.9
Rice	26.0	3.1	50.4	3.0	93.8
Grain Sorghum	15.2	1.8	17.5	1.0	15.1
Export Crops	414.0	50.0	667.0	39.7	61.1
Cotton	260.5	31.5	333.4	19.9	28.0
Coffee	113.2	13.6	225.4	13.4	99.1
Sugarcane	35.1	4.2	65.9	3.9	87.7
Sesame	4.0	0.5	9.9	0.6	147.5
Tobacco	1.2	0.1	32.4	1.9	2600.0
Livestock	291.1	35.0	787.3	46.9	170.0
Beef and Dairy	291.1	35.0	787.3	46.9	170.0
Total	829.3	100.0	1,679.1	100.0	102.5

Source: UNASEC, Censo Nacional Agropecuario, 1963, 1971.

Between the two periods, total production value doubled, the value of basic grains increased 81 percent; export crops 61 percent and livestock activities expanded by 170 percent. While value of production of all activities increased between 1963 and 1971, the increase ranged from only 15 percent in the case of grain sorghum to 2,600 percent for tobacco.

Basic grains as a group had a larger percentage increase in production value than did export crops, but this was due largely to the dominance of cotton in the latter group. The year 1971 was a poor year economically for cotton and this had a major influence not only on the production value of export crops but also on aggregate value of agricultural production for the entire nation. The livestock sector experienced the largest absolute increase in value and as a result, this sector's contribution to production grew from 35 to 47 percent of total production value between the two periods.

Table 30 shows the percentage of total regional production value generated by activity. Of interest is the fact that each region has one activity that contributes a significant amount of total production value. The two southern regions generate over three-fourths of total value from livestock activities. Cotton predominates in the Pacific North as does coffee in the Pacific Central and Interior North regions. Livestock is the dominant contributor to production value

TABLE 30

NICARAGUA: PERCENTAGE DISTRIBUTION OF VALUE OF PRODUCTION BY ACTIVITY IN SIX MAJOR REGIONS, 1971

Activity	REGION					
	Pacific North	Pacific Central	Pacific South	Interior North	Interior Central	Interior South
Basic Grains	4.75	12.72	9.53	14.00	13.35	12.51
Corn	3.51	5.93	2.50	9.58	7.77	8.49
Beans	.07	1.36	1.02	3.01	3.56	.70
Rice (Paddy)	.32	1.96	1.92	0.00	1.01	2.58
Rice (Upland)	.08	2.30	4.02	.40	.08	.46
Export Crops	69.02	63.94	13.85	53.20	32.08	3.28
Cotton	58.23	16.43	.00	.10	1.37	.00
Coffee	.28	41.77	2.48	33.46	26.50	3.20
Sugarcane	9.59	5.06	6.76	.34	.86	.07
Sesame	.92	.48	1.29	.00	.10	.01
Tobacco	.00	.20	3.32	19.30	3.25	.00
Livestock	26.23	23.34	76.62	32.80	54.57	84.21
Beef and Dairy	26.23	23.34	76.62	32.80	54.57	84.21
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: UNASEC, Censo Nacional Agropecuario, 1971.

in the Interior Central region, although production of coffee and tobacco is also of importance. All regions derive ten percent or more of total production value from basic grains except for the Pacific North. Basic grains in this region account for less than five percent of the production value while cotton and sugar cane together amount to 68 percent of the total value of production.

A considerable change occured between 1963 and 1971 with respect to the respective contributions of each region to national value of production. The value of output has increased for each region, but at highly unequal rates (Table 31). The two southern regions have had the greatest percentage increase and the interior regions also experienced the greatest absolute growth in output value. Where in 1963 the Interior South only produced 12.7 percent of total production value, by 1971 it was contributing over a quarter of total national output value. This was in large part due to the very rapid growth in livestock production. Another major change occured in the Pacific North region. In 1963, due to relatively good economic conditions for cotton, this region contributed 38 percent of national output value. Although total value of production increased during the period, the rate of growth was the slowest of all regions and by 1971, the region accounted for 30 percent of national output value. Of the six regions, three, the Pacific South, Interior South and Interior North had production value growth rates considerably above the national average.

TABLE 31

NICARAGUA: REGIONAL DISTRIBUTION OF NATIONAL VALUE OF AGRICULTURAL PRODUCTION; ABSOLUTE AND PERCENTAGE CHANGES, 1963 TO 1971 (MILLIONS OF CORDOBAS)

Region	1963		1971		Change, 1963-71	
	Value of Production	Percent of National	Value of Production	Percent of National	Absolute	Percent
Pacific North	314.0	37.9	507.3	30.2	193.3	61.6
Pacific Central	160.0	19.3	243.9	14.5	83.9	52.4
Pacific South	27.4	3.3	84.2	5.0	56.8	207.3
Interior North	40.4	4.9	108.3	6.4	67.9	168.1
Interior Central	181.8	21.9	312.0	18.7	130.2	71.6
Interior South	105.6	12.7	423.4	25.2	317.8	300.9
Total	829.3	100.0	1,679.1	100.0	849.8	102.5

Source: UNASEC, Censo Nacional Agropecuario, 1963, 1971.

Value of Production by Farm Size and Number

Table 32 presents a summary of data regarding the value of Nicaraguan agricultural production by farm size and number. The basic data from which this table is derived are presented elsewhere in this report. The figures presented clearly manifest the very skewed distribution of land among farms and the resulting distribution of output value from the nation's farms.

As is clear from the data, the value of production increases with farm size while on a per manzana basis, production value declines with farm size increases. In general terms, it is common that the value of production per land area declines as farm size increases. This is only to say that the degree of production intensity is typically lower on the large farms than on the small units. This in part explains the reason for different farm sizes. However, considered on the basis of per farm output value, these data illustrate a correlation indicative of a blatant *minifundia-latifundia* type of agriculture. Comparing the per farm production values of the smallest and largest size stratas reveals a difference of nearly a million cordobas.

The skewed distribution of gross production value by farm number and size is more sharply illustrated by the columns of accumulated percentages. For example 31.7 percent of all farms occupying one percent of the land in farms account for only three percent of the nation's agricultural value of production. Likewise, 75.5 percent

TABLE 32

NICARAGUA: VALUE OF PRODUCTION PER FARM AND MANZANA, ACCUMULATED PERCENTAGES OF FARM NUMBERS, AREA, AND PRODUCTION VALUES, 1971

Farm Size Strata	Value of Production		Accumulated Percentages		
	Per Farm	Per Mz.	Farm Numbers	Area in Farms	Value of Production
0-1	637	1,270	5.81	.05	.19
1-5	2,058	848	31.67	1.00	2.98
5-10	3,900	580	43.81	2.23	5.41
10-20	8,732	650	57.02	4.89	11.33
20-50	13,961	452	75.51	13.36	24.54
50-100	21,195	330	87.77	25.07	37.82
100-200	41,369	325	94.34	37.44	51.73
200-500	95,772	338	98.08	53.19	70.15
500-1000	177,023	269	99.20	64.23	80.40
1000-2500	305,254	210	99.78	76.77	89.42
2500+	1,000,119	130	100.00	100.00	100.00

Source: UNASEC, Censo Nacional Agropecuario, 1971.

of all farms are less than 50 manzanas in size, occupy 13.4 percent of the farm land and produce less than one quarter of the national production value. On the otherhand, the farms in the largest size strata account for less than one-fourth percent (.25%) of all farms, control over a quarter of the land in farms and contribute more than 10 percent of the value of agricultural output.

Of perhaps greater concern than the mal-distribution of land and output is the level of production on smaller farms. Production input costs are perhaps somewhat lower on these units, but by no means do the average per farm or per manzana output values permit any reasonable living level for farm families on these farms. Given that family size averages over five persons, per capita income levels are indeed minimal.

Value of Production per Capita

Production value of agricultural output per capita is not equivalent to the commonly used concept of per capita income since input costs are deducted in the latter concept and not in the former. However, per capita value of production does give some indication of the average economic state of the rural population and of the economically active population (value of production per worker). Given data for more than one point in time, some insight is provided into changes in the average per capita economic welfare over time. It must be recognized, however, that the concept is a

statement of average welfare and therefore can be misleading if gross income distribution is highly skewed. Data in the tables presented in this section provide insights into both the average per capita value of production and the distribution of gross output value by different classifications of the rural population.

Table 33 presents data on average per capita value of production for 1963 and 1971. On an undeflated basis, national average per capita output value increased 94 percent during the period. There were, however, sharp variations in the percentage increases by regions of the country. The two southern regions experienced the greatest growth due largely to the very rapid expansion of the livestock industry in this area. The North Interior region also underwent considerable growth, but it appears that two factors--increased tobacco production and a relative decline in population were the major underlying causes. The two regions that had the lowest growth rates on a per capita basis were those that produced export crops. The relatively depressed economic condition for cotton in 1971 was the principal factor behind the apparent low growth rate. For the Central Interior region, the comparably low growth rate appears to be explained by the migration of people to rural areas near the capital city.

Although average per capita value of agricultural production for the nation in 1971 was 1,849 Cordobas, a very

TABLE 33

NICARAGUA: AVERAGE VALUE OF AGRICULTURAL PRODUCTION PER CAPITA, 1963 AND 1971, BY REGION AND NATION* (IN CORDOBAS)

Region	1963	1971	Percent Change, 1963-1971
Pacific North	1,915	2,916	52.3
Pacific Central	847	1,100	29.9
Pacific South	570	1,602	181.1
Interior North	513	1,111	116.6
Interior Central	697	1,181	69.4
Interior South	585	3,956	576.2
Republic	953	1,849	94.0

Source: UNASEC

*Current cordoba values. Inflation rate between 1963 and 1971 estimated from Banco Central data to be approximately 30% during the period.

large part of the rural population did not realize this level of economic welfare. As shown in Table 34, rural workers (who are generally landless) constituted over half of the rural economically active population. They accounted for 7.5 percent of the total gross output value and realized an average of 845 cordobas annually. The second largest group consisted of self-employed and family labor. In aggregate they received 29 percent of the gross value of production while employers (patronos) accounted for 3.5 percent of the economically active population, received 63 percent of the gross income and averaged over 100,000 Cordobas annually.

The assumptions underlying the derivation of these data are subject to considerable limitation, however, the figures provide some general insight into the distribution of rural income. If the data could be expressed on a real income basis, the income of family labor and workers would perhaps increase and that of employers would likely decrease. This is because the total value of home consumption is probably not fully accounted for in the two former groups while input costs of farms managed by patronos has not been deducted. Thus, figures in Table 34 probably overstate to some extent the relative distribution of real income between the three groups. It is likely however that if more precise data were available, the relative differences would still be very great.

This is a matter of serious concern for it implies that a very significant proportion of the rural population is,

TABLE 34

NICARAGUA: DISTRIBUTION OF VALUE OF AGRICULTURAL PRODUCTION BY RURAL POPULATION GROUPS, 1971 (IN CORDOBAS)

Population Group	Percent of Total Active Population	Percent of Total Production Value	Per Capita Production Value
Self Employed and Family Labor	45.5	29.4	3,731
Workers (Empleados)	51.0	7.5	845
Employers (Patronos)	3.5	63.1	103,158

Source: UNASEC.

in essence, excluded from the national economy. The implications for sustained, broad-based economic growth and development are obvious. In fact, it is indeed questionable whether such development can take place unless greater opportunity is available for this marginalized population.

Implications of the Structure of Nicaraguan Agriculture for Economic Development

Given the analysis presented in the preceeding sections, it must be concluded that Nicaragua faces very serious developmental difficulties not only in the agricultural sector but for the economy as a whole. Although much could be said regarding the social welfare aspects of the development problems, inequities are so obvious that they need not be reiterated. What may not be obvious, however are some of the overwhelming development implications of the preceeding analysis. This summary section very briefly identifies some of the major problems derived from the proceeding analysis and discusses the implications for long term economic development of the country.

As shown in theproceeding analysis, the land resource of Nicaragua--one of the nation's most important resources--is concentrated in the hands of a very limited number of producers.* The consequence of this is that a very high

*Also see the discussion on land use in a following section.

proportion of all producers have a totally insufficient resource base to produce an adequate level of production, and hence income to support themselves at acceptable living levels. At least 50 percent and perhaps as much as 75 percent of the rural population is in this condition. This means that of Nicaragua's population of 2 million, perhaps 750,000 people, or 35 to 40 percent of the total population live at minimal subsistence levels.

This group of people cannot participate in the economic life of the nation. Although they may sell some agricultural product, what they sell is largely "traded" for the most basic necessities of life. This in turn means that they are not consumers of industrial products or other non-farm goods and services.

Because of this basic income problem, the development of the non-farm economy is severely limited. A modern industrial sector requires a broad-based market in order to achieve scale economies in production, marketing and distribution. Without this, per unit costs remain high and industrial employment remains low. Further, investment in industry is destimulated by the lack of a sufficient market and this reverbrates into the service sector resulting in low income and employment levels.

This does not imply that the agricultural sector must always be economically healthy in order to have general economic development. However, given the magnitude of

population numbers in Nicaraguan agriculture and the sector's important role in the national economy, it is doubtful that general economic development can proceed at satisfactory rates unless the agricultural sector is also developing.

There are very strong and intimate inter-relationships between the various sectors of any economy. In Nicaragua, in order to have dynamic industrial and service sectors, the agricultural sector must also be dynamic. It is not sufficient however, that just one part of the agricultural economy such as the export sector be dynamic. Too few producers of the total number are engaged in production for export markets. Although a dynamic agricultural export sector is fundamental in order to increase foreign exchange earnings to purchase capital goods from abroad, the basic question must be asked: Who is going to purchase the product of such capital goods once they are brought into production?

General economic development cannot be achieved when a high proportion of national income and resources are concentrated in the hands of a few. The whole concept of economic development is that of enhancing the economic choice of the entire society. Gross National Product can be increased, for example, by increasing exports, but this need not imply that economic development is taking place. Such an increase in GNP may well be fictitious for all but a very limited proportion of the population. An increased income for the few in no way implies even marginal income

increases for the many. The so-called "trickle down" theory of development has yet to be proven valid unless efforts are deliberately made to redistribute income increases.

The economically marginal population in the agricultural sector cannot be disregarded or neglected if the country is to develop. This group comprises a high porportion of the total population and bringing this group into the market economy to a greater extent would, in itself, prov de a mcuh greater market for non-farm employment and result in increased economic growth throughout the economy.

III

FACTORS OF PRODUCTION

This section briefly analyzes three important factors of production: land, labor and modern input capital used in Nicaraguan agricultural production. The first part of this section discusses land use, giving particular attention to the tenure aspects of this important factor. The labor factor is discussed in the following part and the section concludes with an overview of the use of modern inputs. No data were available regarding the level and magnitude of fixed capital utilized in the agricultural sector, thus the discussion is limited to selected capital inputs for which data were available. It should also be noted that the discussion does not inlude any reference to credit used in agriculture. Use of this resource is analyzed in documents prepared by UNASEC analysts.

III. FACTORS OF PRODUCTION

Land Use

Land is the most important capital resource in Nicaraguan agriculture. Of the 13.7 million manzanas within the country's borders, 5.9 million manzanas or 43 percent of the total area was in farms in 1971. And of the land in farms, about 30 percent was devoted to cropping with the remainder in pasture and other uses. The 1971 census reported a total of 104 thousand farms in the country with average farm size being 68 manzanas per farm. About 82 percent of all farms were located in the six major agricultural regions. These six regions accounted for over 84 percent of the total land area used for agricultural purposes in the country.

Changes in Farm Numbers and Sizes

Between 1963 and 1971, total farm numbers in the six major regions expanded by 9.3 percent, from 78,362 to 85,635 farms. Changes in farm numbers, however, varied considerably by size strata. As can be noted in Table 35, the number of farms in all stratas increased between the two census years with the exception of farms in the 1 to 5 and 5 to 10 manzana strata. Farm numbers in these two classes declined by over 16 and 14 percent respectively. The group of farms that had the largest growth in numbers were those of less than one manzana. Change for this stratum was greater than 200 percent between 1963 and 1971. It thus appears that, in part, the increase in the number of farms of less than one manzana was due to a parcelization of farms in the 1 to

TABLE 35

NICARAGUA: NUMBER AND PERCENT OF FARMS BY STRATA, ABSOLUTE AND PERCENT CHANGE, IN SIX MAJOR REGIONS, 1963 AND 1971

Strata	1963		1971		Change, 1963-71	
	Number of Farms	Percent of Total	Number of Farms	Percent of Total	Absolute	Percent of Total
0-1	1,643	2.10	4,979	5.81	3,336	203
1-5	26,407	33.70	22,147	25.86	-4,260	-16.13
5-10	12,193	15.56	10,395	12.14	-1,798	-14.75
10-20	10,430	13.31	11,311	13.21	881	8.45
20-50	11,572	14.77	15,839	18.49	4,267	36.87
50-100	7,979	10.18	10,499	12.26	2,520	31.58
100-200	4,438	5.66	5,631	6.57	1,193	26.88
200-500	2,535	3.23	3,204	3.74	669	26.39
500-1000	712	.90	959	1.12	247	34.69
1000-2500	324	.41	495	.58	171	52.78
2500+	129	.18	176	.21	47	36.43
Total	78,362	100.0	85,635	100.0	7,273	9.3

Note: Excludes the Caribbean North and South Regions.

Source: Censos Nacionales Agropecuarios, 1963, 1971.

5 and 5 to 10 manzana groups. Data, however, are not sufficiently detailed to fully support this hypothesis.

Farms between 1 and 5 manzanas continued to be the largest group in terms of numbers in 1971 as in 1963, although as a proportion of all farms, this stratum declined from 35.8 percent to 31.7 percent of total farm numbers between the two census years. The decline in farm numbers in these two groups appears to have resulted due to two different reasons. First, apparently some of the farms were broken into smaller units, thus accounting for the increase in farms of less than one manzana. Second, it appears that consolidation of farms also took place within these two stratas. Farmers most likely purchased or rented adjoining or nearby farms in order to expand their land resource base.

The number of farms larger than 10 manzanas increased rather sharply between the two census years. The total number grew by nearly 10,000 units--an increase of 20 percent. Apparently this growth was a result of parcelization as well as the opening of new lands. Both hypotheses are supported by data in Tables 36 and 37. As can be noted in table 36, average farm size declined in all stratas except for farms of 2,500 manzanas or more. This implies that some degree of parcelization most likely occurred between the two census years. Yet, on the other hand, the 23 percent increase in farmed area (Table 37) clearly indicate that part of the growth in farm numbers can be accounted for by the expansion of farms into new areas.

TABLE 36

NICARAGUA: AVERAGE SIZE OF FARMS BY STRATA, ABSOLUTE AND PERCENT CHANGE, IN SIX MAJOR REGIONS, 1963 AND 1971

Strata	1963 Mz	1971 Mz	Change Absolute	Change Percent
0-1	0.67	0.53	-.14	-20.90
1-5	2.85	2.52	-.33	-11.58
5-10	7.87	6.85	-1.02	-12.96
10-20	15.39	13.58	-1.81	-11.76
20-50	35.10	31.13	-3.97	-11.31
50-100	73.43	64.77	-8.66	-11.79
100-200	144.11	127.59	-16.52	-11.46
200-500	320.84	285.45	-62.39	-19.45
500-1000	745.69	640.50	-105.19	-14.11
1000-2500	1,622.65	1,472.48	-150.17	-9.25
2500+	6,749.20	7,663.00	913.80	13.54
Total	60.04	67.82	7.78	12.96

Note: Excludes the Caribbean North and South Region.

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

TABLE 37

NICARAGUA: AREA IN FARMS (MZ), PERCENT OF TOTAL BY STRATA, ABSOLUTE AND PERCENT CHANGE IN SIX MAJOR REGIONS, 1963 AND 1971

Strata	1963		1971		Change, 1963-71	
	Area	Percent of Total	Area	Percent of Total	Absolute	Percent
0-1	1,102	.023	2,649	.045	1,547	140.38
1-5	75,160	1.59	55,722	.96	-194,438	-25.86
5-10	95,995	2.04	71,180	1.23	-24,815	-25.85
10-20	160,514	3.41	153,630	2.65	-6,884	-4.29
20-50	405,706	8.62	493,081	8.49	87,375	21.53
50-100	585,890	12.45	679.975	11.71	94,085	16.04
100-200	639,580	13.59	718,458	12.37	78,878	12.33
200-500	813,321	17.28	914,567	15.75	101,246	12.44
500-1000	530,934	11.28	614,254	11.04	110,320	20.77
1000-2500	525,740	11.17	728,879	12.55	203,139	38.63
2500+	870,647	18.50	1,348,688	23.22	478,041	54.90
Total	4,704,589	100.00	5,808,083	100.00	1,103,494	23.46

Note: Excludes the Caribbean North and South Region.

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

Data in Table 37 provide further insight into the question. Although land area in all but three strata increased, the greatest percentage increase (excepting farms of less than one manzana) occurred in the two largest size strata. Of the increase in farmed area between 1963 and 1971, the expansion of farms exceeding 2,500 manzanas accounted for 43 percent of the total.

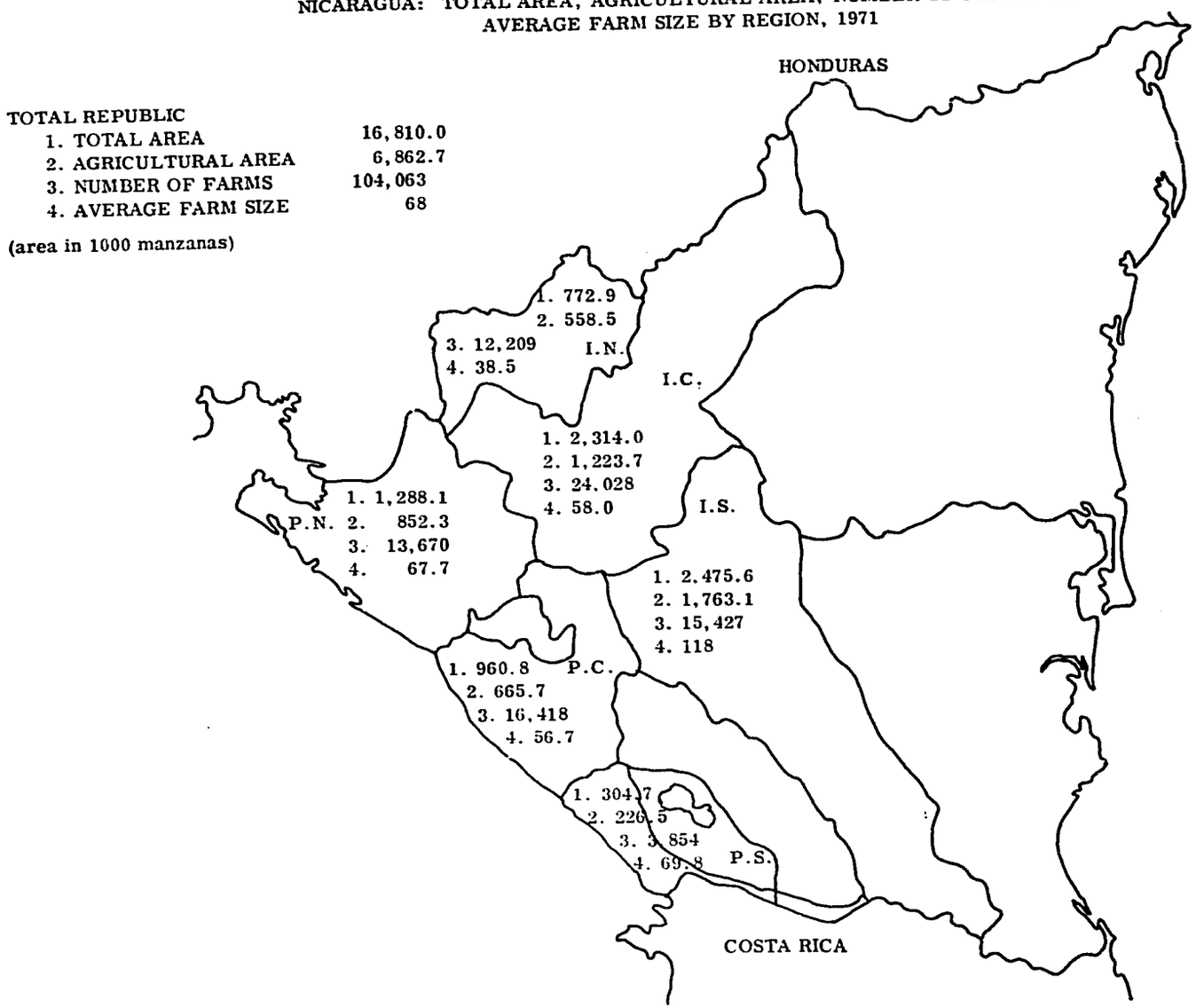
This is particularly noteworthy considering that there were only 47 more farms in this strata in 1971 than in 1963. Further, the average size of all farms in this strata grew by more than 900 manzanas (Table 36). This suggests, but does not necessarily imply still another hypothesis: large farms are absorbing smaller farms, especially farms in the 2,500 manzana or greater strata. Most likely, however, the farms in the largest stratas are those that have been established in new, previously unfarmed areas.

Farm Size and Number by Region

Figure 2 presents 1971 census data on total area, farm numbers for the six major regions as well as for the nation as a whole. As can be noted, average farm size in 1971 varied from a low of 38.5 manzanas per farm in the North Interior region to a high of 118 manzanas per farm in the South Interior region. Although the number of farms per region differed considerably, this is explained by the varying sizes of the regions.

MAP 2

NICARAGUA: TOTAL AREA, AGRICULTURAL AREA, NUMBER OF FARMS AND AVERAGE FARM SIZE BY REGION, 1971



Data on regional farm numbers and land area occupied as a percentage of the respective national totals are shown in Table 38 for 1963 and 1971. In the Central Interior region, farm numbers declined as did the area occupied. All other regions experienced as increase in farm numbers as well as area occupied with the exception of a small decline in area within the North Pacific region.

The North Interior region had the greatest increase in farm numbers, although occupied land area did not increase proportionally. This implies that very considerable parcelization of farms took place within this region at the same time that relatively limited new land areas were being opened. Average farm size fell by 21 percent or over 10 manzanas per farm. As a consequence, this region accounted for 14.3 percent of the nation's farms in 1971 as contrasted to only 10.6 percent in 1963.

Although the opposite effect took place in other regions, the most striking impact occurred in the South Interior region. In this region farm numbers increased by 17.7 percent while land occupied by all farms in the region increased 69 percent. Thus, in 1971, this region accounted for one sixth of the nation's farms, but nearly a third of the agricultural land area. This explains the sharp 44 percent increase in average farm size from 82 manzanas in 1963 to 118 manzanas in 1971 (Table 39).

