AGRICULTURAL PRODUCTION IN ACOSTA-PURISCAL, COSTA RICA

Physico-biological and socio-economic conditions. Preliminary study

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AGRICULTURAL PRODUCTION IN ACOSTA-PURISCAL, COSTA RICA: PHYSICO-BIOLOGICAL AND SOCIO-ECONOMIC CONDITIONS

C O N T E N T S

ABBREVIATIONS

A & A (SNAA)	:	Servicio Nacional de Acueductos y Alcantarillados (National Aqueduct and Sewer Service)
BCCR	:	Banco Central de Costa Rica (Central Bank of Costa Rica)
BCR	:	Banco de Costa Rica (Bank of Costa Rica)
BNCR	:	Banco Nacional de Costa Rica (National Bank of Costa Rica)
CAR	:	Centro Agrícola Regional (Regional Agricultural Center)
CENADA	:	Centro Nacional de Abastecimiento y Distribución de Alimentos. (National Food Supply and Distribution Center)
DINADECO	:	Dirección Nacional de Desarrollo de la Comunidad (National Administration of Community Development)
ICE	:	Instituto Costarricense de Electricidad (Costa Rican Institute of Electricity)
IFAM	:	Instituto de Fomento y Asesoría Municipal (Institute of Municipal Promotion and Consultation)
MAG	:	Ministerio de Agricultura y Ganadería (Ministry of Agriculture and Livestock)
MEIC	:	Ministerio de Economía, Industria y Comercio (Ministry of Economy, Industry and Commerce)
RTC	:	Republic Tobacco Company
4S Clubs	:	Youth activities in rural communities: knowledge, health, service, sentiment, etc.

1. Introduction

Johannes Lagemann[1)]

The objectives of CATIE are to produce and diffuse production systems that can increase the present production, and consequently, the general welfare of the small farmers in Central America. The CATIE-GTZ Project "Farming Systems in Central America" works within this approach and is carrying out research in two regions of Central America. One region is the Acosta-Puriscal area which is situated in the northern part of the Central Pacific about 70 kilometers from San Jose. (see Map #1).

A schematic framework of the sequential project stages is given in Figure 1. The second stage of the project provides a description of the physico-biological and socio-economic environment and the characteristics of the farms in the selected area. The objectives of the stage "Description of Areas" are listed below:

1. Identification of resources and main farm enterprises.
2. A brief description of technology used in the more important agricultural enterprises.
3. Identification of the principal problems encountered by the farmers.
4. Identification of the limitations evident in the physico-biological and socio-economic environment and in the actual technology used.

This information will be used to design exploratory experiments during the first year of field work, to prepare a multi-visit survey with 70 farmers of the zone and to aid national institutions in the preparation of an Agricultural Research and Development Project.

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1) Agricultural Economist and Coordinator of the CATIE-GTZ Project.

Map 1: General map of Costa Rica and project area

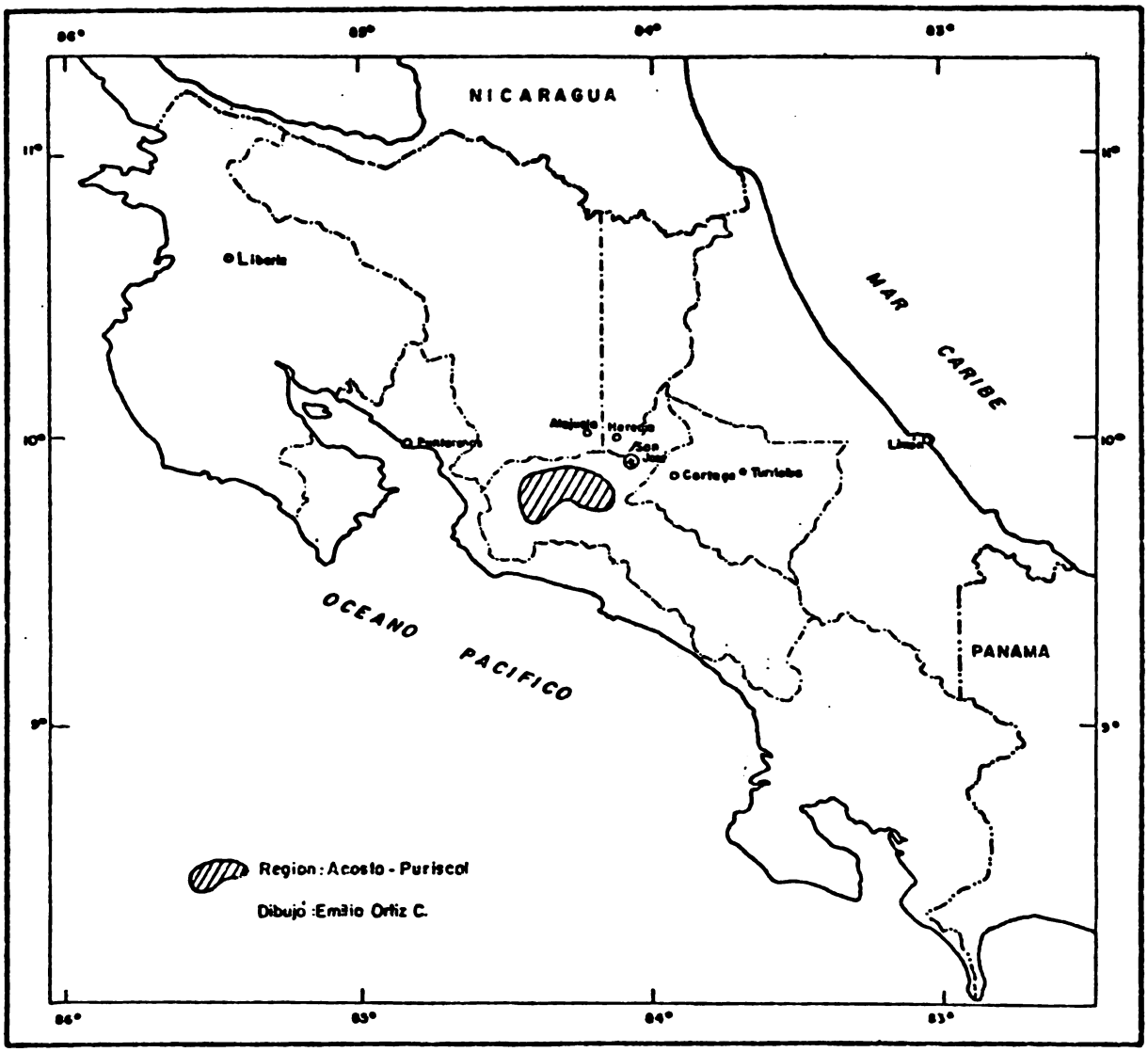
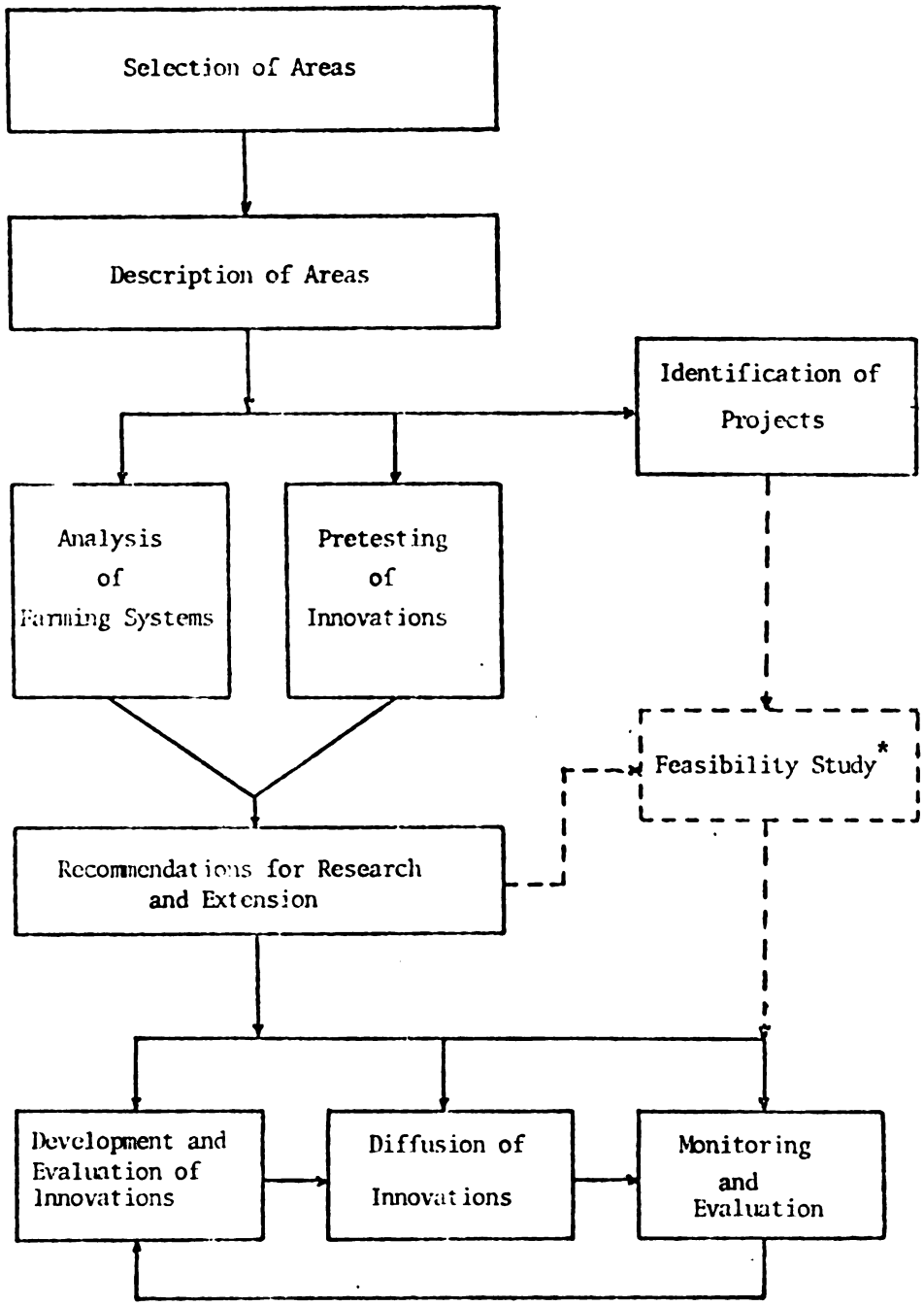