Detailed data on number of farms per size stratum and percentage of farms of respective regional and national totals

TABLE 38

NICARAGUA: NUMBER OF FARMS AND AREA BY REGION, 1963 and 1971

Region	1963				1971				Percent Change, 1963 to 1971	
	Number	Percent	Area	Percent	Number	Percent	Area	Percent	Number of Farms	Area
Pacific North	13,287	16.96	931,713	19.80	13,670	15.97	924,960	15.92	2.8	-.72
Pacific Central	15,098	19.27	662,077	14.07	16,418	19.18	931,010	16.03	8.7	43.2
Pacific South	3,461	4.42	230,074	4.89	3,854	4.50	268,905	4.63	11.4	16.9
Interior North	8,329	10.63	404,180	8.59	12,209	14.26	469,687	8.09	46.6	16.2
Interior Central	25,084	32.00	1,400,900	29.78	24,028	28.07	1,392,738	23.98	-4.2	-.58
Interior South	13,103	16.72	1,075,645	22.87	15,427	18.02	1,620,783	31.35	17.7	69.3
Total	78,362	100.00	4,704,589	100.00	85,606	100.00	5,808,083	100.00	9.3	23.5

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

TABLE 39

NICARAGUA: AVERAGE SIZE OF FARMS, PERCENT CHANGE BY REGION, 1963 AND 1971

Region	1963 Mz	1971 Mz	Change, 1963-71 Percent
Pacific North	70.12	67.66	-3.5
Pacific Central	43.85	56.71	29.3
Pacific South	66.48	69.77	4.9
Interior North	48.53	38.47	-20.7
Interior Central	55.85	57.96	3.8
Interior South	82.09	118.03	43.8

Source: Censo Nacional Agropecuario, 1963-1971 y cifras del Area de Recursos Naturales de UNASEC.

are presented in Tables 40, 41 and 42 for 1963 and 1971. In general, regional trends follow those for the nation as a whole. It is interesting to note, however, that some rather significant changes occurred within regions between 1963 and 1971. For example, in the Pacific North and Central regions, the number of farms of less than one manzana rose sharply between 1963 and 1971. (Table 40). Together these two regions accounted for 63.5 percent of the nation's farms of less than one manzana. At the other extreme, these same two regions also accounted for over 64 percent of all farms of more than 2,500 manzanas. An additional 30.7 percent of the farms greater than 2,500 manzanas was located in the South Interior region.

The increasing importance of the South Interior region is evidenced by the rising percentage of the region's farm numbers as a proportion of the national total between 1963 and 1971. With the exception of farms in three size stratas, 0 to 1, 5 to 10 and 10 to 20 manzanas, the numbers of farms as a percentage of the national total increased between 1963 and 1971. This indicates that this region has been very dynamic in terms of establishing farms on land previously not devoted to agriculture.

Table 43 presents average farm size by strata for the two census years. Of interest is the fact that in both the North and Central Pacific regions farm size in the 2,500 manzana or greater class have increased considerably, while average farm size in all other stratas has declined.

TABLE 40

NICARAGUA: NUMBER OF FARMS BY STRATA AND REGION, 1963 AND 1971

	Pacific North		Pacific Central		Pacific South		Interior North		Interior Central		Interior South		Total	
	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971
0-1	102	1,008	899	2,155	178	427	38	344	237	516	189	529	1,643	4,979
1-5	4,060	3,870	7,216	6,501	1,642	1,493	2,425	3,173	7,301	4,795	3,763	2,315	26,407	22,147
5-10	2,530	2,012	2,625	2,473	604	501	1,257	1,612	3,612	2,742	1,565	1,055	12,193	10,395
10-20	2,238	2,210	1,858	1,908	360	427	1,187	1,873	3,355	3,537	1,432	1,356	10,430	11,311
20-50	2,143	2,262	1,195	1,556	286	409	1,547	2,748	4,411	5,782	1,990	3,082	11,572	15,839
50-100	982	1,021	491	688	148	227	1,094	1,403	3.463	3,871	1,811	3,259	7,979	10,499
100-200	582	581	352	488	86	142	492	645	1,572	1,617	1,354	2,159	4,438	5,631
200-500	411	416	264	350	77	100	220	297	786	793	777	1,248	2,535	3,204
500-1000	133	152	101	155	33	61	53	88	238	242	154	261	712	959
1000-2500	66	96	61	104	32	48	22	19	92	119	51	109	324	495
2500+	40	42	36	40	15	19	4	7	17	14	17	54	129	176
Total	13,287	13,670	15,098	16,418	3,461	3,854	8,329	12,209	25,084	24,028	13,103	15,427	78,362	85,635

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

TABLE 41

NICARAGUA: PERCENT DISTRIBUTION OF FARMS
BY STRATA AND REGION, 1963 AND 1971

	Pacific North		Pacific Central		Pacific South		Interior North		Interior Central		Interior South		Total	
	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971
0-1	0.77	7.38	5.95	13.13	5.14	11.08	0.46	2.82	0.95	2.15	1.44	3.43	2.09	5.81
1-5	30.56	28.31	47.79	39.59	47.44	36.74	29.12	25.98	29.11	19.96	28.72	15.00	33.70	25.86
5-10	19.04	14.72	17.39	15.06	17.45	13.00	15.09	13.20	14.40	11.41	11.94	6.84	15.56	12.14
10-20	16.84	16.17	12.31	11.62	10.41	11.08	14.25	15.34	13.38	14.72	10.93	8.79	13.31	13.21
20-50	16.13	16.55	7.91	9.48	8.26	10.61	18.57	22.51	17.58	24.06	15.19	19.98	14.77	18.49
50-100	7.39	7.46	3.25	4.19	4.28	5.89	13.04	11.49	13.81	16.11	13.82	21.12	10.18	12.26
100-200	4.38	4.25	2.33	2.97	2.48	3.68	5.91	5.28	6.27	6.73	10.33	13.99	5.66	6.57
200-500	3.09	3.04	1.75	2.13	2.22	2.59	2.64	2.43	3.13	3.30	5.93	8.09	3.23	3.74
500-1000	1.00	1.12	0.67	0.94	0.95	1.58	0.64	0.72	0.94	1.00	1.17	1.69	0.90	1.12
1000-2500	0.49	0.70	0.40	0.63	0.92	1.24	0.26	0.16	0.37	0.49	0.38	0.71	0.41	0.58
2500+	0.30	0.30	0.24	0.24	0.43	0.49	0.03	0.06	0.08	0.06	0.13	0.35	0.17	0.21
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

TABLE 42

NICARAGUA: PERCENT DISTRIBUTION OF FARMS BY SIZE STRATA FOR SIX MAJOR REGIONS, 1963 AND 1971

	Pacific North		Pacific Central		Pacific South		Interior North		Interior Central		Interior South	
	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971
0-1	6.2	20.2	54.7	43.3	10.8	8.5	2.3	6.9	14.4	10.4	11.5	10.6
1-5	15.4	17.5	27.3	29.4	6.2	6.7	9.2	14.3	27.6	21.6	14.3	15.0
5-10	20.7	19.4	21.5	23.8	4.9	4.8	10.3	15.5	29.6	26.3	12.8	10.1
10-20	21.5	19.5	17.8	16.8	3.5	3.8	11.4	16.6	32.2	31.3	13.7	12.0
20-50	18.5	14.3	10.3	9.8	2.5	2.5	13.4	17.3	38.1	36.5	17.2	19.5
50-100	12.3	9.7	6.2	6.6	1.8	2.1	13.5	13.4	43.4	36.9	22.7	31.0
100-200	13.1	10.3	7.9	8.7	1.9	2.5	11.1	11.5	35.4	28.7	30.5	38.3
200-500	16.2	12.9	10.4	10.9	3.0	3.1	8.7	9.3	31.0	24.8	30.7	39.0
500-1000	18.7	15.8	14.2	16.2	4.6	6.4	7.4	9.2	33.4	25.2	21.6	27.2
1000-2500	20.4	19.4	18.8	21.0	9.8	9.7	6.8	3.8	28.4	24.0	15.7	22.0
2500+	31.0	23.9	27.9	40.2	11.6	10.8	3.1	3.9	13.2	7.9	13.2	30.7

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

TABLE 43

NICARAGUA: AVERAGE SIZE OF FARMS BY STRATA AND REGION, 1963 AND 1971

	Pacific North		Pacific Central		Pacific South		Interior North		Interior Central		Interior South	
	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971
0-1	0.7	0.35	0.66	0.63	0.67	0.63	0.71	0.46	0.7	0.46	0.66	0.45
1-5	3.0	2.4	2.8	2.7	2.7	2.2	2.9	2.3	3.0	2.7	2.8	2.4
5-10	8.2	6.3	7.8	7.5	7.8	6.1	7.7	6.5	7.8	7.1	7.7	6.5
10-20	15.8	13.0	15.4	14.9	15.3	10.3	15.2	13.0	15.2	14.0	15.4	13.0
20-50	34.8	29.0	34.3	34.3	34.5	27.3	35.0	29.1	12.6	32.5	35.4	31.0
50-100	76.5	62.6	77.8	74.6	73.2	58.9	71.8	62.2	71.9	66.0	74.5	63.4
100-200	150.0	124.2	147.0	145.7	152.0	120.5	143.6	123.6	141.0	130.0	144.2	124.2
200-500	330.4	284.0	340.1	332.4	347.0	268.4	321.0	277.3	319.8	297.0	307.6	268.9
500-1000	742.0	644.2	767.1	718.8	789.0	627.7	733.4	591.5	743.5	697.3	733.1	662.1
1000-2000	1,640.3	1,416.4	1,654.1	1,649.5	1,564.0	1,345.0	1,618.0	1,266.2	1,594.6	1,507.1	1,651.8	1,407.3
2500+	7,102.0	7,629.5	5,376.0	7,246.3	5,246.0	4,517.7	5,375.0	3,140.3	5,827.6	5,279.1	11,397.0	10,308.7

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

This is in contrast to the other four regions which have had decreases in average farm size in all stratas, including farms of greater than 2,500 manzanas. This is the case even for the South Interior region although farms in this size class in 1971 were still nearly twice the average size of other regions.

To better understand the reasons for the differences between regions in regard to changes in average farm size by stratum, it is useful to observe data in Table 44. In the North Pacific region, total land area occupied by farms declined between 1963 and 1971. Likewise, the same occurred on a stratum by stratum basis except for the two largest farm size classes. In these two stratas together, land area occupied by farms increased by 64 thousand manzanas or more than 16 percent. This is strong evidence that consolidation of farms took place at a rather rapid rate between 1963 and 1971. As a result, farms greater than 2,500 manzanas have grown by an average of more than 500 manzanas per farm between the two census years. While the evidence in the case of the Central Pacific region is less dramatic, indications are that a similar occurence has taken place in that region as in the North Pacific region.

In the other regions, with a few exceptions, land area occupied by farms in each strata increased between 1963 and 1971. This implies that not only was new land opened up for agricultural purposes, but in addition, parcelization of large farms into smaller farms also took place.

TABLE 44

NICARAGUA: AREA IN FARMS BY SIZE STRATA AND REGION, 1963 AND 1971

	Pacific North		Pacific Central		Pacific South		Interior North		Interior Central		Interior South	
	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971	1963	1971
0-1	74	354	598	1,390	120	271	27	160	159	236	124	238
1-5	12,018	9,191	19,496	17,646	4,467	3,256	7,149	7,326	21,304	12,839	10,726	5,464
5-10	20,652	12,761	20,631	18,658	4,691	3,037	9,690	10,467	28,246	19,353	12,085	6,904
10-20	35,294	28,748	28,679	28,408	5,496	5,184	18,078	24,319	50,969	49,389	21,998	17,587
20-50	74,622	65,360	41,050	53,339	9,870	11,161	54,154	79,934	155,490	187,860	70,520	95,427
50-100	75,112	63,894	38,191	51,310	10,834	13,364	77,860	87,298	248,923	255,502	134,970	208,607
100-200	87,079	72,185	51,732	71,118	13,077	17,107	70,656	79,734	221,724	210,185	195,312	268,129
200-500	135,791	118,125	89,801	116,338	26,756	26,838	70,605	82,356	251,354	235,359	239,014	335,551
500-1000	98,688	97,925	77,475	111,408	26,293	38,293	38,872	52,052	176,961	168,765	112,904	172,811
1000-2500	108,264	135,979	100,899	171,544	50,045	64,557	35,589	24,059	146,701	179,347	84,242	153,393
2500+	931,713	924,960	662,077	931,010	230,074	268,905	404,180	469,687	1,400,900	1,392,738	1,075,645	1,820,783

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

Land Resource Distribution by Farm Size and Number

Knowledge of the distribution of the nation's land resource by farm sizes and numbers is important in order to assess the economic and social welfare impacts of alternative, production-oriented, agricultural development programs. This information, together with the structure of agricultural production (discussed in a preceeding section) is essential in designing policies and programs to increase output and resource productivity. The relationships between farm numbers and sizes and the relative proportion of land occupied by the various farm size stratas in Nicaragua are indicated by data in Tables 45 and 46. These relationships are also expressed graphically in Figure 3.

For the country as a whole, there has been virtually no change in the relationships between farm numbers and area occupied between the two census years. Discussion, therefore, will be limited particularly to 1971 data.

As can be noted from Tables 45 and 46 and Figure 3 a very high proportion of all Nicaraguan farms occupy a very small proportion of the agricultural land area. Ninety percent of all farms were concentrated on 29 percent of the land in 1971. Conversely, 10 percent of total farm numbers occupied 72 percent of the agricultural land area. Utilizing the 50 percent figure as a reference point, it can be noted from Figure 3 that half of all farms are concentrated on slightly more than 3 percent of the land in farms.

TABLE 45

NICARAGUA: NUMBER OF FARMS AND ACCUMULATED PERCENT BY STRATA, 1963 AND 1971

Strata	1963		1971	
	Number of Farms	Percent Accumulated	Number of Farms	Percent Accumulated
0-1	1,643	2.10	4,979	5.81
1-5	26,407	35.80	22,147	31.67
5-10	12,193	51.36	10,395	43.81
10-20	10,430	64.67	11,311	57.02
20-50	11,572	79.34	15,839	75.51
50-100	7,979	89.52	10,499	87.77
100-200	4,438	95.18	5,631	94.34
200-500	2,535	98.41	3,204	98.08
500-1000	712	99.31	959	99.20
1000-2500	324	99.72	495	99.78
2500+	129	100.00	176	100.00
Total	78,362		85,635	

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

TABLE 46

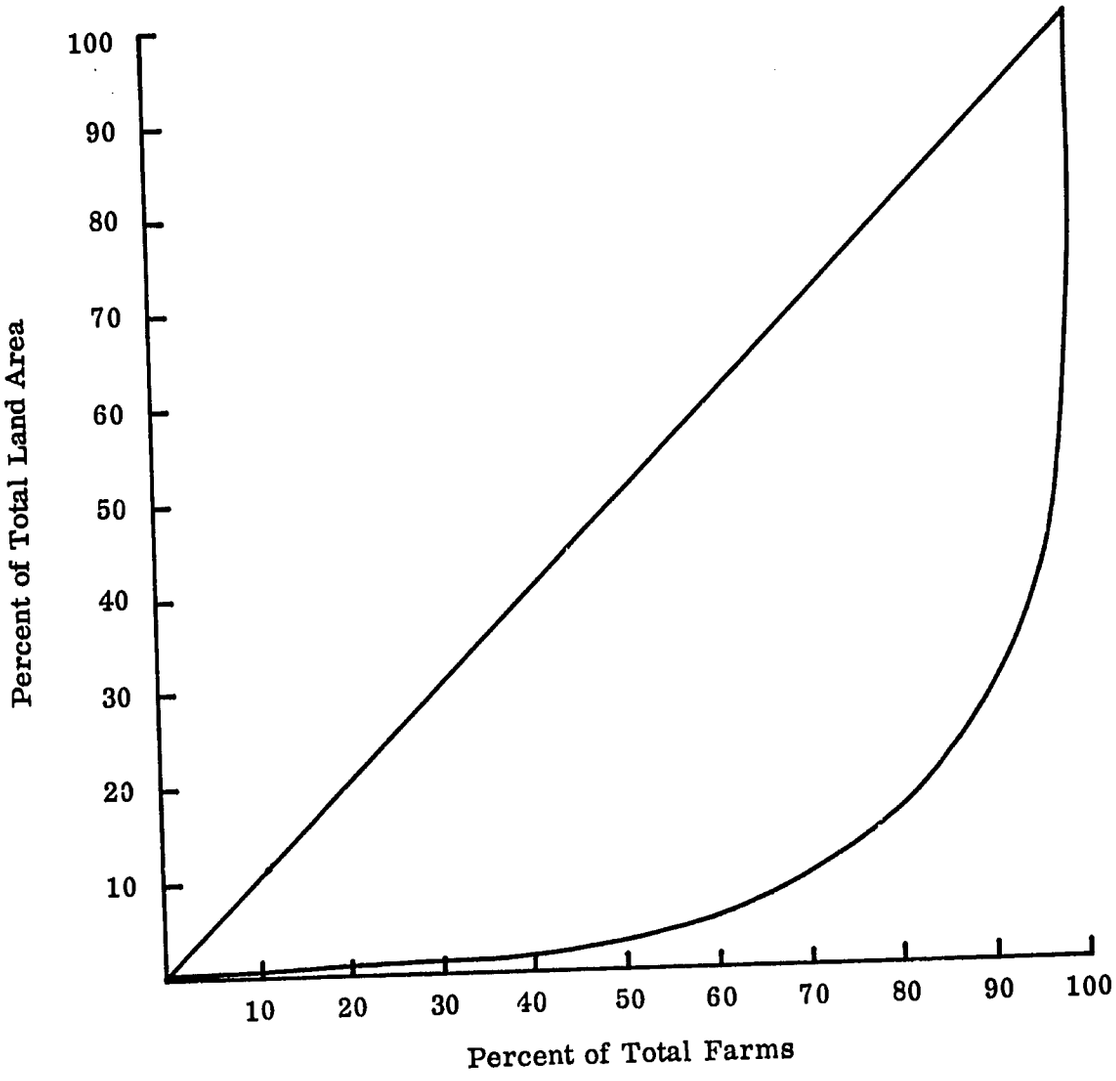
NICARAGUA: AREA AND ACCUMULATED PERCENT BY STRATA, 1963 AND 1971

Strata	1963		1971	
	Area	Percent Accumulated	Area	Percent Accumulated
0-1	1,102	.023	2,649	.045
1-5	75,160	1.613	55,722	1.004
5-10	95,995	3.653	71,180	2.229
10-20	160,514	7.063	153,630	4.874
20-50	405,706	15.683	493,081	13.363
50-100	585,890	28.133	679,975	25.070
100-200	639,580	41.723	718,458	37.439
200-500	813,321	59.003	914,567	53.185
500-1000	530,934	70.283	641,254	64.225
1000-2500	525,740	81.453	728,877	76.774
2500+	870,647	100.000	1,348,688	100.000
Total	4,704,589		5,808,083	

Source: Censos Nacionales Agropecuarios, 1963, 1971.

FIGURE 1

Relationship Between Farm Numbers
And Land Area Occupied, In Percent
Of Totals, Nicaragua, 1971



Source: Censo Nacional Agropecuario, 1971

Likewise, half of the farmed land area is occupied by between 2 and 3 percent of all farms.

At the regional level, for 1971, there was some variation in land concentration from region to region, as is indicated by Table 47. Highest concentration levels existed in the three Pacific regions and the lowest levels of concentration existed in the three interior regions. Of the six regions, the Central Interior region had the lowest level of concentration with a coefficient of .70. The Central and South Pacific regions had the highest concentration coefficients--both equalling .89.

Of considerable interest is the change that occurred in the coefficients between 1963 and 1971. As verified previously, land concentration on fewer and larger farms has taken place in the two Northern regions as well as the Central Pacific region. Concentration is declining, however, in the other three regions, but especially in the Central Interior region. Thus, with exception of this region, the older, more established agricultural areas of the country are experiencing increasing land concentration, while in the newer areas land concentration is declining.

The data presented above obviously indicate very high concentration of total farmed area on a limited number of farms. The social-welfare, economic and perhaps political implications need not be detailed. However, considerable care must be taken in evaluating these data. Because all

TABLE 47

NICARAGUA: COEFFICIENTS OF CONCENTRATION OF LAND AREA, 1963 AND 1971

Region	1963 cc.	1971 cc.
Pacific North	.82	.86
Pacific Central	.88	.89
Pacific South	.90	.89
Interior North	.72	.75
Interior Central	.73	.70
Interior South	.76	.74
Total Republic	.82	.81

Source: Censos Nacionales Agropecuarios, 1963 and 1971.

farms are included in these data, it is not entirely valid to draw general conclusions regarding land area--farm number concentration for several reasons (1) aggregate data do not take into consideration the type of agriculture by farm size, (2) inherent land capability of different farms is not considered, (3) intensive or extensive agriculture is not distinguished by aggregate data and (4) income producing capability of different soil types or ecological zones is not taken into consideration. As a simple example of the complexity of the issue is the fact that a cattle ranch obviously requires far more land to produce an adequate family income than does a truck-garden farm.

Although land concentration is often a volatile political issue, more important from a social welfare and developmental point of view is whether or not small farmers have a sufficient land resource base to earn an adequate family income. On this basis and given the low technological level of much of Nicaraguan agriculture, it is rather clear that at least half and perhaps 75 percent of the nation's farmers do not control sufficient land resources to provide anything more than a subsistence living. Further, although there is some variation from region to region, the number of farmers with an inadequate land resource base increased between 1963 and 1971. Considering only farms of less than one manzana, an increase of over 3,300 occurred between the two census years.

The very limited land resource base of a high proportion of the nation's farms should be viewed as a more serious concern than a straightforward land concentration problem, although there is clearly a strong inter-relationship between the two issues. This inter-relationship is manifested by the fact that the simple average farm size for the six major agricultural regions is 68 manzanas. Hence, even if all land presently in farms were to be divided equally among all farmers, it is very questionable whether social welfare or agricultural development potential would be enhanced. Further, given that only about 900 thousand manzanas of all land in farms is cropped, the average cultivated land area per farm is less than nine manzanas. In no way is it suggested or implied that land should be equally divided among farmers. Rather these data are cited to illustrate the serious nature of the land resource problem.

Although the implications of the land concentration problem are complex, the implications for increasing agricultural output are not. As noted previously, the alternatives for increasing agricultural output are clear: (1) increase productivity per land unit, (2) bring into production more land, or (3) opt for some combination of these two alternatives.

In the short run, it is unlikely that Nicaragua can either develop internally or import sufficient and necessary technology to obtain significantly greater output from the present land in farms. Thus, serious attention should be given to opening new areas for agricultural purposes. One means of accomplishing this would be to give high priority to new roads and other infrastructure investments in new areas. It is also likely that such an approach would have the effect of intensifying production on land now being used extensively, particularly in the newest areas.

In the longer run, the nation has no alternative but to intensify land and labor resource efficiency via new technology in both the new areas as well as existing agricultural area. This implies that investments of a much different type than new roads or physical infrastructure will be required. In order to produce new technology, adapt imported technology to local conditions, and insure its adoption, significant investments in human resources will be an absolute prerequisite. Highly trained researchers, capable research administrators, dedicated extension personnel and agricultural technicians as well as educational investments in rural people are essentials for long run agricultural as well as industrial development.

There are no shortcuts to this process. Further, the training necessary to produce skilled researchers, administrators, extension personnel as well as educated rural people requires many years and the expenditure of funds that have many

alternative and usually more popular and spectacular uses. These are costly investments, but are investments that will yield high social and economic returns.

Labor

Labor and land are the two most important factors of production in traditional agriculture. In Nicaragua, labor costs account for some 40 percent of total production input costs, including land. This is significantly higher than in developed countries, but on par with other countries where use of purchased inputs is limited. This section breifly analyzes the labor factor in Nicaraguan agriculture, giving particular attention to labor use by crop and the inter-relationships between farm size, technological level and labor use per manzana.

Agricultural Labor--An Overview

The 1971 population census reported that some 52 percent of Nicaragua's population resided in rural areas or towns of less than 2,500 people. Among the different regions of the country the percentage of rural population varied considerably with the lowest percentage in the Central Pacific region which includes the capital city, to 78 percent in the South Interior region (Table 48).

Of the nation's total work force, nearly 47 percent are found in the agricultural sector and within this sector the work force constitutes 24 percent of the total population.

TABLE 48

NICARAGUA: TOTAL POPULATION AND POPULATION OF RURAL AND URBAN SECTORS BY REGION, 1971

Region	Total Population	Urban* Population	Rural Population	Percent Rural of Total
Republic	1,911,543	916,872	994,671	52.0
North Pacific	305,494	151,875	153,619	50.3
Central Pacific	753,836	552,672	201,162	26.7
South Pacific	74,156	25,396	48,760	65.8
North Interior	130,123	30,498	99,625	76.7
Central Interior	303,299	80,159	223,140	73.6
South Interior	194,899	42,250	152,649	78.3
Caribbean (All)	149,854	34,020	115,716	77.2

Source: CENSO POBLACION NACIONAL AND CENSO NACIONAL AGROPECUARIO DE NICARAGUA, 1971

*Urban Population Defined as People Residing in Centers of Greater than 2,500 Inhabitants.

TABLE 49

NICARAGUA: RURAL POPULATION AND WORK FORCE, 1971

Region	Total Rural Population	Rural Work Force	Percent Rural Work Force of Total Population
Republic	994,971	237,327	23.9
North Pacific	153,619	40,051	26.0
Central Pacific	201,162	38,553	19.2
South Pacific	48,760	10,223	21.0
North Interior	99,625	24,103	24.3
Central Interior	223,140	63,337	28.4
South Interior	152,649	30,429	19.9
Caribbean	149,854	30,620	20.4

Source: Censo Poblacion Nacional De Nicaragua, 1971

TABLE 50

NICARAGUA: MANYEARS AVAILABLE AND UTILIZED IN AGRICULTURE, BY REGION, 1971

Region	Manyears* Available	Manyears Utilized	Difference Absolute not Utilized	Difference Percent not Utilized
Republic	214,587	151,222	63,365	29.5
North Pacific	41,922	39,879	2,043	4.9
Central Pacific	41,332	25,448	15,884	38.4
South Pacific	10,485	6,749	3,736	35.6
North Interior	25,935	13,904	12,031	46.4
Central Interior	67,588	33,618	33,969	50 3
South Interior	27,325	31,624	-4,299	....

Source: Censo Poblacion Nacional De Nicaragua, 1971

*One manyear = 280 days.

The work force is composed of several different groups as defined by the 1971 census (Table 51). In general terms, about half of the work force is either self-employed on farms or is non-remunerated family labor. Virtually all of the rest of the work force are empleados--landless laborers employed by others for agricultural work. It is upon this group that the burden of unemployment and poverty falls most heavy. An estimated 50 percent of all empleados are unemployed and when employed draw salaries amounting to less than 7 cordobas per day (Table 52). As a result UNASEC analysts have estimated that empleados receive about 7.5 percent of the nation's net agricultural income compared to 29.4 percent for self-employed and family farm labor and 63.1 percent for agricultural employers (patronos).