Figure 1: Sequential stages of the Farming Systems Project



* A feasibility study will not be conducted by the research team, but assistance could be given.

2. Methodology

Johannes Lagemann[1)]

In order to gather the necessary information about environment, farm characteristics and the various limitations, the following methods have been used (apart from an analysis of the existing literature): visits to the study area with scientists of different disciplines, meetings with local and regional institutions, execution of a preliminary survey, and collection of soil samples.

2.1 Visits to the work area

The purpose of visiting the area with various specialists from CATIE and MAG was to obtain a detailed geographic knowledge of the region in order to stratify it according to a few factors that most strongly influence the type of farming systems, check the accessibility of each zone, and identify limiting factors on the farm (for example: use of improved seeds, pest and weed control).

This information was obtained in informal interviews with both farmers and personnel of national institutions. At the same time, these interviews provided the opportunity to explain to them the objectives and different activities planned for the project.

2.2 Meetings with regional and local institutions

The knowledge of technicians and other persons who work in the zone is a very important source for the collection of data. Much information about farm management and the physico-biological and socio-economic environment is derived from these meetings. Another benefit is the active participation of MAG technicians in the elaboration of this study.

2.3 Preliminary survey

The objectives of the preliminary survey were: identification of resources and most important farm enterprises, use of land and inputs, maximum work demand, relative importance of agricultural products as a source of cash in-

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1) Agricultural Economist and Coordinator of the CATIE-GTZ Project.

come and problems observed by the farmer. The questionnaire was precoded to permit a direct transfer of the data to the computer pretested with some farmers in the work area.

2.3.1 Sampling methods

The first step was to identify the districts and villages within the zones chosen for sampling[1]. The main factors determining the choice of these zones were: a) the concentration of small farmers, and b) the access to the villages during the year. The next step required a complete list of farms in the villages in order to make a random sample. This list was obtained from the General Administration of Information and Statistics. (Population Census of 1973).

With the budget and time available, it was possible to visit 286 farmers; this number represents approximately 10% of the farmers in the work area. Sample distribution in the different districts can be seen in the following table:

Table 2.1 Sample distribution

Sampling zone	District	Number of Observations
Acosta	San Ignacio	57
	Guaitil	37
	Cangrejal	35
	Palmichal	49
Puriscal	Tabarcia	25
	Mercedes Sur	40
	Candelarita	15
	Barbacoas	28
	TOTAL	286

1) The zone is very heterogeneous in respect to the topography, soils, farm resources, and land usage. Therefore, the stratification was made according to topography only. (see paragraph 3.2).

2.3.2 Execution of the survey

The preliminary survey was done in November, 1980, with the help of 10 enumerators. All were from the same area and were graduates of Agricultural schools.

These enumerators received training in the office as well as in the field. Much emphasis was placed on the explanation of project objectives, technical terminology, work description, confidential information, and explanation of the questionnaire.

Before the survey was conducted, its objectives and the districts to be visited were distributed in pamphlets (to grocery stores and farmers connected with MAG) and announced on the radio. The 10 enumerators were sent to different villages and were able to visit four or five farmers per day. Two supervisors controlled the questionnaires daily. The collaboration of the farmers was very good; only one farmers did not want to participate.

2.3.3 Data analysis

The first analysis of the data was made with a mini-computer IBM 5110 and a program in the BASIC language[1]. The averages and distributions of all the variables were calculated for the sampling areas, districts and villages. In the second stage the data was analyzed using variance, cross tabulations, correlations, and regressions.

2.4 Soil samples

During the survey's execution, the supervisors collected a total of 36 samples in the different districts; each was composed of 2 subsamples per site, at a depth of 0-25 cms. The method of analysis for the samples is described in paragraph 3.3 "Soils".

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1) Elaborated by Henning von Platen; the questionnaire and the program are available to other institutions and persons.

3. Physico-biological environment

Henning von Platen[1)]

3.1 Climate

Costa Rica can be divided into two main large climatic zones: the Atlantic with rain all year and the Pacific with a very defined dry season. The influence of the Atlantic is manifested more or less to the east of the line formed by San Isidro de El General - Talamanca mountains - San Jose - Guanacaste mountains. The study area is under the influence of the Pacific climate, in different levels of altitude in the warm climate. The botanical zone mostly consists of moist forest and premontane moist forest. (Classification according to Holdridge). (see maps in the Appendix).

3.1.1 Rainfall

The two subareas have abundant rainfall. The average for various years has been 2,050 mm in Acosta and 2,470 mm in Puriscal, which mainly occurs between the months of May and October. The rest of the year is practically dry with a decimal part of the rainfall. (see Figure 3.1.1, Table 3.1 and map 1 in the Appendix).

As can be seen in Figure 3.1.1, the differences between the maximum rainfall per month, the average, and the minimum are very great.

3.1.2 Temperature

On the average, the temperature fluctuates around 21°C in the two subareas and this is relatively constant during the whole year: it varies between 19.5°C (November-December) and 22.4°C (April)[2)]. The maximum and minimum temperatures were only taken in Puriscal: the maximum was around 28°C and the minimum around 15°C[3)].

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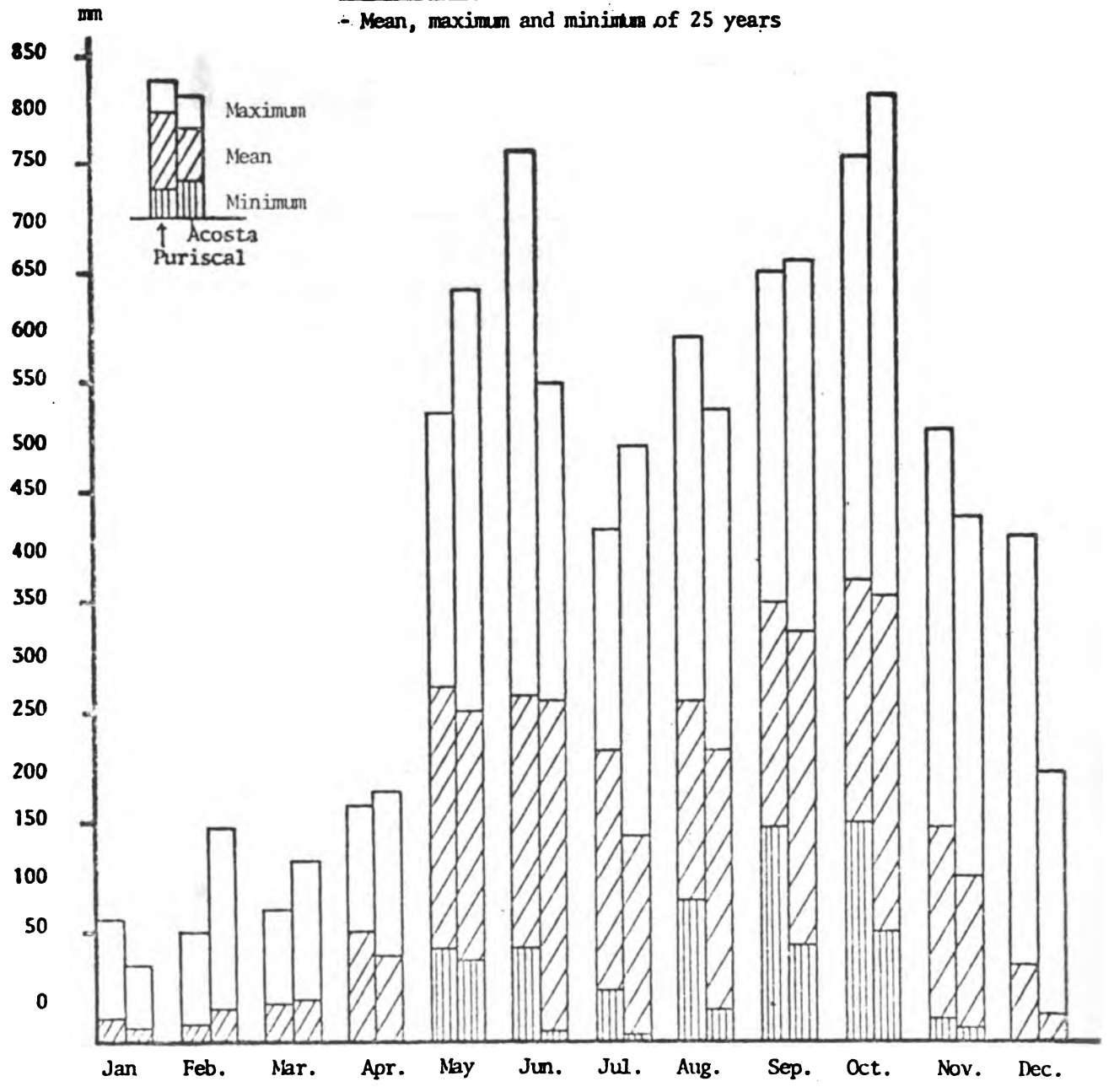
1) Agricultural Economist of the CATIE-GTZ Project.
2) HARGREAVES, op. cit.
3) National Meteorological Institute, op. cit.

Figure 3.1.1. Distribution of rainfall in Acosta and Puriscal - Mean, maximum and minimum of 25 years



Source: Instituto Meteorológico Nacional. Puriscal: years 1940-1973. Acosta: years 1950-1978, without 1974.

Table 3.1 Climatic Data of Acosta and Puriscal

- figures represent means

ACOSTA:	Altitude: 1094							Period: 10 years					
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Temperature	20.2	20.7	21.8	22.4	21.8	20.7	21.3	20.7	20.2	20.2	19.6	20.6	20.8
Rel. Humidity	84	80	82	76	82	84	84	83	84	85	86	88	84
Precipitation	11	61	50	65	261	354	224	244	436	460	173	17	2356
Pot. evapotransp.	113	107	139	150	142	127	134	136	127	122	106	101	1504

PURISCAL:	Altitude: 1102							Period: 18 years					
	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Temperature	20.1	20.7	21.8	22.3	21.3	20.7	21.2	20.7	20.1	20.1	19.6	19.6	20.7
Rel. Humidity	74	69	69	73	83	84	85	85	87	86	85	77	80
Precipitation	75	29	57	159	277	258	231	262	279	214	154	150	2145
Pot. evapotransp.	127	130	159	155	139	127	132	132	120	120	108	118	1567

Source: HARGREAVES, G. 1976. Tables Showing Climate and Potencial Evapotranspiration for Central America and Panama; Working Paper 76-E166, Utah., Logan.

3.1.3 Water availability

In Figure 3.1.2 it can be seen that from December to April there is a water deficiency in both subareas. Large quantities of rain fall in the other months.

In the rainy season, the farmer has to confront heavy rains that especially affect very steep areas, crops that only partly cover the soil (tobacco, recently planted corn, new coffee plantations, and pastures with soils already damaged by erosion)[1]. In the dry season, it can be seen that the pasture is highly affected by the lack of water. Furthermore, the fact must be considered that strong winds do a great deal of damage to the plants.

3.2 Topography

Puriscal: The city of Santiago de Puriscal is situated high in the Puriscal hills along a narrow plateau drained by three rivers: the Picagres (north), the Tabarcia (east) and the Turrubares (west). The city's elevation is 1,100 meters above sea level which is the highest point in the area. To the south, the Project area is still mountainous, descending to about 800 meters (Túfares). Especially in Mercedes Sur, there are moderate (from 20-30%) to very steep (more than 100%) slopes. The terrain is formed by mountains and hills of different elevations. The topography of Barbacoas and Tabarcia is still irregular, but more moderate. The latter area has some places that are almost level and slopes of 20-30%.

Acosta: In this area, all of the land is broken. The altitude varies between 800 meters (Agua Blanca) and 1,200 meters (Palmichal). The southern part (Guaitil) is bordered by a mountain range. The houses are mostly found on the hilltops. To the north, the land drops steeply until Agua Blanca where it rises again with vigorous slopes, breaks and hills until Tabarcia. (see maps 3 and 4 in the Appendix).

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1) The last heavy rains are accompanied by the ripening and gathering of coffee.

Figure 3.1.2 Comparison of precipitation and potential evapotranspiration in Acosta and Puriscal