Not surprisingly, the total agricultural work force has declined during the past several years due to rural to urban migration. As a group, empleado numbers fell by 27,500 persons between 1963 and 1971 although the rate of decline of unpaid family labor has been even greater (Table 51). It is clear, however, that given urban unemployment rates, alternative work opportunities are limited for such migrants. Rural to urban migration may thus have somewhat relieved unemployment problems of the countryside only to accentuate difficulties in urban areas.

TABLE 51

NICARAGUA: RURAL WORK FORCE 1963 AND 1971 BY OCCUPATIONAL TYPE

Occupational Type	1963	1971	Difference 1963-1971 Absolute	Percent
Employer	8,380	7,831		- 6.6
Self-Employed	81,067	76,778		- 5.3
Laborer	136,091	108,574	-27,517	-20.2
Unpaid Family Labor	57,561	40,868	-16,693	-29.0
Other	7	3,276	3,269	.....
TOTAL	283,106	237,327	-45,779	-16.2

Source: Censo Poblacion Nacional De Nicaragua, 1971.

TABLE 52

NICARAGUA: AVERAGE SALARIES PAID TO AGRICULTURAL LABORERS BY REGION, 1971

Region	Daily Salary*	Hourly Salary
Republic	6.88	.86
North Pacific	7.25	.90
Central Pacific	7.44	.93
South Pacific	5.73	.71
North Interior	7.44	.93
Central Interior	5.23	.65
South Interior	8.24	1.03

Source: Encuesta Nacional Agropecuario, 1971

*Work day = 8 hours.

Structure of Rural Labor Use

The amount of labor utilized in agricultural production varies very considerably by activity, technology level, farm size and region of the country. Rather excellent micro data were available from production analyses of major agricultural activities. Although sampling was not done on a random basis and hence no totally valid national aggregations can be made, the data provide very useful insights into important relationships regarding the use of the labor factor.

Table 53 provides data on the average number of mandays utilized for major agricultural crop and livestock activities. These data have been converted to equivalent manyear figures by region in Table 54. As can be noted, in aggregate, livestock activities utilize the greatest amount of labor (nearly 46,000 manyears) of any activity. Corn is the second most labor-using activity with 35,0 manyears followed by cotton, coffee and beans. Although tobacco production requires more labor per manzana than any other activity, the relatively small area of the Nicaraguan crop accounts for the rather low level of total labor utilization. In general terms, basic grain crops use roughly 40 percent of all labor employed while export crops and livestock activities each use around 30 percent of total employed labor.

Tables 55 and 56 denote average labor utilization per farm and per manzana by region. As expected, labor employed per farm increases directly with farm size, but on a per

TABLE 53

NICARAGUA: AVERAGE MANDAYS OF LABOR UTILIZED PER MANZANA ON SURVEYED FARMS BY ACTIVITY, 1971

Activity	Average Mandays Labor
Basic Grains	
Corn	39.9
Beans	42.5
Grain Sorghum	40.0
Rice (Upland)	71.3
Export Crops	
Cotton	42.6
Sugar Cane	30.5
Coffee	168.9
Sesame	37.0
Tobacco	319.2
Livestock	Mandays Per Head
Beef	5
Dairy	10

Source: Encuesta Nacional Agropecuario, 1971

TABLE 54

NICARAGUA: MANDAYS PER YEAR FOI
AGRICULTURAL ACTIVITIES BY REGION, 1971

	Basic Grains					
Regiones/Productos	Maize	Sorgo	Frijol	Ajonjoli	Arroz Secano	Arroz De Riego
Region Pacific North	6,901	1,832	294	1,370	166	182
Region Pacific Central	4,258	1,314	1,069	232	1,502	583
Region Pacific South	851	40	376	212	703	73
Region Interior North	4,397	407	1,818	1	132	1
Region Interior Central	10,704	1,433	4,977	100	119	230
Region Interior South	7,674	441	1,819	27	687	781
Republic	34,785	5,467	10,353	1,942	3,309	1,850
Percent of Total	23.0	3.6	6.8	1.3	2.2	1.2

	Export Crops and Livestock					
Regiones/Productos	Tobacco	Azucar	Algodon	Cafe	Ganaderia	Total
Region Pacific North	20	2,803	17,468	258	8,585	39,879
Region Pacific Central	130	844	3,432	6,856	5,228	25,448
Region Pacific South	. . .	404	. . .	247	3,843	6,749
Region Interior North	607	53	7	3,369	3,112	13,904
Region Interior Central	294	357	388	8,857	6,160	33,619
Region Interior South	. . .	42	. . .	1,245	18,418	31,634
Republic	1,051	4,503	21,295	20,832	45,846	151,233
Percent of Total	.7	3.0	14.1	13.8	30.3	100.00

Source: Censo Nacional Agropecuario 1971
Euenesta Nacional Agropecuaria UNASEC 1972

TABLE 55

NICARAGUA: AVERAGE MANYEARS OF RURAL LABOR UTILIZED PER FARM BY FARM SIZE STRATA AND REGION, 1971

Strata	Pacific North	Pacific Central	Pacific South	Interior North	Interior Central	Interior South
Less than 1	0.23	0.29	0.35	1.31	1.53	0.77
1 a 5	0.92	0.58	0.67	1.45	2.16	2.18
5 a 10	0.88	0.55	0.63	1.08	1.63	2.29
10 a 20	1.04	0.82	0.71	0.66	0.94	2.06
20 a 50	1.51	1.65	1.22	0.65	0.63	1.35
50 a 100	3.05	3.99	2.00	0.96	0.73	1.14
100 a 200	7.11	6.53	3.26	1.48	1.87	1.55
200 a 500	20.51	11.21	8.48	3.12	3.68	2.62
500 a 1000	29.48	11.83	16.54	1.10	4.92	7.73
1000 a 2500	40.81	18.19	19.81	8.79	3.33	10.14
2500 +	88.24	38.75	36.47	21.57	13.79	54.20

Source: UNASEC Y Censo Nacional Agropecuario 1971.

TABLE 56

NICARAGUA: AVERAGE MANYEARS UTILIZED PER MANZANA BY FARM SIZE STRATA AND REGION, 1971

	Pacific North	Pacific Central	Pacific South	Interior North	Interior Central	Interior South
0 - 1	0.65	0.44	0.55	2.82	3.34	1.76
1 - 5	0.38	0.21	0.31	0.63	0.81	0.92
5 - 10	0.13	0.07	0.10	0.11	0.23	0.35
10 - 20	0.07	0.05	0.07	0.05	0.07	0.16
20 - 50	0.05	0.05	0.04	0.02	0.02	0.04
50 - 100	0.04	0.05	0.03	0.02	0.01	0.02
100 - 200	0.05	0.04	0.03	0.01	0.01	0.01
200 - 500	0.07	0.03	0.03	0.01	0.01	0.01
500 - 1000	0.04	0.02	0.03	0.01	0.01	0.01
1000 - 2500	0.03	0.01	0.01	0.01	0.002	0.01
2500 +	0.01	0.005	0.01	0.01	0.00	0.002
Total	0.04	0.02	0.03	0.03	0.02	0.02

Source: UNASEC Y Censo Nacional Agropecuario 1971.

manzana basis, the relationship is inverse. Regional variations are due to the differing composition of production activities from region to region. Cotton, for example plays a very important role in explaining the greater average intensity of labor use in the Pacific North region, especially on farms of 200 manzanas or more.

These aggregative data are of limited value, however, for policy purposes. While it is clear that labor intensity per farm declines with an increase in farm size, this is in part due to the difference in enterprise combinations on large and small farms. As noted previously, smaller farms in Nicaragua tend to produce basic grains while larger farms tend toward livestock or export crop production. Hence, it should be expected that labor intensity would vary considerably with farm size. To avoid this confusion it is necessary that the analysis deal with labor intensity for a given crop produced on different size units and under different production systems.

Although not complete for all major crops produced in Nicaragua, an analysis was undertaken of the factors influencing the demand for labor. Data were available for the four basic food grains and some abstractions can be made from this information for other crops as well. Included in the analysis was an assessment of the impact on the demand for labor due to (1) changes in farm size, (2) different sources of power, i.e., animal or tractor, (3) differing magnitudes of purchased inputs utilized, (4) varying wage rates

and (5) varying capital costs, using interest charges as a proxy variable. Only highlights of the research results are reported.

For all four crops aggregated, farm size showed a negative relationship to labor employed per manzana. However, when technology level and other factors were held constant, a linear relationship was found, i.e., labor use per manzana was not significantly different as farm size changed. Analyzed by crop, the same results were found as for all crops aggregated with the exception of rice. For this activity, a positive relationship existed between farm size and labor demand per manzana.

The relationships between labor demand and different sources of power were consistent with expected results. Use of machine power decreased labor use at the rate of four percent for each one percent increase in power costs. A one percent increase in animal power costs, however, increased labor use by five percent. Again, individual crops did not show results different from the aggregate except for rice. In this case, a one percent rise in animal unit costs resulted in a twelve percent increase in labor use.

The magnitude of purchased inputs used was significantly related to per manzana labor demand. Employment elasticity was .06 for all crops aggregated and rice showed a highly positive elasticity of 18 percent. In other words, for every one percent increase in expenditures for purchased inputs, labor demand per manzana grew by 18 percent. More

detailed findings on these relationships are discussed in the section dealing with modern inputs.

Surprisingly, a very strong inverse relationship was found between wage rate levels and labor demand. While an inverse relationship is to be expected, aggregate results showed a labor use--wage rate elasticity of -18 percent. Thus a small change in wage rates yielded a major change in labor employed per manzana. For individual crops, the elasticity varied from a low of -3 percent for beans to -35 percent for rice.

The magnitude of working capital and its effect on labor demand was the final relationship analyzed. As with purchased input use, this relationship was positive. The elasticity equaled 18 percent for all crops aggregated, for beans 32 percent, rice 25 percent, and 10 and 3 percent respectively for corn and grain sorghum. Thus, increases in working capital have a very positive impact on labor use per manzana. In effect, this variable is a proxy for technology level and hence is an additional confirmation that when other factors are held constant, labor use per land area increases as the use of purchased capital inputs rise.

These findings are significant in designing policy measures to alleviate the very serious employment problems found in Nicaragua's rural sector. With nearly 30 percent of the rural labor force unemployed and half of all <u>empleados</u> without work, unemployment must be considered the greatest single problem of Nicaraguan agriculture. It is not, though

a problem limited to the agricultural sector for it spills over directly into the urban areas. More employment opportunities must be found and they must be found in agriculture. The service and industrial sectors cannot be expected to resolve agriculture's problem through absorbtion of massive levels of out-migrants from rural areas. Furthermore, not only must more employment opportunities be found, but also a means of increasing labor productivity is essential. Only through enhanced productivity can labor receive greater real income.

The general outlines of a labor policy are rather blatant. First, more land must be brought under more intensive cultivation. Second, far greater use of modern inputs must be stimulated, excepting indiscriminant use of mechanized power. Third, an aggressive population control policy must be implemented through the nation. This latter issue is too frequently either disregarded or altogether avoided as a means of reducing long term employment problems. Burying our heads in the sand on this issue is folly. With some 60 percent of Nicaragua's population under 20 years of age, the future is not unknown. Rationality must prevail over emotion. But population control is a long term measure; there are shorter term measures which can be effective in dealing with rural unemployment and these are the two noted above.

Research utilizing data from Nicaraguan farms has established that increased use of modern inputs (excepting

mechanized power) significantly increases labor intensity per manzana (labor productivity is also increased--see the following section). Every effort must be made to get these inputs into the production processes of all Nicaraguan agricultural activities. This applies to both existing farms as well as new areas opened up for agricultural production. While land is an important factor of production, its importance decreases with increased modern input use. This is not to imply that there is not a land resource distribution problem in Nicaragua in that a high proportion of the nation's farmers have an insufficient land base to earn a reasonable living. But even without markedly disturbing present land distribution patterns, employment can be sharply increased if the bulk of farmers utilized high levels of modern inputs. This applies to basic grain crops and appears equally true for export crops. Furthermore, it applies to both family labor and landless workers (empleados). This theme may appear overemphasized in this report, but no other feasible means exist to alleviate labor factor problems.

Modern Inputs

The magnitude of the use of nontraditional inputs in the agricultural production of a country is one of the best measures of the degree of modernization of the agricultural sector. Modern inputs both substitute for and complement

traditional factors of production, raising the productivity of land, labor as well as capital. In general terms modern inputs tend to be either land substituting or labor substituting in the sense that when utilized, the same output can be achieved from reduced inputs of these two factors, and/or more output can be produced with the same inputs. While non-traditional inputs may reduce per unit production costs, this is not universally the case. In fact, data presented in a following section point out that often rather insignificant differences in per unit costs of production exist for many Nicaraguan crops when comparisons are made between production under highly varying technology levels.

This fact has led some observers to conclude that no advantage is to be gained from utilizing modern inputs. Disregarded in such an observation is that so long as land and/or labor have some positive price, productivity of these two resources must remain a concern. There is likewise a growing worry that modern input use may be socially undesirable since it can lead to the substitution of labor to the extent that notable unemployment may result. Not infrequently, this is a valid concern. However, the direct employment impact varies sharply between different non-traditional inputs. Some inputs such as fertilizer, insecticides and improved seeds can in fact be employment creating while mechanized harvesters may have the contrary effect. Yet, the aggregate

employment impact of mechanization, as noted in recent research, is far more complex than superficial observations would tend to conclude.

Stimulating the use of modern inputs need not result in a conflict of the policy objectives of employment creation and raising factor productivity. Of particular importance in this regard are those measures which either directly or indirectly influence all factor prices. These include but are not limited to credit, trade, and foreign exchange policies, social legislation (e.g., minimum wages) as well as monetary and fiscal policies plus specific input subsidies or taxes. Thus, any effort to enhance agricultural modernization to achieve d sired objectives requires a highly cohesive and integrated set of policies, many of which lie outside the realm of strictly agricultural policy.

Use of Modern Inputs in Nicaraguan Agriculture

Discussion in this section is limited to important modern inputs for which data were available. This includes agricultural chemicals, fertilizer, improved seeds and very brief comments on mechanized implements. Available data were neither detailed nor complete, thus only a rather general analysis of non-traditional inputs is presented.

As can be noted in Table 57, the value of imports of major modern inputs has varied markedly between 1960 and 1971. Import values of these inputs increased dramatically from 1960 to 1967, then fell sharply during the 1968-71 period.

TABLE 57

NICARAGUA: VALUE OF IMPORTS OF FERTILIZERS INSECTICIDES, SEEDS AND AGRICULTURAL MACHINERY, 1960-1971 (1,000 CORDOBAS)

Year	Fertilizers	Insecticides[1]	Seeds	Machinery[2]	Total Value	Total Index[3]
1960	6,739.6	26,048.3	207.5	14,310.3	46,954.7	76
1961	8,503.0	26,405.7	149.8	15,198.0	50,256.5	82
1962	13,641.2	43,541.7	216.1	30,183.3	87,582.3	142
1963	14,709.3	46,902.4	204.4	36,787.2	98,603.3	160
1964	17,067.1	34,702.9	155.4	53,889.7	105,815.1	172
1965	35,257.6	92,071.0	604.3	66,726.0	194,658.9	316
1966	25,641.6	116,870.7	294.0	57,593.7	200,400.0	325
1967	36,687.0	197,996.0	367.3	46,220.9	281,270.4	457
1968	42,790.6	103,339.5	1,758.3	32,329.0	180,217.3	292
1969	20,339.9	52,590.7	2,264.3	23,413.1	98,608.0	160
1970	28,785.3	54,062.0	1,401.8	18,347.9	102,597.0	166
1971	26,437.3	76,861.1	1,240.1	19,449.9	123,988.4	201

1/ Includes ready to use 1960-71 and raw materials after 1965.
2/ Includes tools, machinery and tractors.
3/ Index: 1960-62 = 100.

Source: Comercio Exterior del Banco Central and Ministry of Agriculture

Thus, the peak year of 1967 registered an aggregate index of 457 compared to the 1960-62 base, but by 1971, import values were less than half those in 1967. Although 1967 was the year of greatest total value of input imports, this was due largely to very high levels of insecticide imports. In total, these chemicals accounted for over 70 percent of all agricultural inputs imported in that year (Table 58). Fertilizer imports reached a peak in 1968 while seed and machinery imports reached record highs in 1969 and 1965 respectively.

Of interest is the great year to year variation in individual as well as total input imports. In general this is accounted for by the conditions relating to cotton production and world cotton prices. Cotton is by far the single largest consumer of modern inputs (Table 59). At no point between 1960 and 1971 did cotton utilize less than 72 percent of the nation's total supply of agricultural chemicals (fertilizer herbicides and insecticides) and during the peak cotton years of 1965 and 1966, over 87 percent of these inputs were applied to that crop. Thus, a very direct relationship exists between the economic status of cotton and the importation and use of not only agricultural chemicals, but also machinery (cotton seed is produced domestically).

In further reference to data in Table 59, it can be noted that some shift occurred in the mix of crops accounting for the bulk of all agricultural chemical use between 1960

TABLE 58

NICARAGUA: IMPORTS OF AGRICULTURAL INPUTS, 1960-71 (IN PERCENT)

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	Total
Fertilizers	13.6	16.9	15.6	14.9	16.1	18.1	12.8	13.0	23.7	20.6	28.0	21.3	17.6
Insecticides[1/]	55.5	52.6	49.7	47.6	32.8	47.3	58.3	70.4	57.0	53.3	52.7	62.0	55.4
Seed	0.4	0.3	0.2	0.2	0.1	0.3	0.1	0.1	1.0	2.3	1.4	1.0	0.6
Tools, Equipment and Tractors	30.5	30.2	34.5	37.3	51.0	34.3	28.8	16.5	18.0	23.8	17.9	15.7	26.3
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Includes chemicals for insecticide production

SOURCE: Cuentas Nacionales, Banco Central De Nicaragua

TABLE 59

NICARAGUA: PERCENT OF AGRICULTURAL CHEMICALS CONSUMED BY CROP ACTIVITY, 1960-71

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Export Crops	87.8	88.1	87.7	89.1	91.8	92.0	90.6	88.5	84.4	80.3	77.9	78.0
Sesame	0.1	0.2	0.3	0.4	0.2	0.1	0.1	0.3	0.5	0.5	0.5	0.5
Cotton	80.3	80.3	79.9	80.4	85.3	87.1	87.1	84.4	79.6	75.1	72.0	72.0
Cane	5.3	5.0	5.1	6.1	4.5	3.4	2.1	2.0	2.2	2.7	3.2	3.3
Coffee	2.0	2.4	2.1	1.9	1.4	1.0	0.9	0.8	0.9	1.0	1.1	1.0
Tobacco	0.1	0.2	0.3	0.3	0.4	0.4	0.4	1.0	1.2	1.0	1.1	1.2
Food Crops	6.3	6.6	6.5	6.3	5.3	5.5	7.2	9.1	13.1	16.8	18.9	18.9
Rice	1.5	1.9	2.5	2.8	2.3	1.8	2.4	4.1	5.6	7.9	9.4	9.5
Beans	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.4
Corn	3.6	3.4	3.3	3.0	2.6	3.2	4.2	4.2	6.4	7.7	8.2	8.3
Sorghum	0.9	1.0	0.4	0.2	0.1	0.2	0.3	0.5	0.7	0.8	0.8	0.7
Other Crops[1/]	5.9	5.3	5.8	4.3	2.9	2.5	2.2	2.4	2.5	2.9	3.2	3.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1/] Other crops include bananas and peanuts

SOURCE: Cuentas Nacionales Banco Central De Nicaragua

and 1971. During early years of the series, export crops utilized about 88 percent of all chemicals, while in the latter part of the period, two basic grains, corn and rice together accounted for nearly 18 percent of these inputs. However, in spite of a long term shift in the mix of crops other than cotton utilizing the bulk of all agricultural chemicals, the value of these inputs per manzana remained very low.

In 1971, rice and corn were the second and third largest consumers of chemicals, yet this amounted to only 468.20 and 39.90 cordobas expended per manzana for fertilizers and insecticides (Table 60). On a per manzana basis, the use of agricultural chemicals on other crops was practically insignificant. To a very great extent, these figures explain the very low yields of most Nicaraguan crops noted previously in this report. Only cotton yields compare favorably with yields in other countries and the relationship between yields and input use is exceedingly evident observing data in the tables in this section.

The use of another important modern input-improved seeds-is also very limited in the production of Nicaraguan crops except for improved cotton seed. The value of all imported seeds has not exceeded 2.3 million cordobas (1969) and in most years since 1960, the total value of imported seed has been but a fraction of this amount (Table 57). Further, with the exception of cotton, other crops have received little

TABLE 60

NICARAGUA: DOMESTIC CONSUMPTION OF
AGRICHEMICALS PER MANZANA
BY CROPS, 1960-71
IN CORDOBAS

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Export Crops												
Cotton	741.60	976.10	1089.90	1012.00	846.[illegible]	976.80	1033.30	1522.40	933.40	484.70	639.60	940.50
Sesame	3.80	9.90	28.40	56.60	32.90	17.60	19.40	66.00	86.10	39.80	42.00	63.30
Cane	190.60	189.50	259.80	340.70	214.50	206.40	180.80	244.90	159.50	80.10	101.40	122.20
Coffee	15.90	20.20	25.00	25.00	19.20	17.20	16.80	24.00	17.00	9.60	12.20	14.80
Tobacco	138.60	300.90	651.30	735.80	1147.30	1302.00	983.60	2953.60	1940.60	896.40	1027.80	1334.00
Basic Grains												
Rice	44.10	61.70	107.80	146.60	122.60	120.30	175.90	482.50	406.00	284.30	360.70	468.20
Beans	4.70	5.50	6.70	8.40	8.00	9.70	9.70	14.60	11.80	5.70	8.30	8.10
Corn	17.20	18.00	23.30	27.80	18.50	27.50	36.20	57.80	48.30	27.00	30.80	39.90
Sorghum	10.20	13.70	7.50	4.20	2.80	6.30	9.50	26.91	23.00	12.30	13.70	15.60

SOURCE: Censo Nacional Agropecuario 1971

attention in the seed producing programs of the Ministry of Agriculture. Only an average of about 10,000 hundredweight of corn seed was produced annually between 1968 and 1971 by the Ministry, enough to plant not more than perhaps 10 percent of the Nicaraguan corn acreage (Table 61). Imported seed raised the percent of corn acreage planted with improved seed to an estimated 16 percent of the planted area.

For two other important food grain crops--grain sorghum and edible beans--Ministry seed production was essentially insignificant (rice seed is imported from neighboring countries). Again, the relationship between yields and the use of modern inputs is blatant. Over 90 percent of all cotton acreage is planted with certified seed, while most other crops are planted with seed from the producer's previous harvest. The impact of planting inferior seed is well established. Poor genetic potential, diseases and susceptablity to pests are perpetuated by this practice and germination levels are frequently so low that seeding rates must be markedly increased in order to establish adequate stands. This latter fact alone reduces the amount of product which is available for consumption, since a substantial part of the harvest must be saved back for the next season's planting.

TABLE 61

NICARAGUA: DOMESTIC PRODUCTION OF IMPROVED SEED, 1965-71 (IN HUNDREDWEIGHT)

Year	Corn	Grain Sorghum	Edible Beans	Cotton
1965	---	---	58	57,531
1966	---	---	71	71,264
1967	---	91	81	81,976
1968	3,417	238	47	47,322
1969	13,879	549	48	48,108
1970	12,794	195	75	74,917
1971	11,371	339	100	100,304

Source: Ministerio de Agricultura

Structure of Modern Input Use

The 1971 Agricultural Census provided important insights into the use of agricultural chemicals by farm size and region (Tables 62 and 63). In aggregate, less than 8 percent of the nation's farms use both fertilizer and insecticides. Fertilizer alone is used on but 2.7 percent of all farms while insecticides are utilized on 14.3 percent of the farms.

The use of chemical inputs varies notably with size of farm. As a general statement, there is a very strong relationship between farm size and chemical use with a higher percentage of larger farms using these inputs. This is especially evident considering the figures for the two smallest and two largest size stratas. Although farms of less than 5 manzanas account for nearly 32 percent of the farms in the six major producing regions, less than 700 of the more than 27,000 units utilize fertilizer. A not dissimilar relationship exists for pesticide use. Of the 670 farms greater than 1,000 manzanas, 43 use fertilizer even though most of these units are devoted to livestock production. Further, in total, nearly two-fifths of these farms use insecticide.

Although no data were available regarding agricultural chemical use by type of farm, data in Table 63 provide some insights into use of these inputs. The North Pacific region had the highest percentage of farms using both fertilizer and insecticides while the North Interior region had the lowest percentage of chemical using farms. Cotton production

TABLE 62

NICARAGUA: PERCENT OF FARMS USING AGRICHEMICALS BY FARM SIZE, 1971

	Fertilizer[1/]	Insecticide[2/]	Fertilizer Insecticide
Total	2.7	14.3	7.6
<1	1.3	7.3	3.7
1 - 5	2.8	14.5	7.6
5 - 10	3.6	17.5	9.9
10 - 20	3.7	17.7	10.3
20 - 50	2.5	12.1	6.7
50 - 100	2.0	11.1	5.5
100 - 200	2.8	18.1	8.3
200 - 500	4.2	26.2	12.6
500 - 1000	5.0	34.9	17.1
1000 - 2500	6.7	33.2	20.0
2500 +	5.6	42.4	15.3

[1/] Includes chemical and organic fertilizer.

[2/] Includes insecticides, fungicides and herbicides.

Source: Censo Nacional Agropecuario, 1971.

TABLE 63

NICARAGUA: PERCENT OF FARMS USING AGRICHEMICALS BY REGION, 1971

	Fertilizer[1/]	Insecticides[2/]	Fertilizers Insecticides
Total Republic	2.7	14.4	7.6
Pacific North	5.7	27.9	17.1
Pacific Central	4.0	20.9	11.1
Pacific South	2.3	21.0	9.4
Interior North	0.8	3.6	1.5
Interior Central	1.9	8.1	4.3
Interior South	.3	5.8	.9

1/ Includes chemicals and organic fertilizers.

2/ Includes insecticides, fungicides and herbicides.

Source: Censo Nacional Agropecuario, 1971.

is concentrated in the former region and is grown on relatively large farms, while the latter region produces largely basic grain crops. Average farm size in the North Pacific is nearly double that of the North Interior.

Very limited data were available for mechanized equipment. Census data indicate that some 3,577 tractors were in use in 1971, with over 60 percent of these located in the major cotton and sugar cane producing areas. Informed opinion has expressed the view that the number of tractors in use in the country has declined over the past several years, particularly in areas outside of the cotton and cane production regions. This has been due to the fact that imports have not been sufficiently great to replace those lost from service due to age. Thus, the average age of the nation's tractor stock has declined over the past few years, especially since the peak cotton years of the mid-1960's.

To summarize this section on modern inputs, some data from the National Agricultural Survey by UNASEC is presented. These data show a number of very significant relationships in regard to different levels of modern input usage on Nicaraguan farms. All data are derived from sample surveys rather than from aggregated census information.

Table 64 shows the relationship between yields and three technology levels for five different crops, including the four basic grains plus coffee. These data are highly significant in that they clearly establish the impact of the use of modern inputs on agricultural yields. As can be

TABLE 64

NICARAGUA: TECHNOLOGY LEVELS, PURCHASED INPUTS[1] AND YIELDS[2] FOR SELECTED CROPS, 1971

Tech. Level / Crop	Corn	Grain Sorghum	Rice (Upland)	Edible Beans	Coffee
Traditional (1)					
Purchased Inputs	4.7%	7.5%	11.0%	13.5%	2.9%
Yield	15.12	14.0	25.92	10.49	46.0
Cost of Prod./QQ	21.60	22.39	21.75	43.17	22.13
Intermediate (2)					
Purchased Inputs	17.5%	16.5%	25.4%	21.1%	19.6%
Yield	24.17	24.5	30.28	12.59	60.2
Cost of Prod./QQ	23.69	23.64	28.27	45.23	23.21
Modern (3)					
Purchased Inputs	24.3%	24.3%	28.2%	27.5%	33.5%
Yield	42.64	34.1	50.38	25.00	154.0
Cost of Prod./QQ	19.71	25.60	23.71	28.68	26.00

[1] Expressed as percentage of total production costs.

[2] Hundredweight per manzana.

Source: Encuestra Nacional Agropecurio, 1971, UNASEC

noted, yields for the five crops increase sharply as purchased inputs (expressed as a percentage of total production costs) increase. Comparing yield levels between the traditional and modern technological levels, shows that corn yields rose 182 percent, grain sorghum 143 percent, rice 94 percent, edible beans 138 percent, and coffee yields increased 234 percent. Thus, on the average, yields much more than doubled for these five important crops with increased use of purchased inputs.

Of further interest is the relationship between different technology levels and per unit production costs. With the exception of edible beans, there was no statistically significant difference in per unit production costs between the three different technology levels. The case of beans having markedly lower production costs for technology level three may be due to the fact that the sample size for this technological level was very small. Thus, data for beans are not necessarily valid for the highest technological level.

The conclusions that can be drawn from these data are rather obvious. In general terms, yields are sharply affected with increases in the use of purchased inputs, while per unit production costs are relatively unaffected. Land and labor productivity consequently rise notably with increased modern input use without a resulting rise in per unit production costs.

Although an analysis of factor productivity under different technological levels was not complete at the time of writing, Table 65 provides some highly significant data for two of the nation's most important food crops, corn and beans plus incomplete, but interesting data for rice and grain sorghum. The Marginal Value Product of labor (MVP_L) is a measure of the contribution of the labor factor to output. In equilibrium, it would be expected that the average MVP_L would approximate the average wage rate level. Any significant deviation would imply that wage rates were either too high or too low or that excess or insufficient labor was being employed.

As can be noted from data in Table 65, the average MVP_L is lower than the average wage rate for all four crops. Only in the case of edible beans do the two averages approximate each other. The conclusion to be drawn is that for these four crops, labor is not "earning" the paid wage rate for the sampled farms.

For the two crops for which an analysis of the MVP_L by technological level was complete, rather significant results are indicated. Labor employed in corn production at the lowest technological level "earned" only 29 centavos per day compared to the paid wage rate of 5.99 cordobas per day. However the MVP_L at the highest technological level exceeded the wage rate by more than fifty percent. The case of edible beans parallels that of corn, except for the magnitude of the differences.

TABLE 65

NICARAGUA: MARGINAL VALUE PRODUCTS OF LABOR AND AVERAGE WAGE RATES FOR SAMPLE CORN AND BEAN FARMS, 1971

Crop	Margin Value Product of Labor (cordobas)				Average Wage Rate in cordobas
	Sample Average	Technology Level			
		1	2	3	
Corn	0.0	.29	negative	9.13	5.99
Beans	5.25	3.85	7.10	--	6.27
Rice	.36	--	--	--	5.90
Grain Sorghum	.89	--	--	--	5.44

Source: Nicaraguan Production Costs and Returns Analysis, University of Missouri, 1974.

The direct implications of these findings are that at high technological levels, more labor could be productively employed in corn and bean production and/or a higher wage rate could be paid to labor. Given the serious concern with rural income and employment in Nicaragua, as well as production insufficiencies, there remains no question that increased use of modern inputs is one means of increasing the level of labor employed, the wage rate as well as aggregate output.

This conclusion is further validated by data shown in Table 66. As is apparent, output per manday is markedly different comparing farms in the lowest and highest technological levels. The average laborer produces four times more beans per day employed on high level technology farms as does his counterpart on low level technology farms. For the other crops average output per manday is nearly tripled when comparing the lowest and highest levels of technology.

Although it might be expected that higher technology levels would utilize less labor per manzana, the data indicate that such is not necessarily the case. No significant difference can be noted in mandays of labor use between different technology levels for corn and grain sorghum. For beans and rice, the picture is somewhat mixed. A review of the basic data indicates that sample sizes for technological level three were very small for these two crops. Further, the sample farms in this category were large (greater than

TABLE 66

NICARAGUA: DAYS OF LABOR EMPLOYED AND OUTPUT PER MANDAY UNDER THREE TECHNOLOGICAL LEVELS FOR CORN, BEANS, RICE AND GRAIN SORGHUM, 1971

	Corn	Beans	Rice	Grain Sorghum
Tech. Level	Labor Days per Manzana			
1	36.1	44.6	70.0	38.6
2	43.5	40.2	91.9	41.4
3	40.1	26.0	41.2	42.0
av.	39.9	42.5	71.3	40.0
	Output in Hundredweight per Manday			
1	.42	.24	.38	.36
2	.56	.31	.34	.59
3	1.06	.96	1.22	.81
av.	.55	.27	.47	.50

Source: Nicaraguan Production Costs and Returns Analysis, University of Missouri, 1974

10 manzanas for beans and over 100 manzanas for rice) and were highly mechanized. This would imply that for these two crops, capital is substituting for labor on large producing units. Given the size of the farms in the highest technological level, this could well be expected.

Despite the fact that to some degree capital may substitute for labor as the level of technology advances, (at least for perhaps rice and beans), the previous comments remain valid since farm size is not held constant. For small producing units, mechanization is neither practical (small fields) or economically feasible (high fixed costs). Fertilizer, pesticides and improved seeds, however, are infinitely divisible inputs and scale of production is relatively unimportant. This suggests that policy measures should emphasize non-mechanical technology. This is not a profound conclusion. But what is of significance is that labor and land productivity is increased to such a degree in Nicaragua when technology levels are advanced. Non-traditional inputs must therefore be the basis for any program which has the objectives of reducing unemployment, increasing rural income and raising aggregate agricultural production.

IV

COST OF PRODUCING FARM PRODUCTS

This section presents production costs and returns for the major activities of Nicaraguan Agriculture. The primary purpose was to record and analyze the cost structure for each activity and to develop detailed enterprise budgets in order to facilitate resource adjustments to improve the level of farm income and employment as well as to increase aggregate output. The analysis utilizes the same groups of activities as in previous sections, ie., basic grains, export crops and livestock. The nine crops account for an estimated 90 percent of the total value of crop production in Nicaragua. Cotton is the leading cash crop accounting for over 50 percent of the total value of agricultural exports. Coffee also contributes to foreign exchange earnings as does sugar, sesame and tobacco.

There is no distinct dividing line between export crops and food crops. Rice until recently considered a subsistence food crop, has emerged as an export crop and has the potential to fill the rice requirements of Central America. This crop is highly adapted to mechanization and is produced at a higher level of technology than the other food crops. Corn is the principal crop of Nicaraguan subsidence agriculture and is the basis of the daily diet for the majority of the people. It is estimated that one third of the daily

caloric intake comes from corn. Beans also make up a basic part of the diet and are an important source of protein. Grain sorghum has been grown in Nicaragua primarily for livestock feed, but is becoming more important for human consumption. Food crop yields remain relatively low and the increase in the land area devoted to the crops is largely responsible for the total increase in production of these crops.

The basic data were taken from farm surveys. The number of farms in each area was determined by census information from the National Census Office. The study sample was selected by interval and by crop at the county (municipio) level and production information was obtained by field survey during the last half of 1972 for the 1971-72 crop year. These farms were classified by farm size (area cultivated), technology level and natural resource area.

The area in manzanas under cultivation was used in determining the size classification. The size stratification refers to the area under cultivation and not necessarily to the size of the farm although this classification is intended to analyze the economics of farm size. The size stratification also varied among crops. Export crops were generally produced on larger farms than the food crops.

Production costs for the various levels of technology were presented for each crop where possible. The technology levels were defined as:

1. Traditional technology--Farms that used very limited commercial inputs and engaged in a traditional

system of agriculture with little or no investment in farm equipment.

2. Intermediate technology--Farms that did not use technology at the optimul level but make intermediate combinations with the use of some modern commercial inputs as well as animal and mechanical energy inputs.
3. Optimum technology--Farms that used the most adequate technology available for the activity under study.

The optimum level of technology indicates the present level of technology achieved by a relatively small number of good farmers in each crop activity.

Technological dualism is evident in Nicaraguan agriculture. The production of cotton, the major cash crop, is carried out on a large scale that can support a high level of technology. Production costs for cotton, tobacco and sugarcane are presented in this study for one level of technology. Production costs for the food crops, coffee and sesame are presented for three levels of technology.

Food crops are generally grown on the least productive land. For these activities, costs are presented for the various levels of ecology. The ecological level refers to the land classification and is defined as:

p--optimum--the most productive soils suitable for intensive crop use.

b--good--moderately productive soils suitable for more extensive crop use.

m--marginal-- soils of low productivity suitable for extensive use only.

IV. COST OF PRODUCING FARM PRODUCTS

Production Cost Requirements

In calculating the production cost for each crop, detailed information from the field survey was used. Only costs are presented and not the physical inputs, with the exception of average labor inputs for each classification. Variable costs include the value of the factors of production and are based on information supplied by the farmer. In some cases the breakdown of the cost of purchased inputs varied with each crop. Chemical expenses are aggregated for some crops and for others detailed costs are presented. Fixed labor costs include the cost of full time management and workers and in some cases include the value of fixed family labor. The model used in the production analysis is defined in the appendix.

Costs and Returns for Individual Crops

Cotton

Cotton production is concentrated in the Pacific regions where the coastal plains are relatively level. Rainfall is sufficient but poorly distributed, yet cotton has not been intensively irrigated. In 1971 cotton farms totaled 2,888 and area under cotton cultivation was 136,286 manzanas, (Table 67). The Pacific North and Central regions accounted for 98 percent of the total number of farms, area and production. There was a relatively large number of small farms, however most of the cotton production takes place on large farms under

TABLE 67

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR COTTON BY FARM SIZE AND REGION, 1971

	Number Farm	Percent	Area	Percent	Production	Percent	Yields
Total Republic	2,888	100.00	136,286	100.00	1,736,523	100.00	12.7
1	22	.76	22	.01	169	.01	7.7
1-5	341	1.18	631	.46	3,902	.22	6.1
5-10	427	14.78	1,492	1.09	11,679	.67	7.8
10-20	500	17.31	3,317	2.43	24,755	1.42	7.4
20-50	534	18.49	6,444	4.72	51,970	2.99	8.0
50-100	342	11.84	10,106	7.41	77,648	4.47	7.6
100-200	296	10.24	19,556	14.34	227,064	13.07	11.6
200-500	278	9.62	44,917	32.95	602,777	34.71	13.4
500-1000	94	3.25	25,283	18.55	307,010	17.68	12.1
1000-2500	44	1.52	16,042	11.77	246,456	14.19	15.3
2500+	10	.34	8,476	6.21	183,093	10.54	21.6
Pacific North	2,642	91.48	110,650	81.19	1,519,126	87.48	13.7
Pacific Central	190	6.50	23,110	16.95	195,507	11.25	8.4
Pacific South	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Interior North	3	.10	46	.03	502	.03	10.9
Interior Central	53	1.83	2,480	1.82	21,387	1.23	8.6
Interior South	. . .	. . .	. . .	. . .	. . .	. . .	. . .

Source: UNASEC. Censo Nacional Agropecuario 1971 and Cuentas Nacionales, Banco Central De Nicaragua

improved cultural methods and 90 percent of the total cotton production was on farms larger than 100 manzanas. Fertilizer is a relatively important input but insecticides account for one quarter of the total cost of production. In some areas intensive use of insecticides have disturbed the biological balance of the area.

The average total cost of inputs to cotton production and the cost variations by regions are shown in Table 68. Production cost by size strata are shown in Table 69. Average total costs were C$179.61 per manzana. The distribution of these costs to variable and fixed costs was 72 percent and 28 percent respectively. Table 68 shows that among the factors of production, purchased inputs accounted for the largest expenditure or slightly over 40 percent of the total cost, the largest charge going to insecticides and fertilizer. Total labor charges (fixed and variable) were 31 percent of the total budget. Animal energy was not used on these sample farms but average machine energy cost were 8 percent of total cost. Land charges accounted for 12.5 percent of the cost.

Regional cost comparison indicate that total costs varied about 12 percent with costs slightly higher in the Pacific regions than in the Interior regions. There was some variation in individual factor costs, however, these variations were of relatively minor significance.

TABLE 68

NICARAGUA: PRODUCTION COSTS FOR COTTON BY REGION

Item	Total Cost	Total Percent	Pacific North Cost	Pacific North Percent	Pacific Central Cost	Pacific Central Percent	Interior North Cost	Interior North Percent	Interior Central Cost	Interior Central Percent
Total Cost	1796.61	100.0	1892.44	100.0	1812.76	100.0	1690.47	100.0	1759.98	100.0
Variable Cost	1294.04	72.0	1325.88	70.1	1357.31	74.9	1182.17	69.9	1280.01	72.7
Labor	352.44	19.6	397.59	21.0	379.70	20.9	298.98	17.7	333.49	18.9
Machine Energy	144.96	8.0	134.24	7.1	160.73	8.9	113.55	6.7	171.33	9.7
Purchased Inputs	726.86	40.5	729.84	38.5	750.66	41.4	713.81	42.2	713.13	40.5
Seed	27.95	1.5	29.70	1.5	28.96	1.6	24.78	1.4	28.36	1.6
Fertilizer	142.71	7.9	154.14	8.1	154.26	8.5	140.68	8.3	121.76	6.9
Insecticide	450.74	25.1	423.81	22.4	481.16	26.5	402.53	23.8	495.47	28.2
Herbicides	6.15	0.4	8.22	0.4	0.55	. . .	15.83	0.9	. . .	. . .
Other	99.31	5.5	113.97	6.1	85.73	4.7	129.99	7.7	67.54	3.8
Interest	69.80	3.8	64.21	3.4	66.77	3.7	58.83	3.4	52.06	3.5
Fixed Cost	502.57	28.0	566.56	29.9	455.45	25.1	508.30	30.1	479.97	27.3
Land	223.69	12.5	284.00	15.0	222.53	12.3	159.21	9.4	229.03	13.0
Labor	204.39	11.4	195.23	10.3	172.06	9.5	263.93	15.6	186.34	10.6
Depreciation	74.49	4.1	87.33	4.6	60.86	3.3	85.16	5.0	64.60	3.7
Gross Income	2022.66		2022.66		2022.66		2022.66		2022.66	
Net Farm Income	728.62		696.78		665.35		840.49		742.64	
Gross Margin	226.05		130.22		209.90		332.19		262.68	
Rate of Return--Invest.	12.6		6.8		11.6		19.6		14.9	
Rate of Return--Work. Cap.	17.4		9.8		15.5		28.1		20.5	
Yield/MZ	35.66		35.66		35.66		35.66		35.66	
Price/QQ	56.72		56.72		56.72		56.72		56.72	
Cost/QQ	50.38		53.06		50.83		47.40		49.35	
Total Labor Requirements	42.6		61.1		56.4		14.8		38.2	

Source: UNASEC, Encuestra Nacional, Agropecuaria, 1971

TABLE 69

NICARAGUA: PRODUCTION COSTS FOR COTTON BY FARM SIZE

	0-50 MZ		50-300 MZ		+300 MZ	
	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	1561.94	100.0	1901.14	100.0	1852.79	100.0
Variable Cost	1108.57	71.0	1391.26	73.2	1308.70	70.6
Labor	336.47	21.5	379.80	20.0	331.06	17.8
Machine Energy	93.30	6.0	175.33	9.2	116.25	6.3
Purchased Inputs	621.75	39.7	760.37	40.0	799.07	43.1
Seed	28.48	1.8	27.16	1.4	28.21	1.5
Fertilizer	137.98	8.8	140.31	7.3	149.84	8.1
Insecticide	424.19	27.1	470.35	24.7	457.70	24.7
Herbicide	1.19	. . .	2.10	0.1	15.75	0.8
Other	29.41	1.9	120.45	6.3	148.07	8.0
Interest	59.55	3.8	75.76	4.0	62.32	3.4
Fixed Cost	453.37	29.0	509.88	26.8	544.09	29.4
Land	210.17	13.5	221.91	11.7	239.00	12.9
Labor	197.19	12.6	199.85	10.5	215.76	11.6
Depreciation	46.01	2.9	88.12	4.6	89.23	4.8
Gross Income	1870.00		2052.00		2146.00	
Net Farm Income	761.43		660.74		837.30	
Gross Margin	306.06		150.86		293.21	
Rate of Return--Invest.	19.6		7.9		15.8	
Rate of Return--Working Cap.	27.6		10.8		22.4	
Yield/MZ	34.00		36.00		37.00	
Price/QQ	55.00		57.00		58.00	
Cost/QQ	46.00		52.80		50.07	
Total Labor Requirements	57.2		44.7		30.7	

Source: UNASEC, Encuestra Nacional Agropecuario 1971

Yields showed no variation by region, indicating that cotton producers have generally adopted the most modern cultural practices available to them. At the present level of technology, lower per unit production cost can be obtained by eliminating non-essential costs. Total costs were lowest in the Interior North region, yielding returns two and one half times higher than the Pacific North region which had the highest production costs.

Labor requirements averaged 42.6 mandays per manzana with a regional variation of 14.8 to 61.1 mandays; however, it is the author's opinion that the labor requirements for the Interior North were grossly underestimated. In this region family labor was a significant input and the labor time may not have been accurately recorded.

There was a larger variation in costs by size class than by region (Table 69). Farms in the less than 50 manzana category recorded total costs 20 percent less than farms of 50-300 manzanas in size. Average yields increased slightly with size class as did the value of the crop. Per unit cost of production was lower in the smallest size category and the gross margin in the two extreme size categories was significantly higher than that of farms in the 50-300 manzana category.

Labor requirements decreased with increasing farm size; however it is again estimated that the recorded labor requirements in the larger size classification were understated due to the lack of accurate accounting records.

Sugarcane

The sugar industry in Nicaragua is relatively modern. About half of the sugarcane is produced on larger commerical farms located near sugar mills that promote efficient cultural practices. Some sugarcane is used for home consumption in the form of crude sugar and/or for livestock feed.

The structure of sugarcane farms is shown in Table 70. Over three-fourths of total production is on a small fraction (3.3 percent) of the farms. Nearly 50 percent of the farms were between 20 and 50 manzanas; however these farms accounted for only 8 percent of the land area and 6 percent of the total production.

Regionally, the Pacific North accounted for 70 percent of total production with slightly over 13 percent of the farms. The largest concentration of farms was in the coastal regions (73.6 percent). However, with smaller average farm size and lower yields, these regions accounted for less than 5 percent of total production.

Table 71 shows the costs and returns for the three size categories of sugarcane farms surveyed. Total cost per manzana increased significantly with the larger classes. Variable cost averaged 88 percent of the total cost. Purchased inputs averaged over one-third of the total cost with the expenditures for chemicals increasing with farm size. Labor requirements averaged 30.5 mandays per manzana. Total labor cost averaged 24 percent of the total budget but decreased in relative importance with increased farm size.

TABLE 70

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR SUGARCANE BY FARM SIZE AND REGION, 1971

	Number of Farms	Percent	Area	Percent	Production	Percent	Yield
Total Republic	3,836	100.00	46,381	100.00	38,964,450	100.00	841.2
1	41	1.06	17	.03	12,568	.03	939.3
1-5	280	7.30	194	.41	91,773	.23	473.0
5-10	247	6.43	252	.54	133,856	.34	531.2
10-20	361	9.41	385	.83	187,331	.48	486.6
20-50	984	25.65	1,513	3.26	919,788	2.36	607.9
50-100	929	24.21	2,211	4.76	1,296,232	3.32	586.3
100-200	562	14.65	2,683	5.78	2,007,932	5.15	748.4
200-500	302	7.87	4,413	9.51	3,746,290	9.61	848.9
500-1000	68	1.77	2,935	6.32	2,650,647	6.80	903.1
1000-2500	44	1.14	7,595	16.37	6,389,218	16.39	841.2
2500+	18	.46	24,120	52.00	21,528,815	55.25	892.6
Pacific North	505	13.16	28,829	62.15	27,435,340	70.41	951.7
Pacific Central	321	8.36	8,683	18.72	6,607,200	16.95	760.9
Pacific South	184	4.79	4,157	8.96	3,077,740	7.89	740.4
Interior North	670	17.46	547	1.18	195,340	.50	357.1
Interior Central	1,495	38.97	3,667	5.75	1,475,160	3.78	402.3
Interior South	661	17.23	435	.93	173,620	.44	399.1

Source: UNASEC Censo Nacional Agropecuario, 1971 and Cuentas Nacionales Banco Central De Nicaragua

TABLE 71

NICARAGUA: PRODUCTION COSTS FOR SUGARCANE BY FARM SIZE

	Total		-70MZ		70-150MZ		+150MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	1551.41	100.0	1189.72	100.0	1504.60	100.0	1959.92	100.0
Variable Cost	1366.08	88.1	1003.27	84.3	1383.47	92.0	1711.51	87.3
Labor	332.16	21.4	322.48	27.1	300.00	19.9	374.00	19.1
Animal Energy	14.70	0.9	44.10	3.7	. . .	. . .	. . .	. . .
Mechanical Energy	423.24	27.3	165.00	13.9	588.73	39.1	516.00	26.3
Purchased Inputs	530.51	34.2	423.94	35.6	428.17	28.5	739.44	37.7
Seed	105.60	6.8	105.60	8.9	105.60	7.0	105.60	5.4
Fertilizer	160.54	10.3	107.00	9.0	160.56	10.6	214.08	10.9
Insecticide	32.86	2.1	. . .	. . .	49.29	3.3	49.29	2.5
Herbicide	88.26	5.7	. . .	. . .	112.68	7.5	152.11	7.7
Other	143.19	9.2	211.27	17.7	. . .	. . .	218.31	11.1
Interest	65.46	4.2	47.75	4.0	66.61	4.4	82.02	4.2
Fixed Cost	185.33	11.9	186.45	15.7	121.13	8.0	248.41	12.7
Land	105.63	6.8	105.63	8.8	105.63	7.0	105.63	5.4
Labor	35.76	2.3	80.62	6.8	15.50	1.0	11.17	0.5
Depreciation	43.87	2.8	. . .	. . .	. . .	. . .	131.61	6.7
Gross Income	1843.33		1400.00		1750.00		2380.00	
Net Farm Income	477.25		396.73		366.53		668.49	
Gross Margin	291.92		210.28		245.40		420.08	
Rate of Return-Investment	18.8		17.6		16.3		21.4	
Rate of Return Working Cap.	21.3		20.9		17.7		24.5	
Yield/MZ	1053.33		800.00		1000.00		1360.00	
Yield/QQ	1.75		1.75		1.75		1.75	
Cost/QQ	1.47		1.48		1.50		1.44	
Total Labor Requirements/MZ	30.5		34.9		25.3		31.4	

Source: Encuestra Nacional Agropecuaria, 1971

Farms in the less than 70 manzana size class used a combination of animal and mechanical energy; machine energy charges in this size class were 60 percent less than the machine energy cost for all farms combined. Machine energy costs on farms larger than 70 manzanas exceeded the cost of labor and were three times higher than on farms of less than 70 manzanas.

The increasing intensive nature of farming on the larger size farms is reflected in the increase in yields and returns per manzana. Yields increased 70 percent and the gross margin doubled through the size classes. There was also a significant increase in labor productivity per manday with increasing size.

Coffee

Table 72 illustrates the structure of coffee production. Nearly 85 percent of the coffee farms were less than 10 manzanas while two-thirds of the total production was of farms between 10 and 200 manzanas. Regionally, 40 percent of the farms were in the Interior Central region, while the Pacific Central and Interior North each had about 23 percent of the farms. These three regions accounted for 92 percent of the total production.

Table 73 shows the average cost of coffee production and the regional variations in these costs. Variable cost accounted for about 80 percent of total cost. Labor was the

TABLE 72

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR COFFEE BY FARM SIZE AND REGION, 1971

	Number of Farms	Percent	Area	Percent	Production	Percent	Yield
Total Republic	17,744	100.00	150,027	100.00	927,935	100.00	6.2
1	3,314	18.67	2,354	1.57	12,487	1.34	5.3
1-5	9,663	54.45	19,716	13.14	100,841	10.86	5.1
5-10	2,053	11.57	12,873	8.58	87,057	9.38	6.8
10-20	1,188	6.69	14,996	9.99	117,260	12.63	7.8
20-50	848	4.78	24,413	16.27	166,541	17.94	6.8
50-100	388	2.18	25,467	16.97	165,909	17.88	6.5
100-200	213	1.20	26,751	17.83	175,627	18.92	6.5
200-500	72	0.40	19,237	12.82	77,859	8.39	5.4
500-1000	4	0.02	2,846	1.89	11,783	1.27	4.1
1000-2500	1	. . .	1,374	0.91	12,571	1.35	9.2
2500+	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Pacific North	176	0.99	1,854	1.23	6,018	0.64	3.3
Pacific Central	3,970	22.37	49,336	32.88	392,904	42.34	7.9
Pacific South	145	0.81	1,779	1.18	8,124	0.87	4.6
Interior North	4,080	23.00	24,258	16.17	139,296	15.01	5.7
Interior Central	7,175	40.43	63,773	42.50	327,304	35.27	5.1
Interior South	1,914	10.78	8,961	5.97	54,020	5.82	6.0
C. North	20	0.11	39	0.02	269	0.03	6.9

Source: UNASEC Censo Nacional Agropecuario, 1971 and Cuentas Nacional Banco Central De Nicaragua

TABLE 73

NICARAGUA: PRODUCTION COSTS FOR COFFEE BY REGION

	Total Sample		Pacific Central		Interior Central	
	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	2044.55	100.0	1885.46	100.0	2399.59	100.0
Variable Cost	1646.63	80.5	1510.38	80.1	1875.49	78.2
Labor	933.10	45.6	753.99	40.0	1250.53	52.1
Machine Energy	3.71	0.2	5.77	0.3	. . .	. . .
Purchased Inputs	621.11	30.4	669.65	35.5	531.83	22.2
Seed	15.03	0.7	14.93	0.8	15.20	0.6
Fertilizer	405.92	19.9	446.52	23.7	332.93	13.9
Insecticides	13.71	0.6	18.11	1.0	5.80	0.2
Herbicides	50.07	2.4	50.88	2.7	46.60	2.0
Fungicide	17.67	0.8	20.88	1.1	11.90	0.5
Other	118.71	5.8	118.33	6.2	119.40	5.0
Interest	88.71	4.3	80.97	4.3	93.12	3.9
Fixed Cost	397.92	19.5	375.08	19.9	524.10	21.8
Land	92.85	4.5	100.00	5.3	80.00	3.3
Labor	263.58	12.9	231.08	12.3	407.14	17.0
Depreciation	41.49	2.1	44.00	2.3	36.96	1.5
Gross Income	3346.42		3130.00		3736.00	
Net Farm Income	1699.79		1510.39		1860.51	
Gross Margin	1301.87		1244.54		1336.41	
Rate of Return-Investment	63.7		66.00		55.7	
Rate of Return-Working Cap.	79.1		82.4		71.3	
Yield/MZ	91.68		86.63		100.76	
Price/QQ	36.50		36.13		37.08	
Cost/QQ	22.30		21.76		23.82	
Total Labor Requirements	168.9		150.9		201.1	

Source: UNASEC, Encuestra Nacional Agropecuaria, 1971

largest charge accounting for 58.5 percent of the total budget. Labor costs in the Interior Central region were as high as 69 percent of total cost. Labor requirements were 25 percent higher in the Interior Central than in the Pacific Central region.