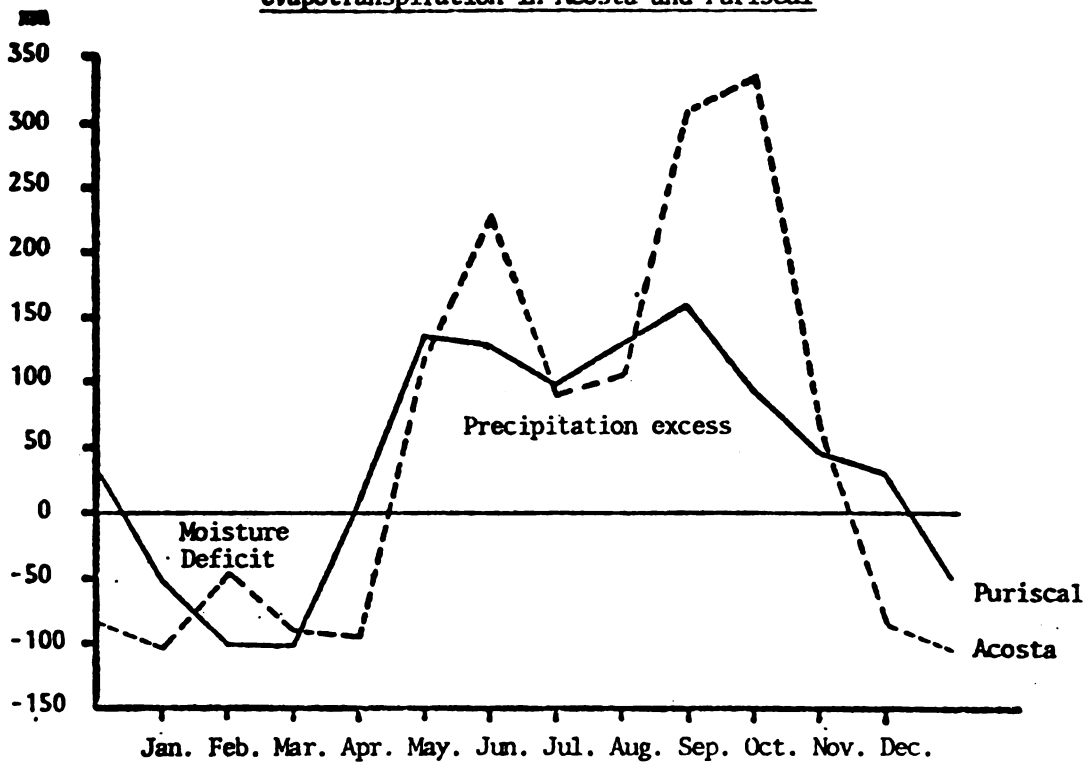
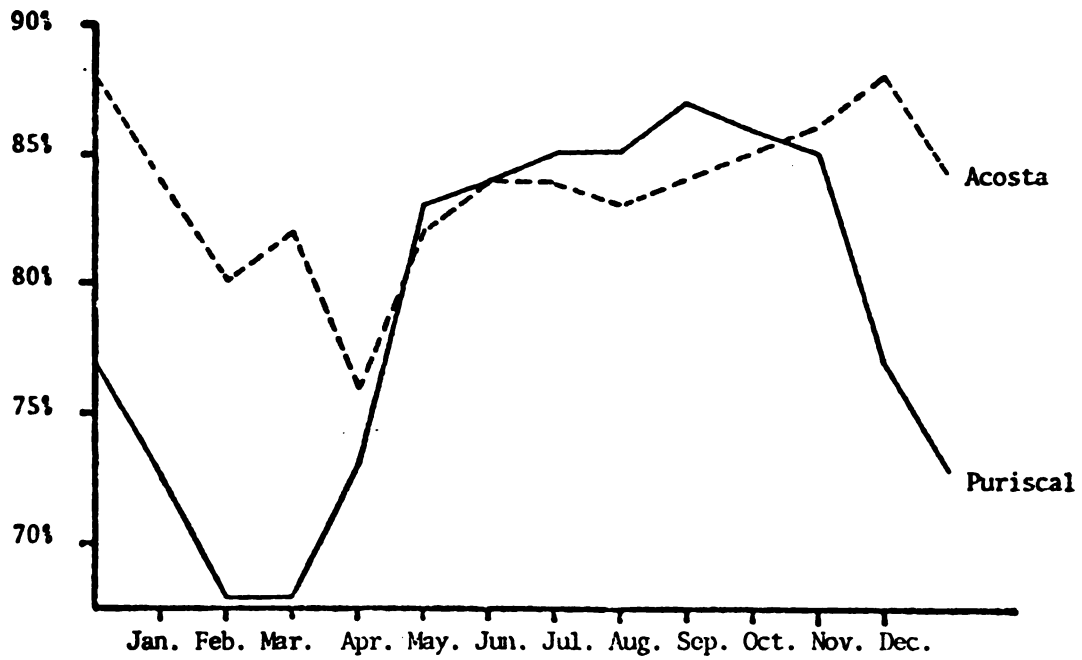


Figure 3.1.3 Relative Humidity in Acosta and Puriscal



Source: HARGREAVES, G. Tables Showing Climate and Potential Evapotranspiration for Central América and Panama. Working Paper 76-E166, Utah State University, Logan, Utah 1976. Observation years: Puriscal 18, Acosta 10.

3.3 Preliminary evaluation of soil fertility

Roberto Díaz-Romeu[1)]

From the geomorphic viewpoint, the region has three divisions. The section covering the districts of Barbacoas, Santiago de Puriscal, Candelarita, and part of Mercedes Sur is composed of "Volcanic Origin Formations". The typical rocks of this are andesite and basal-andesite. Lava, pyroclastics, aglomerates, mud flows, breccian, and ignimbrites can be found. Another section made up of "Formations derived from Intrusive Action" includes the districts of Palmichal, Corrolar, and part of Tabarcia. It is formed of volcanic and intrusive igneous rocks and possibly diorite and andesite. The third division of "Tectonic and Erosion Origin Forms" covers the district of Cangrejal and is composed of very weathered sedimentary and basalt rocks, originating from reddish or red-yellowish soils. (2)

The soils in the Puriscal and Acosta zone can be classified in the Inceptisol and Ultisol Orders (3,4). In Puriscal, the reddish soils in the hills are classified in the Ustic Tropohumult subgroup, while the brownish soils on less-pronounced slopes can be defined as Ustic Humitropept. The soils in lower areas of this zone are classified as Fluventic Humitropept. In the Acosta zone, the reddish-colored are known as Oxic Distropept (Bajos de Jorco and Ococa) (4). In accordance with a geoagronomic study carried out in the Puriscal zone, the soils are mostly Latosoles, they are found in smaller areas with soils classified as Litosoles and alluvial soils (5).

The personnel of the CATIE-GTZ Project gathered a total of 36 samples in the area, each composed of two subsamples per site, at a depth of 0-25 cms. The samples were air-dried, ground, and analyzed in order to determine the nutrient content. The calcium, magnesium and extractable acidity were

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1) Soil Scientist, M. Sc., Head of Soil Laboratory, CATIE, Turrialba, Costa Rica.

2) MAURIGAL, G.R. and ROJAS, E. Descriptive Manual of the Geomorphological Map of Costa Rica (Scale 1:200,000). SEPSA. San José, Costa Rica, 1980. 79 p.

3) PEREZ, S., RAMIREZ, E., ALVARADO, A., and KNOX, E.R. Descriptive Manual of the Map of Soil Subgroups Associations. (Scale 1:200,000) OPSA. San José, Costa Rica, 1979. 236 p.

4) VASQUEZ, A. Soil Unity, Ministry of Agriculture and Livestock, Personal communication.

5) SANCHEZ B., J.M. Geoagronomical Study of the Puriscal Zone. (Thesis of Grade). Agricultural Engineer, Agronomy Faculty, University of Costa Rica, 1967. 103 p. 2 maps.

extracted with a solution of KCL 1N, utilizing a soil relation: extracting solution of 1:10, agitation for 10 minutes and filtration afterwards. The calcium and magnesium analysis was made by spectrophotometry of atomic absorption and the extractable acidity by titation with NaOh 0.01 N. Phosphorus, potassium, manganese, and zinc were extracted using a modified Olsen solution (Na HCO_3 0.5 N, EDTA 0.01 M, and Superfloc 0.5 g/10 L), with a soil relation: solution of 1:10 and agitation for 10 minutes. Phosphorus was determined calorimetrically and potassium, manganese, and zinc by spectrophometry of atomic absorption. The extraction of sulfur was done with a solution $CaH_4 (PO_4)_2 H_2O$ of 500 ppm P, soil relation: extracting solution of 1:2.5 and agitation for 30 minutes. The analysis was done by turbidimetry with $Bacl_2$. The pH was determined in water with a soil relation: water of 1:2.5 using a potentiometer.