Purchased inputs ranged from 22 percent to 35 percent of total cost in the two regions; the largest expenditure in this category went to fertilizer. It is significant to note that land changes were relatively low to total cost. Coffee is generally grown in the upland regions on sloping hillsides at higher elevation not adaptable to other crops. Also significant are the high labor requirements. Coffee production is not adapted to a high degree of mechanization and thus pre-harvest care and harvesting as well as soil and water conservation on the sloping topography requires hand labor.

The average rate of return over total cost was 63 percent. The gross margin in the Interior Central region was slightly higher than income in the Pacific Central region. However, the higher production cost in the Interior Central region resulted in a lower rate of return to investment in this region than in the Pacific Central region.

Total cost, gross income and yields increased with size class up to 200 manzanas then decreased slightly with farms above 200 manzanas (Table 74). Total cost, income and yields registered an increase of 250 percent from farm size

TABLE 74

NICARAGUA: PRODUCTION COSTS FOR COFFEE BY FARM SIZE

	1-20MZ		20-100MZ		100-200MZ		200-500MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	1219.84	100.0	2116.03	100.0	3256.17	100.0	2491.89	100.0
Variable Cost	358.85	29.4	1766.09	83.5	2944.91	90.4	2217.97	89.0
Labor	149.28	12.2	1121.64	53.0	1573.61	48.3	1521.47	61.1
Machine Energy	. . .	. . .	13.00	0.6	. . .	. . .	. . .	. . .
Purchased Inputs	185.25	15.2	537.23	25.4	1214.98	37.3	584.16	23.4
Seed	9.92	0.8	12.68	0.6	18.33	0.6	16.25	0.7
Fertilizer	113.33	9.3	318.43	15.1	886.66	27.2	352.41	14.1
Insecticides	. . .	. . .	18.25	0.9	30.00	0.9	7.25	0.3
Herbicides	42.00	3.5	64.25	3.0	27.33	0.8	59.00	2.4
Fungicides	. . .	. . .	17.37	0.8	30.66	0.9	71.50	0.8
Other	20.00	1.6	106.25	4.9	222.00	6.8	127.75	5.1
Interest	24.32	2.0	94.22	4.5	156.32	4.8	112.34	4.5
Fixed Cost	860.99	70.6	349.94	16.5	311.26	9.6	273.92	11.0
Land	93.33	7.6	90.00	4.3	100.00	3.1	90.00	3.6
Labor	701.86	57.5	212.44	10.0	198.40	6.1	141.21	5.7
Depreciation	65.80	5.4	47.50	2.2	12.86	0.4	42.71	1.7
Gross Income	1760.00		3260.00		4683.33		3610.00	
Net Farm Income	1401.15		1493.91		1738.42		1392.03	
Gross Margin	540.16		1143.97		1427.16		1118.11	
Rate of Return-Investment	44.3		54.1		43.8		44.9	
Rate of Return-Working Capital	150.5		64.7		48.5		50.4	
Yield/MZ	52.01		87.21		131.20		96.27	
Price/QQ	33.84		37.38		35.70		37.50	
Cost/QQ	23.45		24.14		24.81		25.88	
Total Labor Requirements	104.3		157.8		206.0		200.5	

Source: UNASEC, Encuestra Nacional Agropecuario, 1971

TABLE 75

NICARAGUA: PRODUCTION COSTS FOR COFFEE BY LEVELS OF TECHNOLOGY

	01		02		03	
	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	1018.05	100.0	1397.34	100.0	4004.03	100.0
Variable Cost	31.42	3.1	1136.70	81.3	3563.88	89.0
Labor	. . .	. . .	793.81	56.8	2036.93	50.9
Machine Energy	. . .	. . .	7.42	0.5	. . .	. . .
Purchased Inputs	29.93	2.9	274.26	19.6	1343.68	23.5
Seed	9.93	0.9	11.36	0.8	22.20	0.5
Fertilizer	. . .	. . .	154.64	11.1	920.18	23.0
Insecticides	. . .	. . .	9.85	0.7	24.60	0.6
Herbicides	20.00	2.0	36.28	2.6	81.40	2.0
Fungicides	. . .	. . .	7.85	0.5	38.90	0.9
Other	. . .	. . .	54.28	3.9	256.40	6.4
Interest	1.49	0.1	61.21	4.4	183.27	4.5
Fixed Cost	986.63	96.9	260.64	18.7	440.15	11.0
Land	90.00	8.8	94.28	6.7	92.00	2.3
Labor	824.63	81.0	148.86	10.6	284.80	7.1
Depreciation	72.00	7.1	17.50	1.3	63.35	1.6
Gross Income	1440.00		2214.28		5686.00	
Net Farm Income	1408.58		1077.58		2122.12	
Gross Margin	421.95		816.94		1681.97	
Rate of Return-Investment	41.4		58.5		42.0	
Rate of Return-Working Capital	1342.9		71.9		47.2	
Yield/MZ	46.00		60.20		154.00	
Price/QQ	31.30		36.78		36.90	
Cost/QQ	22.13		23.21		26.00	
Total Labor Requirements	130.1		112.1		274.7	

Source: UNASEC, Encuestra Nacional Agropecuario 1971

1-20 manzanas to farms in the 100-200 manzana category. Labor again was the dominant input. Fixed labor on farms in size class 1-20 manzanas accounted for 57.5 percent of total cost. Two thirds of the labor requirements in this category was family labor and was recorded as fixed labor in the field survey

Table 75 presents costs and returns for coffee production by levels of technology. All labor in the traditional (01) level of technology was family labor and accounted for 81 percent of the cost of production. Cash expenditures at this level were only 3 percent of total cost. There was an increase of 3[illegible] percent in total costs between technology levels 01 and 02, but total costs in technology level 03 was nearly 3 times that in the intermediate level of technology. Fertilizer accounted for 23 percent of the total cost in technology level 03. Insects and diseases are not a serious threat to coffee yields thus plant protectant chemicals accounted for only 3.5 percent of total cost in the optimum level of technology.

Due to increasing yields, gross income increased with each level of technology. Gross margin per manzana doubled with each level of technology. However, per unit production cost increased and there was a decrease in the productivity of labor between the intermediate and optimum level of technology.

Sesame

In 1971, 2,355 farms engaged in sesame cultivation and produced 103,539 hundredweight of sesame, (Table 76). Over 80 percent of the farms were less than 10 manzanas. These farms accounted for 60 percent of the total area in sesame production and produced 50 percent of the sesame.

The Pacific North was the dominant region in sesame production, accounting for 56 percent of the farms, 65 percent of the land area and 64 percent of total production. Production in the Interior regions was only slightly over 5 percent of the total production.

The following tables present production costs and returns for sesame. These costs are presented by region, size, and levels of technology and ecology.

Average total cost per manzana for the total sample was C$457.24, (Table 77). With variable costs accounting for 82 percent of total costs, labor costs were half of the variable cost. Animal energy costs accounted for nearly 18 percent of the total cost and was three times higher than machine energy cost. Purchased commercial inputs accounted for another 17 percent of total cost. Land was the dominat fixed cost while fixed labor and depreciation were only 1 percent of total cost. Average production for all sample sesame farms was 8 hundredweight per manzana. Income over total

TABLE 76

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR SESAME BY FARM SIZE AND REGION, 1971

	Number of Farms	Percent	Area	Percent	Production	Percent	Yield
Total Republic	2355	100.00	9561	100.00	103,539	100.00	10.8
1	13	0.55	3	0.03	22	0.02	7.3
1-5	1200	50.95	2928	30.62	24,384	23.55	8.3
5-10	710	30.14	2821	29.50	27,520	26.58	9.8
10-20	159	6.75	149	1.55	1,462	1.41	9.8
20-50	171	7.26	1778	18.59	20,761	20.05	11.7
50-100	73	3.10	748	7.82	8,553	8.26	11.4
100-200	. . .	. . .	. . .	. . .	. . .	. . .	. . .
200-500	29	1.23	1134	11.86	20,837	20.12	18.4
500-1000	. . .	. . .	. . .	. . .	. . .	. . .	. . .
1000-2500	. . .	. . .	. . .	. . .	. . .	. . .	. . .
2500+	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Pacific North	1325	56.26	6269	65.56	66,580	64.30	10.7
Pacific Central	324	13.80	1147	12.00	15,595	15.06	13.6
Pacific South	547	23.22	1512	15.81	15,095	14.58	9.9
Interior North	3	0.12	1	0.01	8	. . .	8.0
Interior Central	145	6.15	560	5.85	5,027	4.85	9.0
Interior South	11	0.46	72	0.75	834	0.80	11.5

Source: Censo Nacional Agropecuario 1971 and Cuentas Nacionales Banco Central De Nicaragua

TABLE 77

NICARAGUA: PRODUCTION COSTS FOR SESAME BY REGION

	Total Cost	Total Percent	Interior Central Cost	Interior Central Percent	Pacific Central Cost	Pacific Central Percent	Pacific North Cost	Pacific North Percent	Pacific South Cost	Pacific South Percent
Total Cost	457.24	100.0	269.64	100.0	606.93	100.0	473.21	100.0	449.41	100.0
Variable Cost	374.95	82.0	214.04	79.4	515.26	84.9	390.77	82.6	358.05	79.6
Labor	188.60	41.2	76.64	28.4	287.20	47.3	189.34	40.0	210.16	46.7
Animal Energy	81.66	17.0	111.64	41.4	35.33	5.8	81.53	17.2	80.09	17.8
Mechanical Energy	27.44	6.0	. . .	. . .	66.66	10.9	26.76	5.6	31.45	7.0
Purchased Inputs	64.67	16.9	25.52	9.5	105.83	17.4	80.07	16.9	23.12	5.1
Seed	9.59	2.1	10.20	3.7	6.33	1.0	9.52	2.0	10.45	2.3
Chemicals	46.52	10.2	. . .	. . .	79.50	13.1	60.57	12.8	12.67	2.8
Energy Repairs	0.54	0.1	. . .	. . .	. . .	. . .	0.83	0.2	. . .	. . .
Other	8.02	1.8	10.16	3.7	20.00	3.3	9.15	1.9	. . .	. . .
Interest	12.75	2.8	5.16	2.0	20.23	3.3	13.06	2.7	13.21	2.9
Fixed Cost	82.29	18.0	55.60	20.6	91.66	15.1	82.44	17.4	91.36	20.3
Land	77.72	17.0	54.00	20.0	91.66	15.1	76.25	16.1	89.54	19.9
Labor	1.61	9.4	. . .	. . .	. . .	. . .	2.47	0.6	. . .	. . .
Depreciation	2.94	0.6	1.60	0.6	. . .	. . .	3.72	0.7	1.81	0.4
Gross Income	541.75		449.35		676.66		445.67		861.38	
Net Farm Income	166.80		235.31		161.40		54.90		503.33	
Gross Margin	84.50		179.71		69.73		-27.53		411.96	
Rate of Return to Investment	18.5		66.6		11.5		-5.8		91.6	
Rate of Return to Working Cap.	22.5		83.9		13.5		-7.0		115.1	
Yield/MZ	8.00		7.46		9.66		6.51		12.69	
Price/QQ	67.72		60.23		70.04		68.46		67.88	
Cost/QQ	57.16		36.15		62.83		72.69		35.41	
Labor Requirements	37.0		29.7		45.3		32.3		53.5	

Source: Nicaraguan Production Costs and Returns Analysis, University of Missouri, 1974

cost was $85.50, yielding a rate of return over investment of 18.5 percent.

There was a considerable variation in total cost as well as in returns and yields per manzana by region. Total cost in the Pacific Central region was 225 percent higher than in the Interior Central. With the exception of the Interior Central region, labor was the dominant charge, accounting for over 40 percent of the total cost. Labor was only 28 percent of the total budget in the Interior Central region. Farms in the Pacific regions used a combination of animal and machine energy; however farms in the Interior Central used only animal energy which accounted for 41 percent of total cost. Land cost was the only significant fixed cost.

Comparing the returns for the four regions, gross margins were relatively high in the Interior Central and Pacific South, comparatively modest in the Pacific Central and negative in the Pacific North region. Moderate cost and high yields in the Pacific South resulted in an exceptionally high rate of return. In the Interior Central region, low land and labor costs contributed to a low cost per manzana. With below average yields and prices this resulted in a relatively high rate of return. The Pacific Central region returned a fair margin, but in general costs were high compared to yields. Poor yields in the Pacific North region resulted in negative returns.

Table 78 gives the factor costs for sesame production by farm size. A majority of the sample farms were less than 10 manzanas. Data presented for the single 100 manzana farm may not be representative for this size of production unit. Average sesame farm size is 4.4 manzanas. Discusssion will be limited to the three size classes under 20 manzanas.

Total cost per manzana varied less than ten percent among the three size classes. There was variation in some of the factor costs, although not significant, indicating that the majority of the sesame is produced under similar cultural methods. Labor costs accounted for the highest percentage of total cost. Animal energy cost decreased through the size classes while machine energy cost increased. There was nearly a 70 percent increase in expenditures for purchased inputs for farms in the size class of 10-20 manzanas over farms of less than 10 manzanas. Land was the dominant fixed cost but this cost decreased with increasing farm size. Depreciation was a significant cost in the 10-20 manzana category, indicating a greater capital investment on the larger sesame farms.

There was a greater variation in the value of the crop by size class than in total cost. Total cost exceeded gross income in size category 10-20 manzanas. Yields decreased with larger farm size. Table 78 indicates that there was a disparity between average price received by all sample farms and the price received on farms in the 10-20 manzana category.

TABLE 78

NICARAGUA: PRODUCTION COSTS FOR SESAME BY FARM SIZE

	1-4.9MZ		5-9.9MZ		10-20MZ		100MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	458.59	100.0	442.11	100.0	442.7	100.0	727.45	100.0
Variable Cost	374.95	81.7	366.30	82.8	368.11	83.1	547.45	75.3
Labor	191.50	41.7	197.85	44.7	147.98	33.5	148.10	20.4
Animal Energy	92.09	20.1	71.96	16.2	57.94	13.1	. . .	. . .
Machine Energy	20.59	4.5	27.81	6.3	53.00	11.9	120.00	16.5
Purchased Input	58.37	12.7	55.93	12.6	96.80	21.8	252.00	34.6
Seed	8.88	1.9	9.72	2.2	13.80	3.1	10.00	1.4
Chemicals	41.27	9.0	40.71	9.2	62.40	14.1	233.00	32.0
Energy Repairs	. . .	. . .	. . .	. . .	6.00	1.3	. . .	. . .
Other	8.22	1.8	5.50	1.2	14.60	3.3	9.00	1.2
Interest	12.37	2.7	12.72	2.9	12.39	2.8	27.35	3.7
Fixed Cost	83.63	18.2	75.81	17.2	74.60	16.9	180.00	24.7
Land	79.84	17.4	74.37	16.8	60.00	13.5	150.00	20.6
Labor	1.78	0.4	. . .	. . .	. . .	. . .	30.00	4.1
Depreciation	2.00	0.4	1.43	0.3	14.60	3.3	. . .	. . .
Gross Income	596.54		483.38		416.46		294.00	
Net Farm Income	221.59		117.07		48.34		-253.45	
Gross Margin	137.95		41.26		-26.25		-433.45	
Rate of Return-Investment	30.1		9.3		-5.9		-59.6	
Rate of Return-Work. Cap.	36.8		11.26		-7.1		-79.2	
Yield/MZ	8.75		7.16		6.54		4.20	
Price/QQ	68.18		67.51		63.68		70.00	
Cost/QQ	52.46		61.73		67.74		173.20	
Labor Requirements	41.7		33.5		21.1		19.1	

Source: Nicaraguan Production Costs and Returns Analysis, University of Missouri 1974

Given the low yield with average price, gross income would have equalled total cost.

Table 79 shows the cost structure by levels of technology. Increases in expenditures for machine energy and purchased inputs indicate some effort to modernize the sample sesame farms. The importance of animal energy decreased with higher levels of technology as did labor requirements. However, there was a general decrease in yields and returns per manzana with each higher technology level.

Table 80 shows the costs by levels of ecology. There was no appreciable difference in total costs. The variation in total cost was attributed to higher fixed cost in level b. However lower yields in the higher level of ecology resulted in a decrease in returns.

Consistent low yields were largely responsible for the low rate of returns to the inefficient sesame producers. It can be assumed that factors other than economic factors may have resulted in the low returns. Sesame production has decreased since 1960 and yields remained virtually unchanged over this period. Most of the exported sesame seed is used in the United States by the bakery and confectionery industries. Sesame produces a high quality oil that is gaining importance on the world market. Higher yielding varieties are essential to maintain and expand sesame production for domestic use and export.

TABLE 79

NICARAGUA: PRODUCTION COSTS FOR SESAME BY LEVELS OF TECHNOLOGY

	01		02		03	
	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	345.89	100.0	460.80	100.0	617.80	100.0
Variable Cost	269.25	77.8	381.89	82.9	514.69	83.3
Labor	138.88	40.2	199.53	43.3	227.05	36.7
Animal Energy	108.25	31.3	84.52	18.3	28.88	4.7
Machine Energy	1.71	0.5	19.86	4.3	94.44	15.3
Purchased Inputs	12.63	3.6	64.92	14.1	144.77	23.4
Seed	8.92	2.6	8.47	1.8	14.62	2.3
Chemicals	. . .	. . .	49.19	10.6	109.38	17.7
Energy-Repairs	. . .	. . .	. . .	. . .	3.33	0.5
Other	3.71	1.0	7.26	1.6	17.44	2.8
Interest	7.75	2.2	13.03	2.8	19.51	3.1
Fixed Cost	76.64	22.2	78.90	17.1	103.11	16.7
Land	74.64	21.6	75.15	16.3	91.66	14.8
Labor	. . .	. . .	1.84	0.4	3.33	0.5
Depreciation	2.00	0.6	1.90	0.4	8.11	1.3
Gross Income	637.00		500.14		541.24	
Net Farm Income	367.75		118.24		26.85	
Gross Margin	291.10		39.33		-76.27	
Rate of Return to Investment	84.2		8.5		-12.3	
Rate of Return to Working Cap.	108.6		10.3		-14.8	
Yield/MZ	9.45		7.45		7.72	
Price/QQ	67.41		67.13		70.15	
Cost/QQ	36.60		61.85		80.03	
Labor Requirements	41.8		36.4		31.7	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri, 1974

TABLE 80

NICARAGUA: PRODUCTION COSTS FOR SESAME BY LEVELS OF ECOLOGY

	B		P	
	Cost	Percent	Cost	Percent
Total Cost	464.70	100.0	441.90	100.0
Variable Cost	375.54	80.8	373.73	84.6
Labor	182.60	39.3	200.92	45.5
Animal Energy	80.59	17.3	83.25	18.8
Machine Energy	33.40	7.2	15.19	3.4
Purchased Input	66.12	14.2	61.72	14.0
Seed	11.22	2.4	6.25	1.4
Chemicals	46.01	9.9	47.55	10.7
Energy Repairs	0.81	0.1	. . .	. . .
Other	8.08	1.7	7.92	1.8
Interest	12.80	2.7	12.63	2.9
Fixed Cost	89.16	19.2	68.16	15.4
Land	83.37	17.9	66.11	14.9
Labor	2.40	0.5	. . .	. . .
Depreciation	3.37	0.7	2.05	0.5
Gross Income	580.72		461.63	
Net Farm Income	205.18		87.89	
Gross Margin	116.02		19.73	
Rate of Return-Investment	24.9		4.5	
Rate of Return-Working Cap.	30.9		5.3	
Yield/MZ	8.70		6.50	
Price/QQ	66.74		71.02	
Cost/QQ	53.41		67.98	
Labor Requirements	38.5		34.1	

Source: Production Costs and Returns Analysis University of Missouri, 1974

Tobacco

Tobacco is a high value commodity. Only in recent years has tobacco become an export crop in Nicaragua. Tobacco accounted for only 1.2 percent of the total value of agricultural exports in 1971, but prior to 1965 Nicaragua had no tobacco exports. As part of an agricultural diversification program to develop tobacco as an export, the crop also created a new source of employment and income.

In 1971, 1,602 manzanas of tobacco were under cultivation (Table 81). The Interior North was the dominant region in terms of land area and total production accounting for 46 percent and 53 percent respectively. The Pacific South region was the second major tobacco producing region with 31.2 percent of the land area and 25.3 percent of production. However, the Pacific South accounted for 55 percent of the total farms. A slight majority of the farms producing tobacco were under 10 manzanas but yields on the farms in these smaller size stratas were significantly lower than the average for the sample.

As indicated in Table 82, tobacco cultivation and harvest requires a large labor input. Labor cost, fixed and variable for the five varieties of tobacco presented ranged from 33.2 to 45.1 percent of total cost. Purchased inputs also accounted for a large percentage of total costs ranging from 29 percent for Sol to 45.6 percent for Rubio tobacco. It is worthwhile to note that depreciation costs accounted for

TABLE 81

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR TOBACCO BY FARM SIZE AND REGION, 1971

	Number of Farms	Percent	Area	Percent	Production	Percent	Yield
Total Republic	306	100.00	1,602	100.00	45,400	100.00	28.3
1	2	0.65	3	0.18	42	0.09	14.0
1-5	90	29.41	147	9.17	2,907	6.40	19.8
5-10	73	23.85	143	8.9	2,966	6.53	20.7
10-20	36	11.76	91	5.68	2,312	5.09	25.4
20-50	53	17.32	333	20.78	12,655	27.87	38.0
50-100	19	6.20	456	22.46	11,744	25.86	25.8
100-200	11	3.59	244	15.23	6,672	14.69	27.3
200-500	14	4.57	69	4.30	2,747	6.05	39.8
500-1000	8	2.61	116	7.24	3,355	7.39	28.9
1000-2000	. . .	. . .	. . .	. . .	. . .	. . .	. . .
2500+	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Pacific North	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Pacific Central	37	12.09	77	4.80	1,500	3.30	19.5
Pacific South	170	55.55	500	31.21	11,521	25.37	23.0
Interior North	66	21.56	738	46.06	24,210	53.32	32.8
Interior Central	31	10.13	284	17.72	8,102	17.84	28.5
Interior South	2	0.65	3	0.18	67	0.14	16.7

Source: UNASEC Censo Nacional Agropecuario 1971 and Cuentas Nacionales Banco Central De Nicaragua

TABLE 82

NICARAGUA: PRODUCTION COSTS FOR TOBACCO

	Rubio		Tapado		De Sol		Burley		Virginia	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	8,379.70	100.0	19,117.84	100.0	11,332.89	100.0	9,880.49	100.0	9,093.13	100.0
Variable Cost	6,363.62	75.9	11,519.96	60.3	8,125.53	71.7	7,218.86	73.1	6,585.89	72.4
Labor	2,276.40	27.2	5,190.85	27.2	4,404.93	38.9	2,434.86	24.6	2,358.80	25.9
Mechanical Energy	42.25	0.5	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Purchased Inputs	3,822.17	45.6	5,957.20	31.2	3,300.14	29.1	4,400.00	44.5	3,873.24	42.6
Seed	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Fertilizer	934.85	11.1	963.32	5.0	674.65	6.0	1,400.00	14.2	845.07	9.3
Insecticides	1,161.97	13.8	827.33	4.3	749.11	6.6	1,400.00	14.2	1,056.34	11.6
Organic Fertilizer	. . .	. . .	672.02	3.5	. . .	. . .	. . .	. . .	. . .	. . .
Fungicides	492.96	5.8	246.99	1.3	139.44	1.2	. . .	. . .	. . .	. . .
Other	1,232.39	14.7	3,247.54	17.0	1,736.94	15.3	1,600.00	16.2	1,971.83	21.7
Interest	222.80	2.6	371.91	1.9	420.46	3.7	384.00	3.9	353.85	3.9
Fixed Cost	2,016.08	24.1	7,597.88	39.7	3,207.36	28.3	2,661.63	26.9	2,507.24	27.6
Land	211.27	2.5	352.11	1.8	352.11	3.1	352.11	3.5	352.11	3.9
Labor	721.83	8.6	1,481.01	7.7	704.23	6.2	845.07	8.6	845.07	9.3
Depreciation	1,080.98	12.9	5,764.76	30.2	2,151.02	19.0	1,464.45	14.8	1,310.06	14.4
Gross Income	9,352.11		30,760.56		10,352.11		11,267.61		10,140.85	
Net Farm Income	2,988.49		19,720.6		2,226.58		4,048.75		3,554.96	
Gross Margin	972.41		11,642.72		-980.78		1,387.12		1,047.72	
Rate of Return-Investment	11.6		60.9		-8.6		14.0		11.5	
Rate of Return-Working Cap.	15.3		101.1		-12.1		19.2		15.9	
Yield/MZ	29.22		25.35		24.65		35.21		31.69	
Price/QQ	320.05		1,213.43		419.96		320.01		320.00	
Cost/QQ	286.78		754.2		459.75		280.62		286.94	
Total Labor Requirements	. . .		462.19		381.16		219.80		213.46	

Source: UNASEC, Encuestra Nacional Agropecuario, 1971

the largest charge to fixed cost, indicating a high degree of capital investment for tobacco production.

Rubio, Sol, Burley and Virginia varieties are used primarily for cigarettes and cigar filler, while Topado, a shade grown tobacco, is used for cigar wrapper. Total cost of production for Topado tobacco was considerably higher than the average cost for the filler tobacco. This higher cost is due to the difference in cultural methods required to produce Topado tobacco.

The price of Topado tobacco was significantly higher than the price received for the other types of tobacco. Gross income for Topado was about three times as high as the other varieties and realized a higher rate of return. The other tobacco varieties averaged a rate of return to investment of 12 percent with the exception of Sol which realized negative returns over total cost.