The analyzed results and the distribution by categories of nutrient content are presented in the following tables. These results indicate the following: in the Puriscal area, soil pH ranges from acid to strongly acid, calcium is adequate or high in all samples, magnesium is adequate or high in all samples, except in one sample from Mercedes Sur (sample #19) and one from Barbacoas (sample #50) that is marginal. Potassium presents more variable values that range from low to high. Samples with marginal to low content that can be considered as deficient are located in the Candelarita and Barbacoas districts. The extractable acidity shows values from low to very high throughout the area. However, only two samples (#34 and #50) show acidity saturation above 25%; it is especially notable in sample #50 from the Candelarita district. In the rest of the samples with high extracable acidity, the saturation is compensated with high values of calcium and magnesium. Phosphorus can be considered as very deficient in all the area, except in one sample from Mercedes Sur (#17) and one sample from (#52) where this element is marginal.

Sulfur is low in one sample from Mercedes Sur (#48), one from Barbacoas (#53) and two from Candelarita (#36 and #37). The rest of the samples show medium to high contents. Magnesium is high in the majority of the soils and only three samples (#18, #51, and #52) have a medium content. Zinc is especially low in the Barbacoas district, medium in Candelarita, and medium to high in Mercedes Sur.

In the Acosta and Mora areas, the soils are mostly acid to medium acid with few samples strongly acid and neutral to alcaline.

Table 3.3.1 Chemical soil characteristics in the area of Puriscal

Sample Nº	District	pH	meq /100 ml				ug/ml			
		H_2O	Ca	Mg	K	acidity	P	S	Mn	Zn
16	Mercedes Sur	5,6	11,0	3,5	0,41	0,3	1,5	17,4	23,1	8,8
17	" "	5,1	11,0	3,4	0,44	2,2	14,5	22,2	49,0	9,8
18	" "	5,6	9,4	2,4	0,34	0,3	0,5	9,2	10,0	4,2
19	" "	5,7	7,3	1,1	0,37	1,4	2,0	13,9	14,2	4,9
99	" "	5,3	11,9	3,9	0,25	1,0	1,5	12,8	12,3	4,2
34	Candelarita	5,0	11,4	5,4	0,24	6,7	0,5	21,0	59,0	3,8
35	"	5,2	15,9	6,3	0,28	2,2	2,0	13,9	45,0	3,1
36	"	5,4	13,4	3,3	0,16	1,7	2,5	1,4	11,9	4,3
37	"	5,7	21,5	6,4	0,07	0,3	2,0	6,2	11,4	2,3
38	"	5,0	14,3	5,6	0,54	4,5	4,5	18,7	37,0	7,2
50	Barbacoas	4,9	6,4	1,8	0,45	5,5	6,0	22,2	33,0	2,1
51	"	5,2	5,3	2,3	0,15	1,8	2,0	23,8	9,8	1,3
52	"	5,5	14,5	3,5	0,48	0,5	18,5	13,6	8,9	1,3
53	"	5,3	7,0	2,4	0,09	1,0	2,5	8,3	11,9	2,9

Table 3.3.2 Chemical soil characteristics in the area of Puriscal

Sample Nº	District	pH H_2O	meq/100 ml				ug/ml			
			Ca	Mg	K	acidity	P	S	Mn	Zn
1	San Ignacio	6,3	14,6	2,9	0,65	0,1	4,0	12,6	6,0	6,0
2	"	5,9	13,0	3,0	0,54	0,3	8,0	7,3	7,2	1,7
3	"	5,9	12,4	3,2	0,73	0,1	11,0	9,9	2,0	3,0
24	"	6,2	18,3	4,3	0,47	0,2	3,5	5,9	1,8	0,8
4	Palmichal	5,9	29,6	5,6	0,53	0,3	11,0	1,7	1,8	3,7
9	"	5,4	12,4	2,9	0,54	0,7	3,5	7,0	11,4	5,6
10	"	5,3	9,2	2,0	0,30	2,2	2,0	4,3	6,7	1,8
11	"	5,4	13,7	4,0	0,45	2,6	0,5	8,3	4,8	1,1
12	"	5,8	19,6	6,1	0,62	0,1	2,0	5,3	2,2	2,5
13	"	5,1	19,3	4,4	0,26	6,6	1,5	13,8	11,8	2,7
30	"	4,7	1,8	0,7	0,12	9,9	4,5	28,4	15,1	1,1
32	"	6,1	34,9	6,6	0,32	0,2	3,5	5,3	1,5	5,5
20	Guaitil	5,9	28,3	6,6	0,15	0,4	0,5	8,2	4,4	0,8
21	"	5,2	3,0	1,1	0,25	1,5	2,0	22,2	4,1	2,0
5	Cangrejal	6,2	25,7	2,8	0,46	0,1	16,0	0,8	0,7	13,9
6	"	6,7	26,9	3,6	0,09	0,1	0,5	2,8	3,3	0,7
7	"	5,5	13,4	1,6	0,16	2,6	4,0	8,0	6,6	1,4
8	"	5,4	4,7	1,5	0,14	2,5	2,0	2,4	5,1	0,9
22	"	7,7	27,6	1,2	1,02	0,1	44,5	6,7	1,2	16,4
23	"	5,5	11,4	3,3	0,46	1,2	1,5	6,2	12,2	2,4
14	Tabarcia	5,9	13,2	1,9	0,37	0,2	9,5	7,0	1,0	17,0
15		5,8	9,3	1,6	0,34	0,1	15,0	5,3	2,2	5,7

Table 3.3.3 Distribution of soil nutrient contents for three categories in Acosta and Puriscal

	CATEGORIES					
	LOW		MEDIUM		HIGH	
	Puriscal	Acosta	Puriscal	Acosta	Puriscal	Acosta
	(in Percentages)					
Calcium	0.0	4.5	0.0	4.5	100.0	91.0
Magnesium	0.0	4.5	14.3	27.3	85.7	68.2
Potassium	28.6	22.7	35.7	27.3	35.7	50.0
Phosphor	84.6	86.4	15.4	9.1	0.0	4.5
Sulfur	0.0	81.8	42.8	9.1	28.6	9.1
Manganese	0.0	59.1	21.4	22.7	78.6	18.2
Zinc	35.7	63.7	42.9	21.4	21.4	13.6

1) Puriscal: 14 samples
Acosta : 22 samples

Calcium is high in the entire zone, except in one sample from Guaitil (#21) that is marginal and one sample from Palmichal (#30) that is very low. Magnesium is high in most of the area, with medium content found especially in Cangrejal, Guaitil, and Tabarcia. Potassium is high in about 50% of the area and low in only 22% of the area, especially in Cangrejal, Guaitil and a site in Palmichal (#30). In respect to acidity, one site in Cangrejal shows an acidity saturation of 28% (#8). In the rest of the sites, the saturation is very low due to the content of calcium and magnesium.

In spite of this situation, it is convenient to keep in mind, from the maintenance point of view, those sites with a high acidity content. Phosphorus should be considered deficient in the whole area. Sulfur presents a similar situation to that of phosphorus with more than 80% of the sites deficient in this nutrient. A manganese deficiency is demonstrated by the fact that 59% of the sites show low content and 23% show marginal content. The majority of the samples with a high content of this element are found in the district of Palmichal. In respect to zinc, the deficiency is even greater; only two sites in Cangrejal (#5 and #22) and one in Tabarcia (#14) show high contents of this nutrient.

In summary, it can be indicated that the area in general is deficient in phosphorus. There are noted deficiencies in sulfur, manganese, and zinc mainly in the Acosta zone. The potassium deficiency is not as marked. The relationships Ca+Mg/K and Mg/K should be observed closely in areas where they are high in order to prevent problems of cationic unbalance. If that occurs, potassium should be applied in order to maintain the above-mentioned relationship at a suitable level. It is recommendable to study in depth the problem of areas with - high content of extractable acidity, and at the same time show, in accordance with the chemical analysis, adequate contents of calcium and magnesium. In areas that show a high acidity saturation, necessary measures should be taken to reduce it to non-toxic levels. Fertilizers should be applied on the basis of nitrogen and phosphorus, using potassium, sulfur, manganese and zinc in the areas that require them.