Rice

Rice is becoming more important for domestic consumption as well as for export. Rainfall in the rice producing regions is insufficient and poorly distributed for paddy rice and the upland varieties have been the dominant varieties. However, efforts are being made to develop paddy rice production by increasing irrigation facilities and land terracing. In 1971 land area devoted to dryland rice was 19,003 manzanas, while land area devoted to paddy rice was 11,421 manzanas.

The following tables illustrate the structure of production for the upland and paddy rice varieties. There were 373 farms in paddy rice (Table 83). Although paddy rice farms averaged 30.6 manzanas in size, over 80 percent of the production was on farms larger than 500 manzanas and less than 3 percent was on farms of less than 100 manzanas. The Interior South region was the most important, contributing 48 percent to total production.

Table 84 shows the structure of production for upland rice varieties. Upland rice farms averaged 3.3 manzanas. The Pacific regions produced nearly 75 percent of the upland rice. While the Interior South contributed 16.4 percent. There was a wide regional variation in yields, ranging from 6.4 hundredweight in the Pacific North to 15.3 hundredweight per manzana in the Pacific South.

Table 85 shows the cost structure for paddy rice by region and by size. Machine energy cost and purchased inputs made up about two-thirds of the total cost. Variable labor cost was a relatively unimportant charge while fixed labor averaged 10 percent of the cost. Land cost accounted for another 10 percent of total costs.

There was less variation in total cost within the Interior regions than between the Interior regions and the Pacific Central. Yields were also significantly higher in the Interior regions resulting in higher returns per manzana.

TABLE 83

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR PADDY RICE BY FARM SIZE AND REGION, 1971

	Number of Farms	Percent	Area	Percent	Production	Percent	Yield
Total Republic	373	100.00	11,421	100.00	340,554	100.00	29.8
1	. . .	. . .	. . .	. . .	. . .	. . .	. . .
1-5	60	16.08	90	0.78	1,302	0.38	14.5
5-10	34	9.11	60	0.52	754	0.22	12.6
10-20	51	13.67	127	1.11	2,033	0.59	16.0
20-50	77	2.64	294	2.57	3,594	1.05	12.2
50-100	41	10.99	140	1.22	1,290	0.37	9.2
100-200	34	9.11	509	4.45	27,528	8.08	54.1
200-500	37	9.92	1,054	9.22	27,174	7.98	25.8
500-1000	21	5.63	2,637	23.09	79,115	23.23	30.0
1000-2500	12	3.21	1,653	14.47	37,432	10.99	22.6
2500+	6	1.60	4,857	42.43	160,332	47.08	33.0
Pacific North	46	12.33	1,360	11.90	25,007	7.34	18.4
Pacific Central	88	23.69	3,029	26.52	69,886	20.52	23.1
Pacific South	41	10.99	492	4.30	33,169	9.74	67.4
Interior North	8	2.14	9	0.08	68	0.02	7.6
Interior Central	70	18.76	880	7.70	47,173	13.85	53.6
Interior South	79	21.17	5,618	49.19	164,594	48.33	29.3
C. North	41	10.99	33	0.28	657	0.19	19.9

Source: UNASEC, Censo Nacional Agropecuario 1971 and Cuentas Nacionales Banco Central De Nicaragua

TABLE 84

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR UPLAND RICE BY FARM SIZE AND REGION, 1971

	Number of Farms	% of Total	Area in Manzanas	% of Total	Production/ Hun'wt.	% of Total	Yield/ Hun'wt.
Total	5707		19033		192094		10.0
< 1 Mz	95	1.6	25	.1	281	.1	11.2
1 - 5	1304	22.8	1621	8.5	15440	8.0	9.5
5 - 10	693	12.1	1321	6.9	12690	6.6	9.6
10 - 20	793	13.9	1099	8.9	16886	8.8	9.9
20 - 50	1151	20.1	2769	14.5	26684	13.9	9.6
50 - 100	932	16.3	2419	12.7	26136	13.6	10.8
100 - 200	463	8.1	2313	12.1	27593	14.3	11.9
200 - 500	190	3.3	3444	18.1	26531	13.8	7.7
500 - 1000	60	1.0	590	3.1	6243	3.2	10.6
1000 - 2500	18	.3	1621	8.5	24019	12.5	14.8
> 2500	8	.1	1211	6.3	9539	4.9	7.9
Pacific North	179	3.1	841	4.4	5440	2.8	6.4
Pacific Central	1712	30.0	9096	47.8	80043	41.6	8.8
Pacific South	904	15.8	3731	19.6	57024	29.7	11.3
Interior North	178	3.1	742	3.9	7551	3.9	10.2
Interior Central	573	10.0	511	2.7	4885	2.5	9.5
Interior South	1752	30.7	3338	17.5	31580	16.4	9.4
Caribbean North	459	8.0	774	4.0	5519	2.8	7.2

Source: UNASEC Censo Nacional Agropecuario, 1971 and Cuentas Nacionales Banco Central De Nicaragua.

TABLE 85

NICARAGUA: PRODUCTION COSTS FOR PADDDY RICE BY REGION AND SIZE

	Pacific Central 100-200MZ		Interior Central 100-200MZ		Interior Central 500-1000MZ		Interior South +2500		Total	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	1,510.00	100.0	1,920.00	100.0	2,204.00	100.0	1,977.00	100.0	1,902.75	100.0
Variable Cost	1,179.00	78.0	1,227.00	63.9	1,425.00	64.6	1,651.00	83.5	1,370.50	72.0
Labor	. . .	. . .	36.00	1.9	36.00	1.6	10.00	0.5	20.50	1.1
Machine Energy	434.00	28.7	631.00	32.8	740.00	33.6	669.00	33.8	618.50	32.5
Purchased Inputs	684.00	45.3	488.00	25.4	567.00	25.7	889.00	45.0	657.00	34.5
Interest	61.00	4.0	72.00	3.5	82.00	3.7	82.00	4.2	74.50	3.9
Fixed Cost	331.00	22.0	693.00	36.1	779.00	35.4	326.00	35.4	532.25	28.0
Land	200.0	13.3	200.00	10.4	200.00	9.1	200.00	10.1	200.00	10.5
Labor	100.00	6.7	283.00	14.7	287.00	13.0	87.00	4.4	189.25	10.0
Depreciation	31.00	2.0	210.00	11.0	292.00	13.3	39.00	2.0	143.00	7.5
Gross Income	1,600.00		2,400		3,000.00		2,320.00		2,330.00	
Net Farm Income	421.00		1,173.00		1,575.00		669.00		959.00	
Gross Margin	90.00		480.00		796.00		343.00		427.25	
Rate of Return to Invest.	6.00		25.00		36.00		17.00		22.4	
Rate of Return to Work. Cap.	8.00		39.00		56.00		21.00		31.2	
Yield/MZ	40.00		60.00		75.00		58.00		58.25	
Price/QQ	40.00		40.00		40.00		40.00		40.00	
Cost/QQ	37.75		32.00		29.38		34.08		32.66	

Source: UNASEC, Encuestra Nacional Agropecuario, 1971

Total costs per manzana were significantly lower for the upland rice (Table 86). Labor was the dominant charge accounting for 44 percent of total cost. Machine energy was a significant charge, though considerably less than machine energy cost for paddy rice. A combination of both animal and machine energy was used in upland rice production. Yields were generally lower for upland varieties, but returns to investments were at acceptable rates. Table 86 also presents cost by region. Average returns were the highest in the Pacific region while the rate of return to investment was highest in the Pacific South. This latter region had the highest yields and lowest per unit costs. Conversely, the Interior South, which had the lowest yields and highest per unit costs, experienced the lowest rate of return.

The average cost of production by size is presented in Table 87. The two largest samples were single case studies. Machine energy replaced animal energy as the dominant power source as farm size increased. Expenditures for purchased inputs also increased. There was a general increase in use of fertilizer as well as improved seed. Yields increased on farms through size category 10-20 manzanas. With the exception of the single case study in the 80 manzana size category, all size categories yielded an acceptable return per manzana.

Returns to technology were evident in upland rice production (Table 88). Yield increased at higher levels of technology; however, there was no significant decrease

TABLE 86

NICARAGUA: PRODUCTION COSTS FOR UPLAND RICE BY REGION

	Total		Interior North		Interior South		Pacific Central		Pacific North		Interior South	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	823.45	100.0	896.91	100.0	670.70	100.0	899.20	100.0	1,027.31	100.0	778.07	100.0
Variable Cost	671.47	81.5	626.77	69.9	580.65	86.6	760.68	84.6	831.31	80.9	627.22	80.6
Labor	351.70	42.7	276.58	30.8	400.73	59.7	358.86	39.9	301.62	29.4	400.20	51.4
Animal Energy	47.28	5.7	11.42	0.1	. . .	. . .	58.82	6.5	75.00	7.3	56.77	7.3
Machine Energy	60.50	7.4	128.42	14.3	49.33	7.4	62.76	6.9	83.30	8.1	38.42	4.9
Purchased Inputs	183.86	22.3	118.49	20.3	108.54	16.2	248.88	27.7	337.25	32.8	104.39	13.4
Seed	64.14	7.8	81.42	9.1	54.28	8.1	71.91	8.0	78.50	7.6	52.38	6.7
Chemicals	94.80	11.5	94.42	10.5	45.42	6.8	142.26	15.8	197.00	19.2	43.63	5.6
Energy Repairs	3.27	0.4	6.65	0.7	8.84	1.3	0.50	. . .	8.75	0.8	2.52	0.3
Other	21.65	2.6	. . .	. . .	. . .	. . .	34.21	3.8	53.00	5.2	5.86	0.8
Interest	28.10	3.4	27.81	3.1	22.02	3.3	31.32	3.5	34.14	3.3	27.42	3.5
Fixed Cost	151.97	18.5	270.14	30.1	90.05	13.4	138.52	15.4	196.00	19.1	150.84	19.4
Land	118.79	14.4	92.85	10.4	47.14	7.0	131.73	14.6	150.00	14.6	141.57	18.2
Labor	12.62	1.5	103.85	11.6	. . .	. . .	0.60	. . .	10.50	1.0	. . .	. . .
Depreciation	20.55	2.5	73.42	8.2	42.91	6.4	6.17	0.7	35.50	3.5	9.26	1.2
Gross Income	1,258.23		1,215.71		820.04		1,314.70		1,674.13		1,342.71	
Net Farm Income	586.76		588.94		239.39		554.02		842.82		715.64	
Gross Margin	434.78		318.79		149.34		415.50		646.82		564.64	
Rate of Return-Invest.	52.8		35.5		22.3		46.2		62.9		72.6	
Rate of Return-Work. Cap.	64.7		50.9		25.7		54.6		77.8		90.0	
Yield/MZ	33.06		36.85		22.20		32.14		36.96		38.40	
Price/QQ	38.06		32.99		36.93		40.90		42.29		34.96	
Cost/QQ	24.90		24.33		30.21		27.97		27.79		20.26	
Labor Requirements	71.3		35.8		58.2		82.6		48.2		73.7	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri, 1974

TABLE 87

NICARAGUA: PRODUCTION COSTS FOR UPLAND RICE BY FARM SIZE

	Less Than 1 MZ		1-4.9MZ		5-9.9MZ		10-19.9MZ		20-57MZ		80MZ		120MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	601.87	100.0	701.28	100.0	954.71	100.0	1,142.24	100.0	1,098.51	100.0	2,132.74	100.0	1,492.77	100.0
Variable Cost	536.87	89.2	583.28	83.2	795.21	83.3	937.91	82.1	864.71	78.7	1,183.74	55.4	1,092.37	73.2
Labor	352.00	58.5	351.73	50.1	477.18	50.0	270.33	23.7	170.98	15.6	401.90	18.8	191.57	12.8
Animal Energy	35.60	5.9	54.45	7.7.	59.87	6.3	46.66	4.1	. . .	. . .	. . .	. . .	. . .	. . .
Machine Energy	. . .	. . .	12.97	1.8	61.50	6.4	186.06	16.3	282.72	25.7	339.00	15.8	345.32	23.1
Purchased Inputs	130.60	21.7	140.57	20.0	160.06	16.7	396.32	34.7	374.86	34.1	362.00	16.9	519.91	34.8
Seed	53.00	8.8	56.08	8.8	57.89	6.1	94.00	8.2	107.20	9.8	100.00	4.7	140.00	9.4
Chemicals	27.20	4.5	59.79	8.5	92.37	9.7	261.00	22.8	250.80	18.7	251.00	11.7	313.00	21.3
Energy Repairs	. . .	. . .	1.29	0.2	. . .	. . .	11.66	1.0	9.46	0.9	11.00	0.5	61.91	4.1
Other	50.40	8.4	23.41	3.3	9.80	1.0	29.66	2.6	7.40	0.6	. . .	. . .	. . .	. . .
Interest	18.67	3.1	23.52	3.3	36.59	3.8	38.51	3.4	36.14	3.3	80.84	3.8	35.57	2.4
Fixed Cost	65.00	10.8	118.00	16.8	159.50	16.7	204.33	17.9	233.80	21.3	954.00	44.6	400.40	26.8
Land	65.00	10.8	113.78	16.2	153.00	16.0	150.00	13.1	130.00	11.8	100.00	4.7	100.00	6.7
Labor	. . .	. . .	. . .	. . .	. . .	. . .	14.00	1.2	20.40	1.8	639.00	29.9	. . .	. . .
Depreciation	. . .	. . .	4.21	0.6	6.50	0.7	40.33	3.5	83.40	7.6	215.00	10.1	300.40	20.1
Gross Income	828.95		1,104.45		1,481.58		2,115.51		1,639.00		1,202.00		2,603.75	
Net Farm Income	292.08		521.16		868.37		1,177.59		774.28		-143.71		1,511.38	
Gross Margin	227.08		403.16		526.87		973.26		540.48		-1,097.74		1,110.98	
Rate of Return to Investment	37.7		57.5		55.2		85.2		49.2		-51.4		74.4	
Rate of Return to Work. Cap.	42.3		69.1		66.3		103.7		62.5		-92.7		101.7	
Yield/MZ	18.76		29.79		37.15		52.62		48.60		40.00		41.66	
Price/QQ	44.18		37.07		39.88		40.20		33.22		26.00		62.50	
Cost/QQ	32.08		23.54		25.69		21.70		22.60		53.44		35.83	
Labor Requirements	97.5		80.0		72.1		36.5		20.9		57.1		13.9	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri 1974

TABLE 88

NICARAGUA: PRODUCTION COSTS FOR UPLAND RICE BY LEVELS OF TECHNOLOGY

	01		02		03	
	Cost	%	Cost	%	Cost	%
Total Cost	571.27	100.0	847.45	100.0	1234.33	100.00
Variable Cost	474.67	83.0	714.24	84.3	952.65	77.1
Labor	352.08	61.6	374.13	44.1	314.15	25.5
Animal Energy	40.44	7.0	72.86	8.6	17.47	1.4
Machine Energy	--	--	22.69	2.6	730.65	18.6
Purchased Inputs	63.25	11.0	214.94	25.4	348.27	28.2
Seed	44.91	7.8	60.61	7.1	104.32	8.5
Chemicals	4.40	.8	114.77	13.5	223.44	18.1
Energy Repairs	--	--	--	--	14.51	1.2
Other	13.94	2.4	39.56	4.7	6.00	.5
Interest	18.89	3.3	29.60	3.5	42.08	3.4
Fixed Cost	96.60	16.9	133.21	15.7	281.61	22.8
Land	94.60	16.6	126.95	14.9	148.57	12.0
Labor	--	--	1.82	.2	52.92	4.3
Depreciation	2.00	.3	4.43	.5	80.17	6.5
Gross Income	878.72	--	126.69	--	1917.10	--
Net Farm Income	404.05	--	555.45	--	964.45	--
Gross Margin	307.45	--	422.23	--	682.77	--
Rate of Return to Investment	53.8	--	49.5	--	55.3	--
Rate of Return to Working Capital	64.7	--	59.1	--	71.7	--
Yield/MZ	25.92	--	30.28	--	50.38	--
Price/QQ	33.90	--	41.93	--	38.05	--
Cost/QQ	22.03	--	27.98	--	24.50	--
Labor Requirements	70.0	--	91.9	--	41.2	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Mo., 1974.

TABLE 89

NICARAGUA: PRODUCTION COSTS FOR UPLAND RICE
BY LEVELS OF ECOLOGY

	B		P	
	Cost	%	Cost	%
Total Cost	824.84	100.00	1001.04	100.0
Variable Cost	683.79	82.8	710.87	71.1
Labor	368.13	4.5	321.01	32.0
Animal Energy	50.95	6.2	10.00	1.0
Machine Energy	52.81	6.4	149.83	15.0
Purchased Inputs	--	22.2	--	19.7
Seed	63.67	--	79.16	--
Chemicals	96.42	--	110.16	--
Energy Repairs	2.90	--	7.76	--
Other	25.56	--	--	--
Interest	28.32	3.4	32.92	3.3
Fixed Cost	141.04	17.1	290.16	28.9
Land	125.92	15.2	83.33	8.3
Labor	1.03	.1	121.16	12.1
Depreciation	14.08	1.7	85.66	8.5
Gross Income	1289.82	--	1183.33	--
Net Farm Income	606.03	--	472.45	--
Gross Margin	463.98	--	182.28	--
Rate of Return to Investment	56.2	--	18.2	--
Rate of Return to Working Capital	67.8	--	25.6	--
Yield/MZ	33.19	--	39.66	--
Price/QQ	38.83	--	29.84	
Cost/QQ	24.85	--	25.24	--
Labor Requirements	73.5	--	51.1	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Missouri, 1974.

in per unit cost. The value of the crop increased directly with higher levels of technology. Gross income in the 02 level was 40 percent higher than in level 01 and more than doubled in the optimum level of technology. There was also a proportional increase in net income and gross margin.

There was a significant increase in yields in the higher resource base, (Table 89) however, production was the least profitable for the sample farms in level P. Lower returns for higher yielding farms, where per unit costs are nearly equal indicate that there was some disparity in average price received by farmers in the two levels of ecology.

Corn

Corn is the leading grain crop in every region in terms of land area. Farm land devoted to corn production occupied 236,347 manzanas or approximately 40 percent of the total land in cultivation in 1971. Much of the farm land utilized for corn production in Nicaragua is the least productive, which accounts to some extent for low average yields of 15 hundredweight per manzana.

Table 90 shows the number of farms, land area and production statistics for corn by farm size and region. The Interior regions account for approximately two thirds of the farms, land area and total production of corn. Forty percent of the farms producing corn were less than 10 manzanas, occupied 18.7 percent of the land in corn and produced 16.5 percent of the corn. Farms larger than 100

TABLE 90

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR CORN BY FARM SIZE AND REGION, 1971

Farm Size	Number of Farms	% of Total	Area in mz	% of Total	Production in Hundred	% of Total	Yield
Total	61816	100.00	236347	100.00	3539151	100.00	15.0
<1 Mz	841	1.36	227	.09	3007	.08	13.3
1 - 5	15672	25.35	26338	11.14	327820	9.26	12.5
5 - 10	8166	13.21	18032	7.62	256007	7.23	14.2
10 - 20	9143	14.79	25286	10.69	319393	9.02	12.6
20 - 50	13121	21.22	41241	17.44	532787	15.05	12.9
50 - 100	8316	13.45	40709	17.22	637280	18.00	15.6
100 - 200	3964	6.41	33135	14.01	501221	14.16	15.1
200 - 500	1885	3.04	27621	11.68	535816	15.13	19.4
500 - 1000	456	.73	11353	4.80	163531	4.62	14.4
1000 - 2500	191	.30	7031	2.97	122527	3.46	17.4
>2500	61	.09	5374	2.27	139762	3.94	26.0
Pacific North	9792	15.84	47228	19.78	659782	18.64	14.0
Pacific Central	7615	12.31	23794	10.06	494501	13.97	20.8
Pacific South	1638	2.64	4626	1.95	73559	2.07	15.9
Interior North	11611	18.78	36358	15.38	420074	11.86	11.6
Interior Central	19825	32.07	67840	28.70	787580	22.25	11.6
Interior South	11000	17.79	56029	23.70	1094722	30.93	19.5
Caribbean North	335	.54	472	.19	8933	.25	18.9

Source: UNASEC Censo Nacional Agropecuario, 1971 and Cuentas Nacionales, Banco Central De Nicaragua.

manzanas accounted for slightly over 10 percent of the total corn producing farms but accounted for 35.7 percent of total land area and 41.3 percent of the total corn production.

An average value of factors affecting production cost were aggregated by crop, region, size strata and by the levels of technology and ecology. Table 91 shows the total cost per manzana for the sample farms and regional variations in costs. Corn production costs averaged $490 per manzana with variable costs making up 77 percent of the total cost. Labor accounted for the largest single cost item, accounting for 47 percent of total cost. Land cost followed with 18 percent. A combination of both animal and machine energy was used and accounted for 14.7 percent of the total budget. Differences in production costs and returns show a regional variation due to resource availability and farming methods. Regional cost varied nearly C$300. There was less variation in the value of the crop by region. Yields and costs per hundredweight on the average were higher in the Pacific regions than in the Interior regions.

Purchases commercial inputs also varied by region. The expenditures and relative position of purchased inputs by region followed the proximity of the producing regions to the population core area of Nicaragua. Regions with low rates of return had relatively high fixed costs. Land costs were nearly 25 percent of the total cost in the Pacific North and land and fulltime labor accounted for 29 percent in the

TABLE 91

NICARAGUA: PRODUCTION COSTS FOR CORN BY REGION

	Total		Interior Central		Interior North		Interior South		Pacific Central		Pacific North		Pacific South	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	490.87	100.0	391.06	100.0	505.12	100.0	306.60	100.0	603.12	100.0	532.69	100.0	546.25	100.0
Variable Cost	377.93	77.0	295.91	75.6	342.04	67.7	235.84	76.9	499.76	82.8	386.38	72.5	432.94	79.2
Labor	216.56	44.1	169.15	43.3	203.86	40.4	185.70	60.6	279.85	46.4	173.31	32.5	245.71	45.0
Animal Energy	45.76	9.3	58.69	15.0	18.59	3.7	14.79	4.8	59.72	9.9	63.83	12.0	60.06	11.0
Machine Energy	26.41	5.4	3.33	0.9	44.53	8.8	2.96	0.9	25.41	4.2	47.14	8.8	31.94	5.8
Purchased Inputs	73.97	15.1	54.31	13.9	58.23	11.5	22.24	7.3	115.34	19.1	88.54	16.6	81.74	15.0
Seed	15.31	3.1	11.58	3.0	9.19	1.8	11.23	3.7	22.58	3.7	15.56	2.9	16.10	2.9
Chemicals	49.56	10.1	36.38	9.3	37.98	7.5	7.85	2.5	79.58	13.2	62.46	11.7	57.63	10.6
Energy Repair	1.28	0.3	. . .	. . .	3.56	0.7	0.67	0.2	1.13	0.2	1.30	0.2	0.91	0.2
Other	7.82	1.6	6.35	1.6	7.50	1.5	2.49	0.8	12.05	2.0	9.22	1.7	7.10	1.3
Interest	15.19	3.1	10.40	2.6	16.80	3.3	10.12	3.3	19.43	3.2	13.53	2.5	18.44	3.4
Fixed Cost	112.94	23.00	95.14	24.4	163.07	32.3	70.75	23.1	103.41	17.2	146.30	27.5	108.30	19.8
Land	88.92	18.1	83.03	21.2	73.75	14.6	53.27	17.4	92.92	15.4	130.66	24.5	92.56	17.8
Labor	14.60	3.0	. . .	. . .	72.34	14.3	11.77	3.8	3.50	0.6	6.92	1.8	. . .	. . .
Depreciation	9.41	1.9	12.11	3.1	16.98	3.3	5.70	1.8	6.98	1.2	8.72	1.6	10.47	1.9
Gross Income	602.89		523.20		547.05		531.18		707.08		561.90		678.29	
Net Farm Income	224.96		227.28		205.01		295.33		207.31		175.31		240.84	
Gross Margin	112.02		132.14		41.92		224.57		103.90		29.21		132.54	
Rate of Return to Investment	22.8		33.8		8.3		73.2		17.2		5.5		24.3	
Rate of Return to Working Cap.	29.6		44.6		12.3		45.2		20.8		7.5		30.3	
Yield/MZ	22.01		17.67		23.32		16.71		25.80		21.11		25.01	
Price/QQ	27.39		29.61		23.46		31.78		27.40		26.61		27.12	
Cost/QQ	18.62		22.13		21.16		18.34		23.37		25.23		21.81	
Labor Requirements	39.9		32.9		43.8		26.2		52.8		30.8		48.5	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri 1974

Interior North. However, regional variations cannot all be explained by differences in soil productivity, amounts of purchased inputs and labor sources. Yields and rates of return did not always vary directly with each factor of production or total cost. Yields in the Interior South were 28 percent below the total of all sample forms yet realized the highest rate of return over investment.

Costs by farm size are presented in Table 92. Nine size classes are presented; however, the last three size categories were single case studies. The position of variable labor cost tended to decline as farm size increased. The comined use of animal and machine energy also increased with farm size. The relative position of animal energy increased through farms in the 3-4.9 manzana category, but was not used as an input in the two largest farms. Machine energy cost increased with farm size but rose sharply on farms larger than 20 manzanas.

There was a significant increase in total cost per manzana as well as gross income and yield with increased use of modern technology (Table 93). Yields nearly tripled from the traditional level of technology (01) to the optimum level of technology (03). Gross margin was also three times higher in technology level 03 than technology level 01. It was clearly evident that the input-output relationship improved with the adoption of modern technology.

TABLE 92

NICARAGUA: PRODUCTION COSTS FOR CORN BY FARM SIZE

	Less Than 1MZ		1-2.9MZ		3-4.9MZ		5-9.9MZ		10-15MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	602.28	100.0	454.38	100.0	449.44	100.0	504.15	100.0	639.23	100.0
Variable Cost	502.28	83.4	359.23	79.1	333.70	74.2	396.69	76.1	489.25	76.5
Labor	430.57	71.5	213.37	46.9	198.00	44.1	207.80	41.2	250.11	39.1
Animal Energy	36.07	6.0	50.61	11.1	50.50	11.2	39.25	7.8	37.91	5.9
Machine Energy	. . .	. . .	11.78	2.6	17.82	3.9	41.44	8.0	55.14	8.6
Purchased Inputs	. . .	3.1	. . .	17.2	. . .	12.1	. . .	15.8	. . .	19.7
Seed	18.57	. . .	14.68	. . .	10.73	. . .	17.20	. . .	20.24	. . .
Chemicals	. . .	. . .	54.53	. . .	36.15	. . .	53.46	. . .	95.23	. . .
Energy Repairs	. . .	. . .	0.32	. . .	0.14	. . .	1.78	. . .	3.56	. . .
Other	. . .	. . .	8.88	. . .	7.22	. . .	7.41	. . .	7.08	. . .
Interest	17.06	2.8	14.02	3.1	13.10	2.9	16.29	3.2	19.96	3.1
Fixed Cost	100.00	16.6	95.15	20.9	115.74	25.8	120.48	23.9	149.97	23.5
Land	100.00	16.6	86.53	19.0	95.16	21.2	83.69	16.6	100.50	15.7
Labor	. . .	. . .	3.87	0.8	12.38	2.7	23.62	4.7	27.15	3.5
Depreciation	. . .	. . .	4.74	1.1	8.23	1.8	13.19	2.6	27.32	4.3
Gross Income	596.35		590.33		505.07		643.17		659.29	
Net Farm Income	94.07		231.10		171.37		259.50		170.03	
Gross Margin	-5.92		135.94		55.62		139.01		20.06	
Rate of Return to Investment	-1.0		29.9		12.4		27.5		3.1	
Rate of Return to Working Cap.	-1.2		37.8		16.6		36.2		[illegible].1	
Yield/MZ	19.58		20.42		19.68		23.86		.31	
Price/QQ	30.45		28.91		25.66		26.95		.06	
Cost/QQ	30.75		22.25		22.83		21.12		[illegible].29	
Labor Requirements	76.1		45.0		38.0		32.4		32.3	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri 1974

TABLE 92 (Continued)

	20MZ		25MZ		33MZ		75MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	514.81	100.0	1,212.44	100.0	1,340.97	100.0	997.00	100.0
Variable Cost	363.81	70.6	913.44	75.0	845.97	63.1	807.00	80.9
Labor	200.20	38.8	395.92	32.5	247.00	18.4	70.96	7.1
Animal Energy	31.66	6.1	38.00	3.1	. . .	. . .	. . .	. . .
Machine Energy	53.33	10.3	166.00	13.6	317.30	23.6	330.00	33.1
Purchased Inputs	. . .	11.9		26.3		18.0		35.0
Seed	10.33		49.00		36.00		60.00	
Chemicals	47.16		174.50		162.50		245.50	
Energy Repairs			16.50		40.00		60.00	
Other	3.75		32.00		. . .		13.50	
Interest	17.36	3.4	42.02	3.4	43.17	3.2	27.01	2.7
Fixed Cost	151.00	29.3	304.00	25.0	495.00	36.9	190.00	19.1
Land	88.33	17.2	100.00	8.2	100.00	7.5	100.00	10.0
Labor	41.66	8.1	173.00	14.2	393.00	29.3	90.00	9.0
Depreciation	26.00	5.1	31.00	2.5	2.00	1.5	. . .	. . .
Gross Income	672.66		1,960.00		1,378.00		1,440.00	
Net Farm Income	308.85		1,046.56		532.03		633.01	
Gross Margin	157.85		742.56		37.03		443.00	
Rate of Return to Investment	30.6		61.0		2.7		44.4	
Rate of Return to Working Cap.	43.4		81.3		4.4		54.9	
Yield/MZ	27.33		70.00		53.00		48.00	
Price/QQ	24.61		28.00		26.00		30.00	
Cost/QQ	18.83		17.39		25.30		20.77	
Labor Requirements	32.8		57.6		44.7		13.9	

Source: Nicaragua Production Costs and Returns Analysis University of Missouri 1974

TABLE 93

NICARAGUA: PRODUCTION COSTS FOR CORN
BY LEVELS OF TECHNOLOGY

	01		02		03	
	Cost	%	Cost	%	Cost	%
Total Cost	326.63	100.0	572.70	100.0	840.50	
Variable Cost	240.03	73.5	447.00	78.1	669.77	79.7
Labor	182.61	55.9	237.81	41.5	268.61	32.0
Animal Energy	29.04	8.9	62.66	10.9	41.53	4.9
Machine Energy	3.18	1.0	27.44	4.8	124.94	14.9
Purchased Inputs	--	4.7	--	17.5	--	24.3
Seed	9.26	--	16.08	--	38.66	--
Chemicals	1.06	--	75.23	--	145.81	--
Energy Repair	--	--	.89	--	8.76	--
Other	5.61	--	8.88	--	12.76	--
Interest	9.25	3.0	17.98	3.2	28.66	3.4
Fixed Cost	86.60	76.5	125.70	21.0	170.73	20.3
Land	70.54	21.6	102.82	18.0	105.96	12.6
Labor	10.64	3.7	13.65	2.3	36.65	4.4
Depreciation	5.41	1.7	9.22	1.6	28.11	3.3
Gross Income	411.90	-	678.33	--	1101.28	--
Net Farm Income	171.87	-	231.33	--	431.50	--
Gross Margin	85.27	-	105.62	--	260.77	--
Rate of Return to Investment	26.1	--	18.4	--	31.0	--
Rate of Return to Working Capital	35.5	--	23.6	--	38.9	--
Yield/MZ	15.12	--	24.17	--	42.64	--
Price/QQ	27.24	--	28.06	--	25.82	--
Cost/QQ	21.60	--	23.69	--	19.71	--
Labor Requirements	36.1	--	43.5	--	40.1	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Mo., 1974

TABLE 94

NICARAGUA: PRODUCTION COSTS FOR CORN
BY LEVELS OF ECOLOGY

	M		B		P	
	Cost	%	Cost	%	Cost	%
Total Cost	348.58	100.0	504.51	100.0	585.35	100.0
Variable Cost	262.05	75.2	391.62	77.6	424.23	72.5
Labor	175.36	50.3	225.19	44.6	188.41	32.2
Animal Energy	40.24	11.5	47.77	9.5	31.95	5.5
Machine Energy	3.19	.9	25.11	5.0	83.56	14.3
Purchased Inputs	33.66	9.7	77.80	15.4	101.24	17.2
Seed	9.09	2.6	16.53	3.3	17.07	2.1
Chemicals	18.76	5.4	51.84	10.3	78.02	13.3
Energy Repair	--	--	.96	.2	7.30	1.2
Other	5.81	1.6	8.47	1.6	3.85	.6
Interest	9.58	2.8	15.72	3.1	19.05	3.3
Fixed Cost	86.52	24.8	112.89	22.4	161.11	27.5
Land	72.08	20.7	91.61	18.2	87.40	14.9
Labor	8.47	2.4	12.08	2.4	55.50	9.5
Depreciation	5.97	1.7	9.19	1.8	18.21	3.1
Gross Income	564.95	--	602.10	--	842.53	--
Net Farm Income	302.90	--	210.48	--	418.30	--
Gross Margin	116.37	--	97.59	--	257.18	--
Rate of Return to Investment	36.2	--	19.3	--	43.9	--
Rate of Return to Working Capital	48.2	--	24.9	--	60.6	--
Yield/MZ	16.26	--	21.98	--	32.79	--
Price/QQ	34.74	--	27.39	--	25.67	--
Cost/QQ	21.43	--	22.95	--	17.85	--
Labor Requirements	33.3	--	40.8	--	41.1	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Mo., 1974

Total cost increased with each level of ecology, (Table 94), although total cost variations were less than that by levels of technology. Marginal land with limited commercial inputs use had yields of 16.2 hundredweight per manzana. More extensive farming practices at the optimum level of ecology increased yields by 100 percent or 32.8 hundredweight per manzana.

The rate of return to investment was highest for the farms in level m with returns of 62 percent. This was nearly one-fifth higher than the farms in level p and in level b. The theory of production as it applies to land defines two margins: the intensive margin--the limit which further intensification on a given area of land would prove unprofitable due to diminishing physical returns, and the extensive margin with separates good land from submarginal land--land that would be unprofitable to cultivate. These economic margins of utilization are not fixed but change with price and technology. Prices received at the farm level for farms in level m were 30 percent higher than for the sample farms in the b and p levels, thus, yielding a very acceptable rate of return on the marginal land.

Beans

Beans have a wide range of adaptablity to soils and climatic conditions and are grown to some extent in all regions of Nicaragua. Table 95 shows the number of farms, land area and production statistics for beans by farm size

TABLE 95

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR BEANS BY FARM SIZE AND REGION, 1971

	Number of Farms	% of Total	Area	% of Total	Production	% of Total	Yield
Total	21318		44802		335760		7.5
< 1	248	1.2	67	.1	441	.1	6.6
1 - 5	4882	22.9	6415	14.3	45481	13.5	7.1
5 - 10	2793	13.1	4189	9.3	33083	9.9	7.9
10 - 20	3140	14.7	5899	13.2	46831	13.9	7.9
20 - 50	4858	22.8	8708	19.4	67617	20.1	7.8
50 - 100	3109	14.6	10497	23.4	76765	22.9	7.3
100 - 200	1437	6.7	4807	10.7	32847	9.8	6.8
200 - 500	672	3.1	3006	6.7	23102	6.9	7.9
500 - 1000	128	.6	549	1.2	4374	1.3	8.0
1000 - 2500	41	.2	574	1.3	4456	1.3	7.8
> 2500	10		91	.2	763	.2	8.4
Pacific North	575	2.7	742	1.6	6100	1.8	8.2
Pacific Central	2884	13.5	5681	12.7	44014	13.1	7.8
Pacific South	540	2.5	1579	3.5	14481	4.3	9.2
Interior North	3922	18.4	6480	14.5	47835	14.2	7.4
Interior Central	9959	46.7	23610	52.7	175662	52.3	7.4
Interior South	3355	15.7	6625	14.8	47668	14.2	7.2
Caribbean North	13	.4	85	.2	1086	.3	12.7

Source: UNASEC Censo Nacional Agropecuario, 1971 and Cuentas Nacionales Banco Central De Nicaragua.

and region. The interior regions accounted for 80 percent of the total bean production and also 80 percent of the farms and 82 percent of the area under cultivation. Farms between 1 and 5 manzanas and 20 to 50 manzanas each had about 23 percent of all bean farms. Farms of less than one manzana accounted for only 1.2 percent of the total farms.

Labor was the largest single expenditure in all regions, averaging about 53 percent of total cost (Table 96). Labor accounted for nearly two thirds of the total cost in the Interior South. No machine energy was used on sample farms in the Interior South and animal energy cost was only C$5.03 per manzana. Animal energy accounted for about 10 percent of the total budget in the central regions and the Pacific South and about 5 percent in the northern regions. Generally, machine energy was a relatively insignificant charge in all regions. The rate of return to investment was relatively high in all regions. However, the low yields and lower price received resulted in the Pacific North region yielding the lowest returns per manzana.

Total cost of bean production increased directly with size class (Table 97). Labor costs accounted for the largest charge in each size class but generally decreased in importance with the larger size category. Machine energy was not used on farms of less than one manzana, and was a relatively small input on farms between 1 and 10 manzanas. Bean cultivation in Nicaragua is unadapted to merchanization.

TABLE 96

NICARAGUA: PRODUCTION COSTS FOR BEANS BY REGION

	Total		Interior Central		Interior North		Interior South		Pacific Central		Pacific North		Pacific South	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	506.18	100.0	515.24	100.0	556.45	100.0	419.63	100.0	501.09	100.0	436.34	100.0	630.78	100.0
Variable Cost	408.51	80.7	415.06	80.5	436.47	78.4	348.44	83.0	410.22	81.8	357.26	81.8	511.90	81.1
Animal Units	37.80	7.4	50.15	9.7	28.97	5.2	5.03	1.2	52.42	10.4	22.46	5.1	58.31	9.2
Machine Units	6.03	1.2	4.43	0.8	8.13	1.5	. . .	. . .	6.44	1.3	10.76	2.5	26.25	4.1
Labor	259.88	51.3	247.86	48.1	295.44	53.1	270.27	64.4	233.61	46.6	228.66	52.4	308.40	48.9
Purchased Inputs	88.24	17.4	92.28	18.7	85.03	15.3	59.03	14.1	101.63	20.3	84.44	19.3	95.20	15.1
Seed	49.42	9.8	47.05	9.1	40.41	7.3	51.53	12.3	60.32	12.0	47.75	10.9	70.43	11.2
Chemicals	26.57	5.2	38.41	7.4	25.38	4.6	3.67	0.8	29.55	5.9	12.42	2.8	19.59	3.1
Energy Repair	1.29	0.2	0.27	. . .	5.75	0.9	. . .	. . .	0.57	0.1	. . .	. . .	. . .	. . .
Other	10.96	2.2	10.55	2.1	13.99	2.5	3.83	0.9	11.19	2.2	24.27	5.6	5.18	0.8
Interest	16.53	3.2	16.30	3.1	18.87	3.4	14.10	3.3	16.08	3.2	12.90	2.9	23.72	3.8
Fixed Cost	97.66	19.3	100.18	19.4	119.97	21.5	71.18	17.0	70.86	18.1	79.07	18.1	118.87	18.8
Land	77.99	15.4	86.11	16.7	70.00	12.5	64.67	15.4	77.10	15.4	71.98	16.5	112.50	17.8
Labor	13.96	2.7	8.64	1.7	36.67	6.6	5.91	1.4	11.78	2.3	2.84	0.6	. . .	. . .
Depreciation	5.70	1.1	5.42	1.0	13.30	2.4	0.59	0.1	1.97	0.4	4.30	1.0	6.37	1.0
Gross Income	717.93		705.72		783.70		680.71		713.80		510.83		977.82	
Net Farm Income	309.42		290.66		347.23		332.27		303.58		153.57		465.92	
Gross Margin	211.75		190.47		227.25		261.08		212.71		74.49		347.04	
Rate of Return to Investment	41.8		36.9		40.8		62.2		42.4		17.1		55.0	
Rate of Return to Working Cap.	51.8		45.9		52.1		74.9		51.8		20.8		67.8	
Yield/MZ	11.54		11.61		12.32		11.26		10.13		9.55		17.33	
Price/QQ	62.21		60.78		63.61		60.45		70.46		53.49		56.42	
Cost/QQ	43.86		44.37		45.16		37.26		49.46		45.69		36.39	
Labor Requirements	42.5		36.2		52.0		39.7		47.4		36.2		50.3	

TABLE 97

NICARAGUA: PRODUCTION COSTS FOR BEANS BY FARM SIZE

	Less Than 1MZ		1-2.9MZ		3-4.9MZ		5-9.9MZ		10-20MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	407.32	100.0	474.20	100.0	501.02	100.0	565.43	100.0	672.81	100.0
Variable Cost	348.32	85.5	391.40	82.5	401.62	80.1	441.02	78.0	526.90	78.3
Labor	220.00	54.0	261.66	55.2	253.47	50.6	269.28	47.6	266.97	39.7
Animal Units	16.42	4.0	37.00	7.8	40.30	8.0	39.46	7.0	38.33	5.7
Machine Units	. . .	. . .	2.47	0.5	6.50	1.3	6.26	1.1	45.66	6.8
Purchased Inputs	99.49	24.4	75.17	15.8	84.88	16.9	106.37	18.9	148.95	23.0
Seed	64.78	15.9	46.71	9.8	51.76	10.3	48.15	8.5	58.03	8.6
Chemicals	13.31	3.2	16.13	3.4	23.52	4.7	48.63	8.6	61.65	9.1
Energy Repair	. . .	. . .	. . .	. . .	0.36	. . .	. . .	. . .	29.27	4.4
Other	21.40	5.2	12.33	2.6	9.24	1.9	9.59	1.7	6.08	0.9
Interest	12.39	3.0	15.07	3.2	16.44	3.3	19.62	3.4	20.93	3.1
Fixed Cost	59.00	14.5	82.80	17.4	99.40	19.8	124.41	22.0	145.85	21.7
Land	58.42	14.4	73.06	15.4	82.45	16.4	85.43	15.1	80.66	11.9
Labor	. . .	. . .	8.43	1.7	12.45	2.5	53.13	5.8	. . .	. . .
Depreciation	0.57	0.1	1.31	0.3	4.50	0.9	58.4	1.0	65.18	9.7
Gross Income	1,234.57		616.95		621.48		899.09		1,164.15	
Net Farm Income	886.24		225.55		219.86		458.06		637.19	
Gross Margin	827.24		142.74		120.46		333.65		491.33	
Rate of Return to Investment	203.1		30.1		24.0		59.0		73.0	
Rate of Return to Work. Cap.	237.5		36.5		30.0		75.6		93.2	
Yield/MZ	17.81		10.34		10.23		13.43		16.61	
Price/QQ	69.32		59.67		60.75		64.54		70.09	
Cost/QQ	22.87		45.86		48.97		40.59		40.50	
Labor Requirements	38.1		45.8		40.1		40.1		37.5	

Source: Production Costs and Returns Analysis Univeristy of Missouri 1974

Ninety-six percent of the sample bean farms had areas under cultivation of less than 10 manzanas. Equipment investment is not justified for small farms. The data from the sample survey indicates that hand labor continues to be the dominant source of power on bean farms in Nicaragua.

The highest bean yields were obtained in the two extreme size categories. Also prices received were about 13 percent higher in these two size categories. The value of the crop was highest on farms of less than 1 manzana, resulting in a 200 percent rate of return over investment.

There was a greater increase in productivity at higher levels of technology than ecology levels. More intensive cultural practices in the optimum level of technology (03) doubled bean yields and reduced per unit cost by one third over the intermediate level of technology (02). As shown in Table 98, total cost per manzana increased nearly 60 percent but the value of the crop increased over three-fold between the traditional level of technology and the optimum level of technology. Gross margin in the 03 level was over 7 times the gross margin in the 01 level, yielding a rate of return of nearly 200 percent over investment in the optimum level of technology.

Total cost, income and yields also increased with higher ecological levels; however, this increase was less significant than by levels of technology. As shown in Table 99, total cost increased by one-third while yields increased by one-half from the marginal level of ecology (m) to the optimum

TABLE 98

NICARAGUA: PRODUCTION COSTS FOR BEANS
BY LEVELS OF TECHNOLOGY

	01		02		03	
	Cost	%	Cost	%	Cost	%
Total Cost	452.93	100.0	569.45	100.0	717.02	100.0
Variable Cost	366.91	81.0	457.03	80.2	617.02	86.0
Labor	259.85	57.4	260.63	45.8	225.40	31.4
Animal Energy	30.16	6.6	48.11	8.4	9.00	1.2
Machine Energy	.86	.2	9.35	1.6	162.50	22.6
Purchased Inputs	61.24	13.5	120.28	21.1	196.99	27.5
Seed	48.03	10.6	50.85	8.9	65.50	9.1
Chemicals	1.39	.3	56.80	10.0	111.12	15.5
Energy Repair	--	--	2.74	.5	11.00	1.5
Other	11.82	2.6	9.89	1.7	9.37	1.3
Interest	14.77	3.2	18.62	3.2	23.12	3.2
Fixed Cost	86.01	18.9	112.40	19.7	100.00	14.0
Land	67.81	15.0	90.99	16.0	75.00	10.5
Labor	15.76	3.4	11.97	2.1	--	--
Depreciation	2.43	.5	9.44	1.6	25.00	3.5
Gross Income	642.02	--	784.57	--	2150.00	--
Net Farm Income	275.10	--	327.54	--	1532.9	--
Gross Margin	189.05	--	215.12	--	1432.98	--
Rate of Return Investment	41.7	--	33.7	--	19.8	--
Rate of Return Working Capital	51.5	--	47.1	--	232.24	--
Yield/MZ	10.49	--	12.59	--	25.00	--
Price/QQ	61.20	--	62.31	--	86.00	--
Cost/QQ	43.17	--	45.23	--	28.68	--
Labor Requirements	44.6	--	40.2	--	26.0	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Mo., 1974

TABLE 99

NICARAGUA: PRODUCTION COSTS FOR BEANS
BY LEVELS OF ECOLOGY

	m		b		p	
	Cost	%	Cost	%	Cost	%
Total Cost	439.77	100.0	509.49	100.0	587.99	100.0
Variable Cost	359.97	81.8	405.41	79.5	488.72	83.1
Labor	240.52	54.7	251.40	49.3	318.62	54.2
Animal Energy	24.84	5.6	41.48	8.1	42.59	7.2
Machine Energy	7.84	1.8	3.78	.7	11.77	2.0
Purchased Inputs	72.72	16.5	92.01	18.0	96.33	16.4
Seed	46.72	10.6	50.87	10.0	47.90	8.1
Chemicals	11.54	2.6	30.05	5.9	34.98	5.9
Energy Repair	--	--	1.98	.3	.61	.1
Other	14.46	3.3	9.11	1.8	12.84	2.2
Interest	14.01	3.2	16.72	3.3	19.40	3.3
Fixed Cost	79.80	18.1	104.08	20.4	99.26	16.8
Land	74.50	16.9	79.57	15.6	77.11	13.1
Labor	2.58	.6	17.78	3.5	16.00	2.1
Depreciation	2.70	.6	6.72	1.3	6.15	1.0
Gross Income	587.77	--	674.56	--	1062.58	--
Net Farm Income	227.79	--	769.14	--	573.86	--
Gross Margin	147.99	--	165.06	--	474.59	--
Rate of Return to Investment	33.6	--	32.4	--	86.7	--
Rate of Return to Working Capital	41.1	--	40.7	--	97.1	--
Yield/Mz	10.33	--	10.81	--	15.82	--
Price/QQ	56.90	--	62.40	--	67.16	--
Cost/QQ	42.57	--	47.13	--	37.16	--
Labor Requirements	42.2	--	41.2	--	47.7	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Mo., 1974.

level of ecology (p). Labor requirements decreased with higher levels of technology while there was a notable increase in labor inputs on the highest resource base. Non-traditional inputs contributed more to productivity than the traditional inputs of land and labor.

Grain Sorghum

Production information obtained by the field survey for the 1971-72 crop year indicates that during this period sorghum producers had consistently low yields. Native varieties of sorghum are not adapted to mechanical harvest and are subject to bird damage if not properly controlled.

Grain sorghum production was concentrated on smaller size farms. Sixty percent of the farms were less than 20 manzanas and 38 percent were less than 5 manzanas (Table 100). The farms of less than 20 manzanas produced about 30 percent of the total production. Only 3.2 percent of the farms were larger than 200 manzanas but these farms had one third of the area under sorghum cultivation and produced one third of total production.

The Pacific North and Interior Central regions accounted for 62 percent of the total production. These two regions also had 60 percent of the farms. The remaining farms were fairly evenly distributed among the other regions with the exception of the Pacific South which had only 91 farms.

As shown in Table 101, the value of the crop for the total sample was less than the total cost of production.

TABLE 100

NICARAGUA: NUMBER OF FARMS, AREA, PRODUCTION AND YIELDS FOR GRAIN SORGHUM BY FARM SIZE AND REGION, 1971

Farm Size	Number of Farms	Percent of Total	Area in Manzanas	Percent of Total	Production/ Hundredweight	Percent of Total	Yield/ Hun'wt.
Total	12980		39136		497854		12.7
< 1 Mz	125	1.0	35	.1	502	.1	14.3
1 - 5	3612	27.8	4343	11.1	53712	10.8	12.4
5 - 10	1906	14.7	3120	8.0	39220	7.9	12.6
10 - 20	2213	17.0	4062	10.3	53838	10.8	13.3
20 - 50	2813	21.6	5943	15.2	76496	15.3	12.9
50 - 100	1350	10.4	4387	11.2	52663	10.6	12.0
100 - 200	545	4.2	4080	10.4	52702	10.6	12.9
200 - 500	286	2.2	4861	12.4	58217	11.7	12.0
500 - 1000	83	.6	3398	8.7	38262	7.7	11.3
1000 - 2500	25	.2	3011	7.7	46948	9.4	15.6
> 2500	22	.2	1896	4.8	25294	5.0	13.3
Pacific North	3538	27.2	11553	29.5	160516	32.2	13.9
Pacific Central	1463	11.3	8488	21.7	109200	21.9	12.9
Pacific South	91	.7	272	.7	2868	.6	10.5
Interior North	1848	14.2	2995	7.6	30981	6.2	10.3
Interior Central	4265	32.8	12111	30.9	149247	30.0	12.3
Interior South	1775	13.8	3717	9.5	45042	9.0	12.1

Source: UNASEC Censo Nacional Agropecuario, 1971 and Cuentas Nacionales Banco De Central Nicaragua.

TABLE 101

NICARAGUA: PRODUCTION COSTS FOR GRAIN SORGHUM BY REGION

	Total		Interior Central		Interior North		Interior South		Pacific Central		Pacific North		Pacific South	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	468.50	100.0	412.77	100.0	488.65	100.0	306.72	100.0	616.76	100.0	517.33	100.0	439.04	100.0
Variable Cost	364.70	77.8	311.83	75.5	385.98	79.0	218.72	71.4	526.42	85.3	393.35	76.0	379.29	86.4
Labor	196.87	42.1	149.12	36.1	179.13	36.7	176.74	57.7	293.34	47.5	190.77	36.9	208.75	47.5
Animal Energy	42.47	9.0	35.88	8.7	45.46	9.3	7.58	2.4	34.60	5.6	63.59	12.3	66.25	15.0
Machine Energy	42.45	9.0	47.92	11.6	60.00	12.2	14.93	4.9	71.73	11.6	36.30	7.0	74.00	16.8
Purchased Inputs	69.07	14.7	66.69	16.1	87.06	17.8	11.99	3.9	104.37	17.0	88.62	17.1	16.19	3.7
Seed	13.32	2.8	19.96	4.8	23.46	4.8	3.71	1.2	19.53	3.2	12.20	2.4	6.19	1.4
Chemicals	36.63	7.8	24.63	5.9	23.76	4.8	. . .	. . .	60.66	9.8	55.30	10.7	7.00	1.6
Energy Repair	2.63	0.6	2.91	0.7	17.18	3.5	. . .	. . .	0.98	0.2	3.58	0.7	. . .	. . .
Other	16.49	3.5	19.19	4.6	22.66	4.6	8.28	2.7	23.20	3.7	17.44	3.3	3.00	0.7
Interest	13.81	2.9	12.45	3.0	14.30	2.9	7.46	2.4	22.36	3.6	14.03	2.7	14.10	3.2
Fixed Cost	103.80	22.2	100.94	24.4	102.66	21.0	87.50	28.5	90.33	14.6	123.98	24.0	59.75	13.6
Land	88.43	18.9	75.44	18.3	60.00	12.3	75.27	24.5	88.33	14.3	107.22	20.7	58.75	13.4
Labor	7.87	1.6	14.16	3.4	42.66	8.7	. . .	. . .	. . .	. . .	9.91	2.0	. . .	. . .
Depreciation	7.49	1.6	11.33	2.7	. . .	. . .	12.22	4.0	2.00	0.3	6.84	1.3	1.00	0.2
Gross Income	459.77		431.69		698.50		319.17		750.34		407.02		424.83	
Net Farm Income	95.06		119.86		312.51		100.45		223.91		13.66		45.53	
Gross Margin	-8.74		18.92		209.85		12.95		133.58		-110.31		-14.21	
Rate of Return to Investment	-1.8		4.6		42.9		4.2		21.6		-21.3		-3.2	
Rate of Return to Working Capital	-2.4		6.1		54.4		5.9		25.4		-28.0		-3.7	
Yield/MZ	19.94		23.05		21.00		13.19		30.31		17.03		22.75	
Price/QQ	23.05		18.72		33.26		24.19		24.75		23.90		18.64	
Cost/QQ	23.49		17.90		24.56		23.21		20.34		30.37		19.27	
Labor Requirements	40.0		28.2		43.3		29.3		42.6		48.6		52.3	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri 1974

Only two regions, the Interior North and the Pacific Central, showed an acceptable return per manzana. Income per manzana was significantly higher in these regions. The higher income in the Interior North was the result of higher prices received while farms in the Pacific Central region had substantially higher yields.