3.4 Pests and diseases

Gerardo Rodríguez P.[1)]

Maize: In this zone pests more damaging to maize are: Army worm (*Spodoptera frugiperda*), Cutworm (*Pseudaletia unipetal*), and Corn ear worm (*Heliothis zea*).

The most common diseases in maize are: Leaf blotch (*Helminthosporium tuyicum, Helminthosporium maydis*), Rust (*Puccinia sorghi, Puccinia polypora, Physopella zeae*) and Smut (*Ustilago maydis*).

Beans: Pests most affecting the bean include: Flea beetle (*Diabrotica sp., Ceratoma sp., Disphaulaca sp., Chrysomelidae, Coleoptera*), Cutworms (*Agrotis sp, Noctuidae, Lepidoptero*), Beetles (*Zabrotes sub-fasciatus, Acontascelides obtectus, Bruchidae, Coleoptera*), and Eelworm, (*Vaginulus (latipes) occidentalis guild, Limacidae, pulmonata*).

Diseases attacking the bean most are: Spider-web (*Thanatephorus cucumeris*), Beanrust (*Ctomyces phaseoli, appendiculatus*), Angular leaf spot (*Isariopsis griseola*) and Mildew (*Erysiphe polygoni*).

Coffee: The most important pests affecting coffee are: Coffee mealybug (*Planococcus cifri, Pseudococcidae homoptera*), Phyllophaga (*Phyllophaga sp.*), Cutworms (*Agrotis spp.*) and Aphids (*Toxoptera aurantii, Aphidae, Homoptera*).

In respect to diseases, coffee is attacked mostly by: Leaf spot (*Mycena citricolor*), Brown-eye disease (*Cercosphora coffeicola*), Derrite or Coffee burn (*Phyllostica coffeicola*) and Damping-off (*Rhizoctania solani*). Some coffee growers have also mentioned problems with "Mal de Hilachas" (*Pellicularia coleroga*) and Pink coffee disease (*Corticium salmonicolor*).

Citrus: Pests most affecting include: Mediterranean fruit fly (*Ceratitis capitatol*), Citrus aphid (*Toxoptera aurantii*), Scale (*Lepidosaphos beckii, Chrysomphalus sp, Coccidae and Homoptera*), and Citrus bee (*Trigona trinidalensis*).

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1) Agricultural Engineer of the CATIE-GTZ Project in Acosta-Puriscal.

The most common diseases in citrus are: Gomosis (*Phytophthora citroptho-ra parasitica, Phytophthora palmivora*) and Pink disease (*Corticium salmoni-color*). When a tree is attacked by any of these diseases, the tree is elimi-nated by cutting it a few centimeters above the soil surface. Apparently there is no known way to combat these diseases.

3.5 Weeds

Myron Shenk[1)]

Weed control in Acosta-Puriscal

These two areas are characterized by climatic conditions that include a very defined dry season. Therefore, the weed complex is quite different from that observed in the Atlantic zone. Many annual species of dicots can be seen, as well as some perennial. Annual monocot species, predominate although there are some perennial.

Of the broad leaf species, a considerable quantity are from the *Compositae, Verbenaceae, Commelinaceae, Tiliacea, Solonaceae and Labriate families.* The annual grasses include *Vigitaria spp, Eleusine indica and Eragrotis sp.*, predominant perennial grasses are *Hyparrhenia rufa, Paspalum spp., Brachiaria sp, and Homolepis sp.*

Apparently, weeds do not present a major problem for established coffee, and a combination of chemical and manual methods can be observed in their control. In maize, beans, and vegetable crops, control is predominantly manual. Paraquat is used prior to planting to eliminate weeds that have germinated after manually preparing the field.

Recommendations:

In view of the extreme slopes and highly erodable soils, it is very important to promote a system of weed management employing minimum tillage. This practice not only reduces erosion but also increases water infiltration and conservation in the soil while maintaining or increasing the present level of soil organic matter.

The present system of completely cleaning the soil with broad shovels (palear) leads to extreme erosion, and when the vegetative growth (weeds and crop residues) is removed to facilitate shoveling, depletion of soil organic matter is severe. In those cases where this vegetative growth is

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1) Weed Specialist, CATIE, Turrialba, Costa Rica.

incorporated into the soil, or accumulated between rows, organic matter depletion is not as severe. Reduced tillage techniques make maximum use of these organic materials.

Farmers in this area commonly believe that "hilling-up" is necessary to reduce lodging of maize. These farmers will object to reduced tillage systems for fear of increased lodging. It is imperative that this aspect be thoroughly studied.

It is possible that following the dry period there will be insufficient vegetative cover to form an effective mulch on the soil surface. In such cases, it will be necessary to mix a residual herbicide with paraquat or glyphosate for adequate season-long weed control, or to study the possibility of establishing a cover crop before depletion of soil moisture, which would provide an added soil cover during the dry period.

Several legumes such as *Vigna* sp., *Leucaena and Canibalia* are promising for this purpose. They offer the further advantage of providing additional soil nitrogen for the following crops.

4. Socio-Economic Environment

Altrut von Platen[1)]

4.1 Infrastructure

There are two urban centers in the Project area:

- San Ignacio de Acosta with 1,000 inhabitants[2)]
- Santiago de Puriscal with 2,500 inhabitants[3)]

The Costa Rican Atlas[4)] indicates that Santiago de Puriscal is a high-level functional center, which plays an important role in supplying the region with social, cultural, and economic services.

San Ignacio de Acosta is a middle-level functional center with some high-level functions; it offers basic services such as doctor, pharmacy, a branch-office bank, grocery stores, etc., but it also has, for example, a high school (high level).

4.1.1 Physical Infrastructure

Roads: The roads between San José and Santiago and between San Jose and San Ignacio de Acosta are asphalted and in good condition. Most of the roads linking Santiago de Puriscal with San Ignacio are constructed of rough stones and the danger of landslide exists after heavy rains. The project area has stone or dirt roads; some are only accessible in summer by horse or by foot. Map 2 shows the accessibility.

Telephones: To facilitate communication the ICE is installing telephones in places frequented by more people such as grocery stores. In Map 2 public telephones are indicated by the letter T, and a good network is evident.

Electricity: In San Ignacio de Acosta this service is provided by an electrification cooperative and the ICE Electricity is available in all the districts of San Ignacio and Palmichal; but goes only as far as La Cruz