Variations in costs by farm size are shown in Table 102 and costs by level of technology and ecology are shown in Table 103 and 104 respectively. There was no significant difference in returns to the factors of production on all size farms less than 15 manzanas. However, there was a significant increase in variable cost and yields on farms between 20 and 50 manzanas. The cost data indicate that a larger degree of mechanization was used on farms in this size category as well as a greater expenditure for seed and chemicals.

Yields increased substantially with each level of technology as well as with each level of ecology; however, increase in gross income resulting from the increased yields was not sufficient to cover the increased cost. Farms producing in the optimum level of technology were less efficient than farms producing under traditional technology. While farms in the optimum level of ecology yielded positive returns per manzana the rate of return was relatively low compared to alternative crop activities. These data indicate that sorghum was produced under similar cultural methods regardless of farm size, technological or ecological levels.

TABLE 102

NICARAGUA: PRODUCTION COSTS FOR GRAIN SORGHUM BY FARM SIZE

	1MZ		1-2.9MZ		3-4.9MZ		5-9.9MZ		10-15MZ		20-50MZ	
	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	477.38	100.0	458.24	100.0	421.18	100.0	489.39	100.0	484.85	100.0	712.20	100.0
Variable Cost	427.38	89.5	362.96	79.2	317.63	75.4	380.66	77.7	355.46	73.3	590.87	82.9
Labor	183.00	38.3	211.93	46.2	197.70	46.9	205.92	42.1	145.45	30.0	87.98	12.3
Animal Energy	107.00	22.4	42.66	9.3	36.57	8.7	50.49	10.3	42.10	8.7	. . .	. . .
Machine Energy	. . .	. . .	31.66	6.9	23.85	5.6	26.60	5.4	83.20	17.1	314.80	44.2
Purchased Inputs	114.98	26.3	63.07	13.7	48.25	11.4	82.25	16.8	69.92	14.4	167.75	23.5
Seed	22.40	4.7	8.99	1.9	10.35	2.4	15.54	3.2	23.55	4.8	39.33	5.5
Chemicals	53.30	11.2	35.94	7.8	26.07	6.2	41.52	8.5	26.58	5.5	104.66	14.7
Energy Repair	. . .	. . .	1.30	0.3	0.75	0.2	4.43	0.9	1.91	0.4	22.43	3.1
Other	50.00	10.5	16.84	3.7	11.08	2.6	20.76	4.2	17.88	3.7	1.33	0.2
Interest	11.68	2.4	13.60	3.0	11.23	2.6	15.36	3.1	14.76	3.0	20.32	2.9
Fixed Cost	50.00	10.5	95.28	20.8	103.55	24.6	108.72	22.2	129.38	26.6	121.33	17.0
Land	50.00	10.5	90.38	19.7	88.90	21.1	91.36	18.6	75.00	15.4	91.66	12.8
Labor	. . .	. . .	3.79	0.8	7.85	1.8	10.27	2.1	23.22	4.8	. . .	. . .
Depreciation	. . .	. . .	1.10	0.2	6.80	1.6	7.09	1.4	31.16	6.4	29.66	4.1
Gross Income	432.90		461.79		400.52		492.67		379.21		837.73	
Net Farm Income	5.52		98.83		82.89		112.00		23.74		246.86	
Gross Margin	-44.48		3.54		-20.65		3.28		-105.64		125.53	
Rate of Return to Invest.	-9.3		0.7		-4.9		0.7		-21.8		17.6	
Rate of Return to Working Capital	10.4		1.0		-6.5		0.8		-29.7		21.2	
Yield/MZ	13.00		19.66		18.86		20.16		18.10		36.81	
Price/QQ	33.30		23.48		21.24		24.44		20.95		22.75	
Cost/QQ	36.72		23.30		22.33		21.27		26.78		19.34	
Labor Requirements	50.3		46.8		40.8		37.9		21.7		13.4	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri 1974.

TABLE 103

NICARAGUA: PRODUCTION COSTS FOR GRAIN SORGHUM BY LEVELS OF TECHNOLOGY

	01		02		03	
	Cost	%	Cost	%	Cost	%
Total Cost	313.87	100.0	577.90	100.0	872.83	100.0
Variable Cost	240.24	76.5	449.21	77.7	704.27	80.7
Labor	168.69	53.7	214.71	37.1	278.93	37.0
Animal Energy	36.98	11.8	55.44	9.6	20.44	2.3
Machine Energy	2.85	.9	66.64	11.5	161.24	18.5
Purchased Inputs	23.55	7.5	95.22	16.5	212.46	24.3
Seed	4.04	1.3	17.94	3.1	45.44	5.2
Chemicals	8.16	2.6	52.00	9.0	130.16	14.9
Energy Repairs	--	--	5.06	.9	7.31	.8
Other	11.35	3.6	20.22	3.5	29.55	3.4
Interest	8.14	2.6	17.20	3.0	31.17	3.6
Fixed Cost	73.63	23.4	128.68	22.2	168.55	19.3
Land	72.61	23.1	104.72	18.1	109.44	12. 5
Labor	--	--	9.36	1.6	44.77	5.1
Depreciation	1.02	.3	14.59	2.5	14.33	1.6
Gross Income	315.26	--	581.61	--	759.13	--
Net Farm Income	75.02	--	132.39	--	54.85	--
Gross Margin	1.39	--	3.71	--	-113.69	--
Rate of Return to Investment	.4	--	.6	--	-13.0	--
Rate of Return to Working Capital	.6	--	.8	--	-16.1	--
Yield/MZ	14.02	--	24.45	--	34.10	--
Price/QQ	22.48	--	23.78	--	22.26	--
Cost/QQ	22.39	--	23.63	--	25.59	--
Labor Requirements	38.6	--	41.4	--	42.0	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Mo., 1974.

TABLE 104

NICARAGUA: PRODUCTION COSTS FOR GRAIN SORGHUM BY LEVELS OF ECOLOGY

	M		B		P	
	Cost	%	Cost	%	Cost	%
Total Cost	268.79	100.0	444.88	100.0	574.49	100.0
Variable Cost	208.16	77.4	336.82	75.7	467.31	81.3
Labor	146.91	54.6	181.28	40.7	243.44	47.4
Animal Energy	24.05	8.9	38.91	8.7	55.10	9.6
Machine Energy	8.75	3.2	40.86	9.2	55.36	9.6
Purchased Inputs	20.43	7.6	63.54	14.3	94.64	16.5
Seed	6.61	2.5	11.62	2.6	18.75	3.3
Chemicals	.70	.3	32.48	7.3	55.50	9.6
Energy Repairs	--	--	3.14	.7	2.35	.4
Other	13.12	4.8	16.21	3.6	18.04	3.1
Interest	8.02	3.0	12.23	2.7	18.75	3.2
Fixed Cost	60.62	22.5	108.11	24.3	107.17	18.6
Land	60.62	22.5	87.20	19.6	98.92	17.2
Labor	--	--	9.87	2.2	5.96	1.0
Depreciation	--	--	11.04	2.5	2.28	.4
Gross Income	262.39	--	408.03	--	623.33	--
Net Farm Income	54.22	--	71.27	--	156.01	--
Gross Margin	-6.40	--	-36.87	--	48.83	--
Rate of Return to Investment	-2.4	--	08.3	--	8.5	--
Rate of Return to Working Capital	-3.1	--	-10.9	--	10.4	--
Yield/MZ	11.52	--	18.70	--	24.90	--
Price/QQ	22.78	--	21.82	--	25.03	--
Cost/QQ	23.33	--	23.79	--	23.07	--
Labor Requirements	37.6	--	38.6	--	43.6	--

Source: Nicaraguan Production Costs and Returns Analysis, University of Mo., 1974.

Livestock Activities

Beef and Milk

The value of cattle production accounted for 25 percent of the total value of agricultural production. In 1971, the cattle inventory exceeded 2 million head of cattle. As shown in Table 105 the Interior South had nearly 43 percent of the cattle population followed by the Interior Central and Pacific North with 21 percent and 17 percent respectively. Land area in pasture was 2.8 million manzanas. The concentration of pasture land in the six major regions generally followed the pattern of the cattle population. Farms larger than 500 manzanas had nearly 50 percent of the total pasture area but only about 30 percent of the cattle population. The cattle density per manzana generally decreased with larger size strata.

There was no estimate available for milk cow numbers, however, the structure of milk production is shown in Table 106. Nearly two thirds of the total milk produced was on farms between 20-500 manzanas. The Interior South region produced 38 percent of total milk production with the Pacific Central and Pacific North producing 15 and 22 percent respectively. The Pacific South and Interior North combined accounted for 10 percent of total production.

Since a majority of the farms in Nicaragua produce beef and milk from the same herd, production costs are given for the total sample average for livestock farms and

TABLE 105

NICARAGUA: CATTLE POPULATION AND PASTURE AREA
BY FARM SIZE AND REGION, 1971

	#Head	%	Pasture Area	%	Head/ Mz
Total Republic*	2,074,569	100.00	2,854,010	100.00	.72
<1	315	.02	418	.01	.75
1 - 5	36,337	1.75	13,402	.47	2.71
5 - 10	58,700	2.83	21,201	.74	2.76
10 - 20	118,038	5.69	58,116	2.04	2.03
20 - 50	331,267	15.97	219,533	7.69	1.51
50 - 100	290,525	14.00	303,537	10.64	.95
100 - 200	280,395	13.52	240,807	11.94	1.16
200 - 500	350,541	16.90	486,330	17.04	.72
500 - 1000	226,324	10.91	352,743	12.36	.64
1000 - 2500	179,134	8.63	377,773	13.24	.47
2500 +	202,984	9.78	608,150	23.83	.33
Pacific North	356,079	17.16	417,023	14.61	.85
Pacific Central	143,487	6.91	367,046	12.86	.39
Pacific South	159,431	7.68	189,424	6.64	.84
Interior North	89,461	4.31	240,043	8.41	7
Interior Central	440,869	21.25	599,422	21.00	.74
Interior South	885,269	42.67	1,041,050	36.47	.85

*Total excludes an estimated 161,472 cattle in the Caribbean regions and an estimated 461,348 manzanas of pasture land.

Source: UNASEC, Censo Nacional Agropecuario, 1971 and Cuentas Nacionales, Banco Central de Nicaragua.

TABLE 106

NICARAGUA: MILK PRODUCTION BY FARM SIZE AND REGION, 1971

	Production	%
Total Republic	102,255,876	100.00
·1	205,773	.20
1 - 5	3,756,326	3.67
5 - 10	3,996,394	3.91
10 - 20	5,857,348	5.73
20 - 50	14,355,287	13.95
50 - 100	14,782,726	14.48
100 - 200	16,940,829	16.59
200 - 500	21,025,610	20.58
500 - 1000	10,971,750	10.73
1000 - 2500	6,339,636	6.20
2500 +	4,023,997	3.94
Pacific North	15,625,334	15.28
Pacific Central	22,205,596	21.71
Pacific South	6,560,744	6.41
Interior North	3,754,095	3.67
Interior Central	15,180,051	14.84
Interior South	38,930,056	38.07

Source: UNASEC Censo Nacional Agropecuario, 1971 and Cuentas Nacionales, Banco Central de Nicaragua.

TABLE 107

NICARAGUA: AVERAGE PRODUCTION COSTS PER HEAD OF CATTLE

	Cost	%
Total Cost	355.26	100.0
Variable Cost	133.44	37.6
Labor		
Application	.34	.1
Other	9.94	2.8
Animal Power	.13	--
Machine Power	.15	--
Feed and Veterinary	29.77	8.4
Hay and Silage	3.79	1.1
Fertilizer and Chemicals	2.83	.8
Implements and Equipment	7.92	2.2
Gas and oil	8.92	2.5
Technical Asst.	3.18	.9
Dairy Expenses	1.65	.5
Dairy Purchases	18.00	5.1
Beef Purchases	35.10	9.8
Interest	11.72	3.3
Fixed Cost	221.82	62.4
Land Cost	109.04	30.7
Land Rent	1.06	.3
Labor		
Management	21.20	5.6
Labor	49.91	14.4
Various	29.99	8.4
Repairs	10.62	3.0
Gross Income	469.17	--
Net Farm	335.73	--
Gross Margin	113.91	--
Return to Investment (%)	32.1	--
Return to Working Capital (%)	85.4	--
Head/Mz	.87	--
Income Ratio (dairy/beef)	74/26	

Source: Nicaraguan Production Costs and Returns Analysis, University of Missouri, 1974.

for farms defined by type--dairy, beef and mixed.* Table 107 shows costs for the total sample coverage for all livestock farms.

Fixed costs accounted for 62.4 percent of total costs. Land costs accounted for 31 percent and fixed labor was 20 percent of total costs. Variable cost accounted for 37.6 percent of the total cost with feed and veterinary expenses making up for 8.4 percent of total cost. Dairy purchases and beef purchased were 5.1 percent and 9.8 percent respectively. Dairy income was 74 percent of gross income and beef income accounted for the remaining 26 percent. Livestock population density was .57 head per manzana.

Costs by farm classification are presented in Table 108. The percentage of fixed cost was notably higher for dairy farms with fixed labor accounting for 22 percent of total costs. Beef cattle purchases were a significant cost in the beef and mixed classification. Feed and veterinary cost accounted for nearly one third of the variable cost on dairy farms.

Returns were highest for mixed farms with a dairy to beef ration of 51/49. Livestock density was 1.11 head per manzana for mixed enterprises while beef and dairy farms had a .94 and .80 head per manzana respectively.

---

*Farm classification by income

If dairy income ration	60%	= Dairy farm
If beef income ration	60%	= Beef farm
If neither exceeds	60%	= Mixed farm

TABLE 108

NICARAGUA: PRODUCTION COSTS PER HEAD OF CATTLE BY TYPE OF ACTIVITY

	Dairy		Beef		Mixed	
	Cost	Percent	Cost	Percent	Cost	Percent
Total Cost	343.41	. . .	229.33	. . .	408.36	. . .
Variable Cost	121.53	35.0	131.45	44.0	168.72	41.0
Labor						
Application	0.50	4.0	0.00	2.0	0.00	1.0
Other	13.09	. . .	4.80	. . .	2.50	. . .
Animal Power	0.19	. . .	0.00	. . .	0.00	. . .
Machine Power	0.23	. . .	0.00	. . .	0.00	. . .
Feed and Vet.	37.89	11.0	17.11	. . .	10.45	3.0
Hay and Silage	5.24	1.0	0.20	. . .	0.79	. . .
Fertilizer and Chemicals	2.99	1.0	0.60	. . .	3.13	1.0
Implements and Equipment	9.12	3.0	8.16	3.0	4.37	1.0
Gas and Oil	10.87	3.0	4.71	2.0	4.66	1.0
Technical Assistant	2.05	1.0	3.41	1.0	6.40	2.0
Dairy Expenses	2.07	1.0	0.37	. . .	0.79	. . .
Dairy Purchases	24.18	7.0	16.01	5.0	0.00	. . .
Beef Purchases	1.59	. . .	66.96	22.0	121.75	29.0
Interest	11.52	3.0	8.82	3.0	13.88	3.0
Fixed Cost	221.88	65.0	168.18	56.0	239.64	59.0
Land Cost	107.11	32.0	110.88	37.0	114.14	28.0
Land Rent	1.37	. . .	0.00	. . .	0.52	. . .
Labor						
Management	25.00	22.0	14.61	11.0	12.37	18.0
Labor	49.81	. . .	18.08	. . .	60.84	. . .
Various	28.35	8.0	11.49	4.0	40.91	10.0
Repairs	16.24	3.0	13.12	4.0	10.86	3.0
Gross Income	423.83		347.15		641.17	
Net Farm Income	302.30		216.60		472.45	
Gross Margin	80.42		48.42		232.81	
Return to Investment Percent	23.4		16.2		57.0	
Return to Working Capital	66.2		37.0		138.0	
Head/MZ	0.80		0.94		1.11	
Income Ratio (Dairy/Beef)	91/9		16/84		51/49	

Source: Nicaraguan Production Costs and Returns Analysis University of Missouri 1974.

V

CONCLUSIONS AND RECOMMENDATIONS

As a summary of the findings of preceeding sections, this section briefly outlines key problem areas in agricultural production and establishes a broad set of policy recommendations for meeting developmental objectives in Nicaraguan agriculture. No attempt is made to outline specific programs or projects since such efforts must also take into account areas of concern such as domestic and international marketing, institutional aspects as well as a host of other factors including balance of payments matters, foreign financial and technical assistance and internal political considerations.

To list key problem areas of Nicaraguan agricultural production borders on an academic exercise in that no single problem or set of problems is fundamental or basic. Any given problem is highly interrelated to other problems, and is therefore only a manifestation of an entire system that is faulty in the sense that it is not compatible with rapid economic development. Thus, any attempt to define a given problem as fundamental to all other agricultural production problems is rather futile because of the many vicious circles of underdevelopment.

There is, however, merit in defining the variables of the vicious circles. Understanding the nature of identifiable problems permits a better comprehension of the system. This in turn provides a basis for disturbing the system through specific policies, programs or projects in the hope that the vicious circles may be broken or at least shaken sufficiently for a new higher level equilibrium to be established. It is for this reason, therefore, that the following listing is denoted. This listing is not comprehensive, but rather attempts to enumerate the obvious problem issues derived from the preceeding analysis.

Key Problem Areas of
Nicaraguan Agricultural Production

- High levels of rural unemployment and underemployment
- Low labor productivity
- Highly skewed land concentration
- Highly skewed income distribution
- Limited use of modern inputs
- Stagnated basic grain sector
- Low yields for most crops
- Very limited applied agricultural research
- Extensive use of land capable of more intensive utilization
- Rapid rural population growth
- Insufficient road and logistical network

An Outline of Policy Priorities

Six major constraints can be identified as basic to the set of problems noted above. These are: (1) the present patterns of land use and control, i.e., the implicit government land policy, (2) foreign exchange limitations for the importation of modern inputs, (3) low levels of domestic technical capacity to adapt and disseminate new agricultural technology, (4) low levels of producer knowledge regarding the use of new technology, (5) an inadequate credit/financial system to assist producers in the financing of new inputs, and (6) a weak logistical-transport network to efficiently handle the inputs and products. It is recognized that a host of other constraints could be noted, but these six are considered basic to the key problems of Nicaraguan agricultural production.

Taking into consideration the manifested problems and the constraints, the following set of policy priorities are presented.

Sharply increase the use of modern inputs. As noted in the preceeding analysis, increased modern input use (excepting the indiscriminate use of mechanical power) raises labor and land productivity, increases employment and income but does not result in higher per unit production costs. A direct benefit is increased production for domestic and/or export markets. The foreign exchange impact of greater

imports of modern inputs appears preverse. However, depending upon price relationships, payoff resulting from the export or increased production is on the order of two to four dollars in foreign exchange earnings for every dollar expended to import modern inputs.

Rapidly increase the technical capability to adapt known technology to local conditions. A comparison of Nicaraguan crop yields with those of other countries indicated that with few exceptions Nicaragua lags behind. The nation has an abysmal technical support system for its agriculture and low yields (especially for basic grains) are a result. The importance of having a domestic adaptive research capability cannot be overstated. This does not imply that basic research should be carried on since this requires an enormous investment of time and money. However, the International Centers (for example, CIAT, CIMMYT, IRRI) maintain training programs and assistance efforts to develop adaptive research capabilities. Investments in human resources of this type yield some of the highest returns available to society. Further, with few exceptions, these efforts must be publicly funded since no single producer can economically undertake

such efforts. An alternative approach would be to utilize existing commodity organizations and/or farm new entities with a commodity orientation. But most important, services from such entities must be made available to all producers.

Expand the capability of producers to utilize new inputs. This priority implies several different types of simultaneous and/or alternative efforts. Credit is a key element, although input subsidies present an alternative approach. Favorable input/output price relationships are basic to the adoption of modern inputs, but producer knowledge and risk reduction are of equal importance. It has been shown that small farmers will willingly adopt new technology if it is available, profitable, affordable, and feasible. Opportunities are available for innovative programs in Nicaragua given that only a skeleton structure presently exists.

Initiate rural population planning programs. This priority is a long-term effort. Perhaps not to be considered as an agricultural policy, nevertheless the fact remains that it is intimately related to the most important resource--the human resource.

Previous discussion of how this question relates to rural and urban employment outlined the reasons why this policy must be ranked as a high priority in agricultural development.

Open new lands for intensive agricultural use. Nicaragua is fortunate in having unexploited land capable of intensive use. If no change is to occur in policies concerning land presently in agricultural use, then the unexploited areas provide an outlet for the very rapidly growing population. This cannot be viewed as a panacea to present agricultural problems due to very high developmental and social overhead costs. Further, it is doubtful whether much can be expected from such a policy regarding increased short-term commercial marketings. Rather, this is a stop-gap measure to deal with a serious land concentration/population problem in existing agricultural areas.

Establish secure long-term tenure relationships on existing agricultural lands. Land ownership and control of production can be relatively independent providing an adequate tenure relationship exists between tenant and landlord. Far more intensive production could be forthcoming from present agricultural lands if incentives existed for the

owner and tenant. Ownership patterns need not be drastically changed, only tenure patterns. Again, opportunities exist for innovative efforts in this regard.

Undertake research as to the most appropriate land policies. The above policy priorities are predicated on the assumption that no significant change will occur regarding implicit government land policy. This assumption may or may not be valid. Either way, the preceeding policy priorities are relevant. However, given that present land policies are a serious constraint to agricultural development, this question must be examined in an objective and rational manner.

METHODOLOGICAL APPENDIX

In calculating the production cost for each crop, detailed information from the field surveys was divided into 17 variables. These variables were used to calculate the cost of production per manzana and were divided into variable cost and fixed cost categories. Variable costs were divided into 5 items and fixed costs were divided into 3 items.

Production Cost Variables

1. Total Labor Mandays
2. Hired Labor Mandays
3. Wage rate
4. Value of Unhired Labor
5. Cost of Animal units Hired
6. Value of Animal Units Owned
7. Cost of Machine Units Hired
8. Value of Machine Units Owned
9. Seed and Plant Expenses
10. Chemical Expenses
11. Energy, Parts and Repair Expenses
12. Other Expenses
13. Equipment Expenses
14. Land Opportunity Cost
15. Fixed Labor - Annual Salary
16. Fixed Labor Mandays - Management
17. Fixed Labor Mandays- Worker

Categories of Cost Estimates

Variable Cost Items

1. Labor Cost
2. Cost of Animal Energy
3. Cost of Machine Energy
4. Purchased Inputs
5. Interest

Fixed Cost Items

6. Equipment Depreciation
7. Land Opportunity Cost
8. Fixed Labor

The method of calculating the cost is presented below. The X's represent the production cost variables and the Y's represent the cost categories..

Variable Cost

1. Labor Cost

$$Y(1) = X(2) \times X(3) + X(1) - X(2) \times X(4)$$

Labor costs include the cost of hired labor and the value of unhired labor. The total mandays of hired labor were summed and multiplied by the wage rate. Information on the wage rates were taken from the questionnaire. The wage rates were given with meals and without meals. In the case of wages paid with meals, two cordobas were added to reflect a more accurate cost of labor to the producer. The number of unhired mandays were determined by subtracting the mandays of hired labor from the total labor utilized. This value was then multiplied by the average wage rate of C$8.00 although this rate varied somewhat by region.

2. Cost of Animal Energy

$$Y(2) = X(5) + X(6)$$

The cost of animal energy was calculated by summing the cost of animal units rented and the value of animal units. This cost was obtained from the field survey and based on information supplied by the farmer.

3. Cost of Machine Energy

$$Y(3) = X(7) + X(8)$$

The value of tractor rent was determined by summing the cost of hired machine units and the value of machine units owned. This cost included the cost of the operator when the machine unit was custom hired.

4. Cost of Purchased Inputs

$$Y(4) = X(9) + X(10) + X(11) + X(12)$$

This cost category includes the cost of seed, chemicals (fertilizer, insecticide, herbicides), energy, (gasoline, lubricants, electricity), parts, equipment repair and other expenses such as irrigation, bags and baskets. These costs were taken from the survey and given in cost per manzana.

5. Interest

$$Y(5) = [X(2)(3) + X(5) + X(7) + X(9) + X(10) + X(11) + X(12) + \frac{X(15)}{365} \times X(16) + \frac{X(15)}{365} X(17)] \times .05$$

This cost was determined by summing the total cash expenditure for labor, purchased inputs, animal and machine

rent. Since not all cash expenses occurred at the beginning of the year and these cost calculations were for a single crop where two crops were possible per year, cash flow was compensated for by multiplying total cash expenditures by an interest rate of 5 percent, which amounted to an effective annual interest rate of 10 percent.

Fixed Cost

In most cases each farm surveyed restricted production to one crop. In this respect it was fairly simple to allocate fixed cost.

6. Equipment Depreciation

$$Y(6) = X(13)$$

The value of equipment inventory was taken during the field survey. This value was multiplied by the percentage of the farm devoted to the particular crop activity under study and divided by the area cultivated to give depreciation cost per manzana.

7. Land Opportunity Cost

$$Y(7) = X(14)$$

In the filed survey, no distinction was made between cash rent cost and land opportunity cost. In this study the cost concept is analyzed on the assumption that the land is owned.

8. Fixed Labor

$$Y(8) = \frac{X(15)}{365} \times X(16) + \frac{X(15)}{365} \quad X(17)$$

In the field survey, fixed labor was divided into two categories, management and worker. In both cases the annual salary for permanent labor was divided by 356 to give daily fixed labor cost. This value was then multiplied by the fixed labor mandays devoted to the specific crop activity.

Total Cost

The five categories of variable cost and the three categories of fixed cost were added together to give the total cost for each farm.

Total Cash Cost

The proportion of total cost representing cash outlays. Cash expenditures in this study are defined as wages for hired and fixed labor, cost of animal and machine units hired, purchased inputs and interest expenses.

Income Analysis

Gross Income

The yield per manzana was multiplied by the price received by the farmer. Yield and price information was again based on information from the field survey.

Net Cash Income

Gross Income-Cash Cost=Net Cash Income

Net Farm Income

Gross Income-Variable Cost-Net Farm Income

Gross Margin

Gross Income-Total Cost=Gross Margin

Rate of Return

Two tests of profitability of the farms used in this study were the return to total investment and return to working capital. More emphasis was placed on return to total investment for long run policy implications. Whether the rates of return were high or low depended on whether the capital could earn more if invested elsewhere. However this freedom of choice in many cases may not be available in less developed countries where investment or employment opportunities are not available outside the agriculture sector.

To Investment

Gross margin/total cost-rate of return to investment

To Working Capital

Gross margin/variable cost-rate of return to working capital