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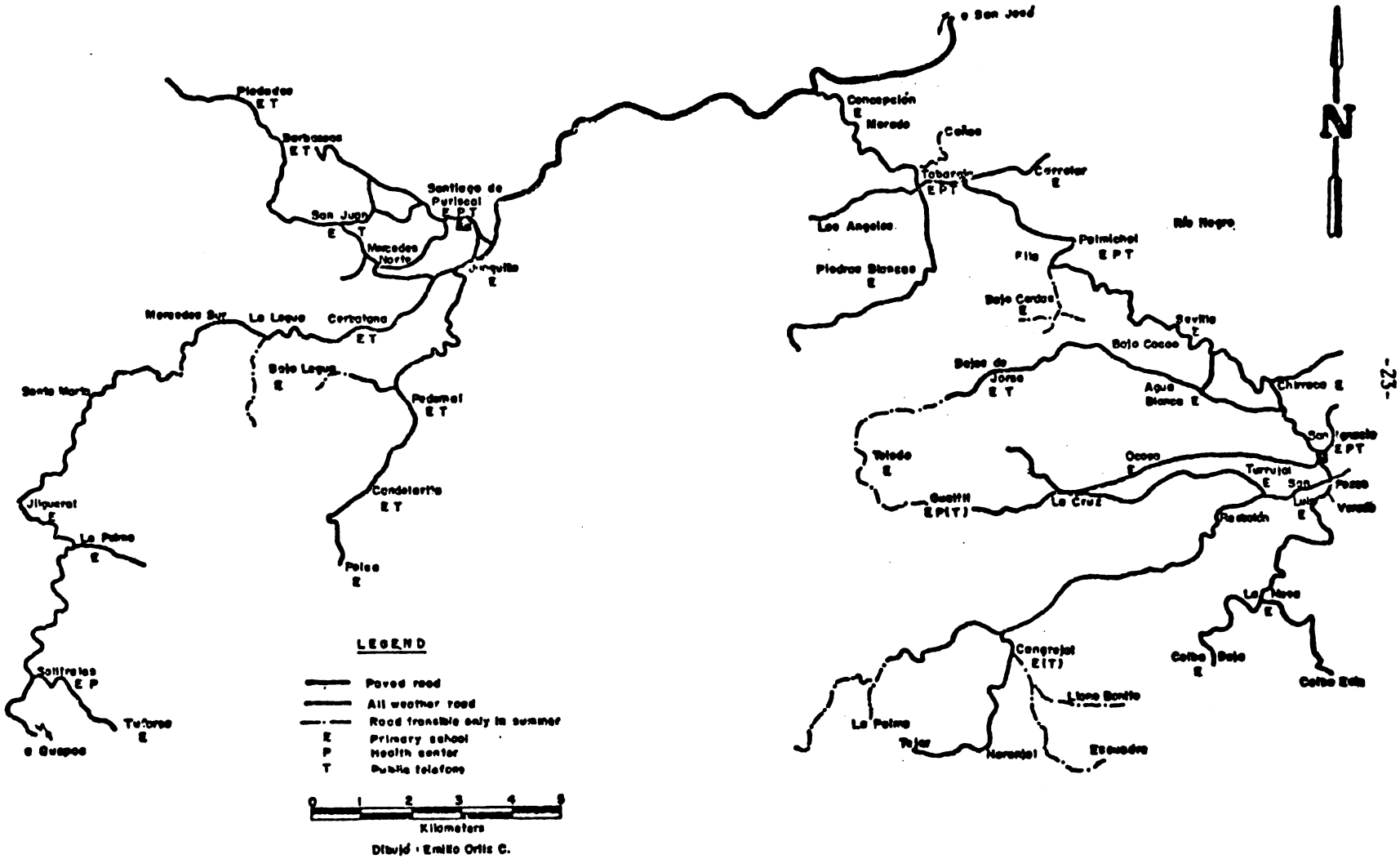
1) Marketing Investigator of Agricultural Products, Project CATIE-GTZ
2) The census gives the urban population in the San Ignacio district, which refers only to the population of San Ignacio (450 persons), however, the population of the neighboring towns must also be considered as urban population because they form part of San Ignacio. Therefore the population in the center of San Ignacio is estimated at approximately 1,000 inhabitants.
3) General Office of Statistics and Census, MEIC, Population Census of 1973, Volume I, San Jose, 1934, p. 34-50.
4) NUHN, H. Preliminary Atlas of Costa Rica, San Jose, 1978. 40 p.



Map 2 : Infrastructure in the area of Acosta - Puriscal

in the Guaitil district. The towns of Coyolar, Toledo and Guaitil do not have electricity; nor does the Cangrejal district[1]. In communities with electric service some houses - probably those that are scattered and on the outskirts of town - do not have electricity.

The ICE is working in Puriscal and electricity is now available from Santiago to Mercedes Sur, La Polka, and Grifo Alto. La Leguita and Bajo La Legua will get electricity this year.

Water and Sewage: In Acosta there is water service in every community and in a high percentage of houses. Only in Coyolar and Escuadra is the percentage of houses with water as low as 50%[2].

In Puriscal, all communities have water except Jilgueral and Candelarita. In Salitrales, Túfares, and La Palma, pipes are being installed. Water is supplied by the National Aqueduct and Sewer Service (A&A) and by private or municipal sources. In both areas, there are no sewage systems latrines and septic tanks are used and in some cases the houses lack even these sanitation means.

Bus Service: Various bus and jeep services exist with routes from the two centers to different places, including communities that are not easily accessible. Sometimes service is scarce, with transportation only once or twice a day.

The connection with San Jose is good. Buses and microbuses leave 12 times daily from San Ignacio; from Puriscal a bus goes every hour to San José and microbus service is also available. Furthermore, there are buses from San Ignacio to Guaitil, Cangrejal, Bajo de Jorco, Ceiba, Sabanilla and Sevilla, and from Santiago to Grifo Alto, Turrubares, Polka, Desamparaditos, and Quepos. There is also a bus to San José from Palmichal and Tabarcia.

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1) For exact figures see:
Institute of Municipal Promotion and Consultation, Study of Basic Services, Community Profiles of Acosta, San Jose, 1976.

2) Institute of Municipal Promotion and Consultation, op. cit.

4.1.2 Social Infrastructure

Health: Both Santiago and San Ignacio have the following health services: pharmacy, physician, social security, clinics and Health Department units. A preventive medical service is also found in Santiago. These health stations in the communities are marked on Map 2.

Education: Santiago has a night school and an agricultural school. There is one high school in San Ignacio that up to last year (1980) had an academic curriculum which now has been changed to an agricultural school. Almost all of the small communities have elementary schools (see Map 2).

Banks: In Santiago, there is an agency of the National Bank of Costa Rica (BNCR) and a branch of the Bank of Costa Rica (BCR). A BNCR agency operates in San Ignacio, as well as a Savings and Credit Cooperative which is of minimal importance.

4.2 Location and Size of Markets

Marketing is done in the Acosta-Puriscal region and in the Metropolitan area. Regional sales are made in the public markets, the farmer's market, the municipal market in Santiago de Puriscal, and with wholesalers and retailers.

The four traditional markets in the Metropolitan area are located in Alajuela, Cartago, Heredia and San Jose. Others include wholesale market on 10th Avenue in San Jose, the new National Food Supply and Distribution Center (CENADA), the livestock markets in Montecillos and Cerrillos, various farmer's markets, and retail buyers. Coffee and tobacco are only sold to processing companies. Some of the markets are described in the following chapters.

4.2.1 Markets in Santiago-Puriscal

4.2.1.1 The municipal market in Santiago de Puriscal

The total area of this market is 800 m^2. Most of the stalls are vegetables stands but grocery stores and meat markets are also found. This

market has little influence in supplying food for the population of the area nor does it have much importance for the commercialization of the county's agricultural products[1]. Around 16% of the retail sales carried out by businesses in the Puriscal county take place in the market of these; 13% are basic grains, 16% meat and sausage, 9.4% chicken and eggs, 24% milk and cheese, and 58% fruits and vegetables[2].

The county's agricultural production represents only 3% of the goods supplied by retailers in the Puriscal market[3]

4.2.1.2 The livestock market in Puriscal

The livestock market is open every Friday in Junquillo near Santiago de Puriscal on the road to Quepos. The Junquillo market is important to the region because of its slaughterhouse. About 90% of the meat and sausage supplied in the Puriscal county comes from this market[4].

4.2.1.3 Other markets in Puriscal

Each Saturday morning candy is sold on the west side of the municipal market. There is also a grain market in the vicinity of the market square.

4.2.1.4 Farmers' market

In recent years, a meeting place for producer and consumer known as the farmer's market has been initiated on behalf of the Ministry of Agriculture and Livestock (MAG) and the Ministry of Economy, and Commerce (MEIC). Markets of this type operate in various places throughout the county: Hatillo, Zapote, Alajuela, Guadalupe and Santiago de Puriscal. They are open on Saturdays and Sundays from 5:00 a.m. to 2:00 p.m. The farmers need an identification card issued by the Agricultural Extension agency of MAG in order to participate in the market.

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1) IFAM (Institute of Municipal Promotion and Consultation), Study of the food market and the remodeling of the municipal market in Puriscal county, San Jose, 1974. 31 p.
2) IFAM, 1974. op. cit. p. 44
3) IFAM, 1974. op. cit. p. 49
4) IFAM, 1974. op. cit. p. 51

The farmer's market in Santiago de Puriscal first opened on July 5, 1980. During the first two months, 189 farmers participated and the total value of the sales was ₡248,400[1].

4.2.1.5 Retail Businesses in Puriscal[2]

According to 1974 figures, there are 27 stores in the commercial zone of Santiago and 106 stores in the rural area that distribute food. The ones in the city include grocery stores, grocery store-bars, warehouses that also sell wholesale, meat markets, and a CNP store. Their main products are processed grains, potatoes, onions and meat. Eggs are also sold in many places. Urban stores are larger in size than the grocery stores, grocery - bars, and meat markets in the rural area: on the average 87 m^2 in comparison with 55 m^2. Although rural stores are more numerous, they have almost the same percentage (43%) of the total sales in Puriscal county as the stores in the commercial square of Santiago that sell 42%. The agricultural production within Puriscal county provides 14% of the goods supplied by retailers in the commercial zone of Puriscal and 1.5% of the same in the rural area[3].

4.2.2 Markets in San Ignacio de Acosta

San Ignacio de Acosta has some grocery stores, grocery stores-bars, fruit and vegetable stands, meat markets, and one CNP store. A market operates on Saturdays and Sundays. In addition grocery stores, grocery store-bars, and meat markets are located throughout the county.

The conditions in regard to retail business in Acosta county are probably similar to those described in Chapter 4.2.1., except that San Ignacio is less important than Puriscal.

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1) Ministry of Agriculture and Livestock. Marketing Unit. Bulletin #2. Program of Market Information, October, 1980. San Jose.
2) IFAM, 1974. op. cit. p. 31
3) IFAM, 1974. op. cit. p. 49

4.2.3 Markets in the Metropolitan Area

4.2.3.1 The Borbon Market zone

The Borbon market zone extending for 16 blocks (approximately 11 hectares) in the northeast part of San Jose includes:

- the Borbon Market
- the Central Market
- the Coca Cola Market
- various retail and wholesale businesses (both separate and mixed), and warehouses in the surrounding area.

The Borbon Market is mostly dedicated to fruit and vegetable sales; the Central Market has a total of 250 stalls which concentrate mainly on the sale of non-alimentary products; and in the Coca Cola Market (opened in 1976 by the municipality) a lot of merchants sell fruits, vegetables and "trinkets" on the street. The Borbon Market zone together with the 10th Avenue Market (Chapter 4.2.3.2) serves a collection and distribution center for fruits and vegetables on a national level[1]. It is estimated that 96,400 metric tons of fruit and vegetables are brought in annually to the Borbon Market zone[2].

4.2.3.2. The 10th Avenue Market

The 10th Avenue Market (wholesale and retail market for fruits and vegetables installed in 1974 by the municipality) is located on 10th Avenue in San Jose and occupies a two-hectare plot of which 1,360 m^2 are used for commercial places. In order to fill the growing demand, CENADA (Chapter 4.2.3.3) was contructed to take charge of the functions of the 10th Avenue Market.

According to estimations[3] 120,000 metric tons of fruits, vegetables, roots, tubers and plantains are delivered annually to the 10th Avenue Market.

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1) IFAM. Agricultural market in Costa Rica, San Jose, 1976.
2) IFAM. 1976, op, cit.
3) IFAM. op, cit. p. 164.

4.2.3.3 National Center of Food Supply and Distribution (CENADA)[1)]

CENADA, located in San Antonio de Belen in the northwest part of San Jose, will be the new wholesale market of the Metropolitan region.

In its first stage (1980-85), the CENADA project has four warehouses in a construction area of 36,000 m^2. Two are used for fruits and vegetables and two for basic grains and input sales. The following complementary services are planned as part of CENADA: market information, banking service, telephone and call system in each warehouse, food conservation system, cafeteria and restaurant, watchmen, and garbage collection. It is estimated that by 1998 CENADA will market 650 million tons annually.

4.2.3.4 Livestock markets (Montecillos and Cerrillos)

The livestock market in Montecillos (Alajuela is held every Monday and the one in Cerrillos every Thursday. Approximately 50% of the livestock for internal consumption is sold in the Montecillos market[2)]; the Cerrillos market is less important. In 1977, the two markets sold monthly 99,700 cattle and 29,500 head of pork[3)].

4.2.4 Others

4.2.4.1 Coffee processing plants

There are various coffee processing plants in the Acosta-Puriscal area: Coopejorco, La Meseta, Montero,etc. The Coopejorco cooperative has a major influence in the Acosta area (see Chapter 5.6.2). All the plants have recievers dispersed in the area where the coffee is taken out by their own trucks.

4.2.4.2 Processing enterprises

In Puriscal two enterprises have contracts with producers of sun-dried tobacco:

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1) VIQUEZ, N.C. Agricultural market notes in relationship to the CENADA Project, San Jose, 1980.
2) RODRIGUEZ, Q.O. Beef Cattle Activity in Costa Rica, San Jose, 1974. p. 54
3) GENERAL ADMINSTRATION OF STATISTICS AND CENSUS. Statistical Yearbook of Costa Rica, San Jose, 1977. p. 160.

- the Costa Rican Tobacco Company (Tabacalera Costarricense).
- the Republic Tobacco Company (RTC)

In addition, a cigar factory, TICOCIGARRO, imports tobacco from Nicaragua, Honduras, etc. It also buys tobacco from the region for mixing.

The Costa Rican Tobacco Company and the RTC fix quotas for the producers and contract them on the basis of capacity (land, hand labor). The companies buy the quotas plus an additional 10% when more tobacco is needed. The quotas range from 20 to 100 qq per farmer per year; most of the farmers have quotas of 20/25 qq. The price paid by the companies depends on the class of tobacco (RTC classification) and the position of leaves on the plant (system of Costa Rican Tobacco Company).

4.3 Marketing System

To understand the importance of sales, one must consider the products that are not sold, but consumed by the farmer and his family.

According to the survey, auto-consumption of maize and beans is fairly high. Of the 226 farmers who produce maize, 72% stated that they do not sell any of their crop; this quota is highest in Guaitil (93%), Cangrejal (82%), Palmichal (97%) and Tabarcia (88%). Of the 227 bean producers, 74% do not sell any of their beans. These figures are much higher than those of the 1973 farm census[1] which showed the autoconsumption of beans to be 61% in Acosta and 39% in Puriscal, and the autoconsumption of maize is 55% in Acosta and 52% in Puriscal.

The IFAM study[2] shows the following percentages of crops saved by the farmer for home use in Puriscal county: 24% of basic grains, 6% of meat and sausage, 72% of chicken and eggs, 83% of milk and cheese, and 58% of fruits and vegetables. Although the figures do not coincide exactly, it is evident that some of the region's products are produced mostly for autoconsumption.

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1) GENERAL ADMINISTRATION OF STATISTICS AND CENSUS, National Census of 1973. Agriculture. San José, 1974.
2) IFAM. 1974, op. cit. p. 48

The survey indicates that the products presently important for sales are coffee and tobacco in Puriscal and coffee and citrus in Acosta.

According to a study by the Program of Integrated Rural Development[1], the following procedures exist for the marketing of citrus produced in Acosta county:

a) Sales at farm level (already harvested and/or on the tree) to non-local buyers who transport the fruit to different places in the Central Valley and resell it to wholesalers and retailers.

b) Producers who take their own fruit and that of their neighbor to the San Jose market.

c) Buyers from the Central Valley who go to the Acosta zone to purchase oranges and other fruit in order to sell them to retailers and consumers.

For meat producers, the Junquillo market (see Chapter 4.2.2.3) serves as a center for livestock sales in the Acosta/Puriscal region. Some of the livestock sold there are cut up in the same slaughterhouse; others are taken to Montecillos. Some producers sell their animals directly in the Montecillos market.

4.4 Prices of agricultural products

Figure 4.4.1 shows the development of prices of farm products that are important in the project area such as coffee, tobacco, beans, corn and livestock for local consumption. The average annual growth rate of these products between 1967 and 1979 was about 10%[2]. The average annual growth rate of living costs[3] in the same period was 12%.

In 1980, the price of basic grains was ₡98/qq = 46 kg for maize and ₡285/qq for beans.

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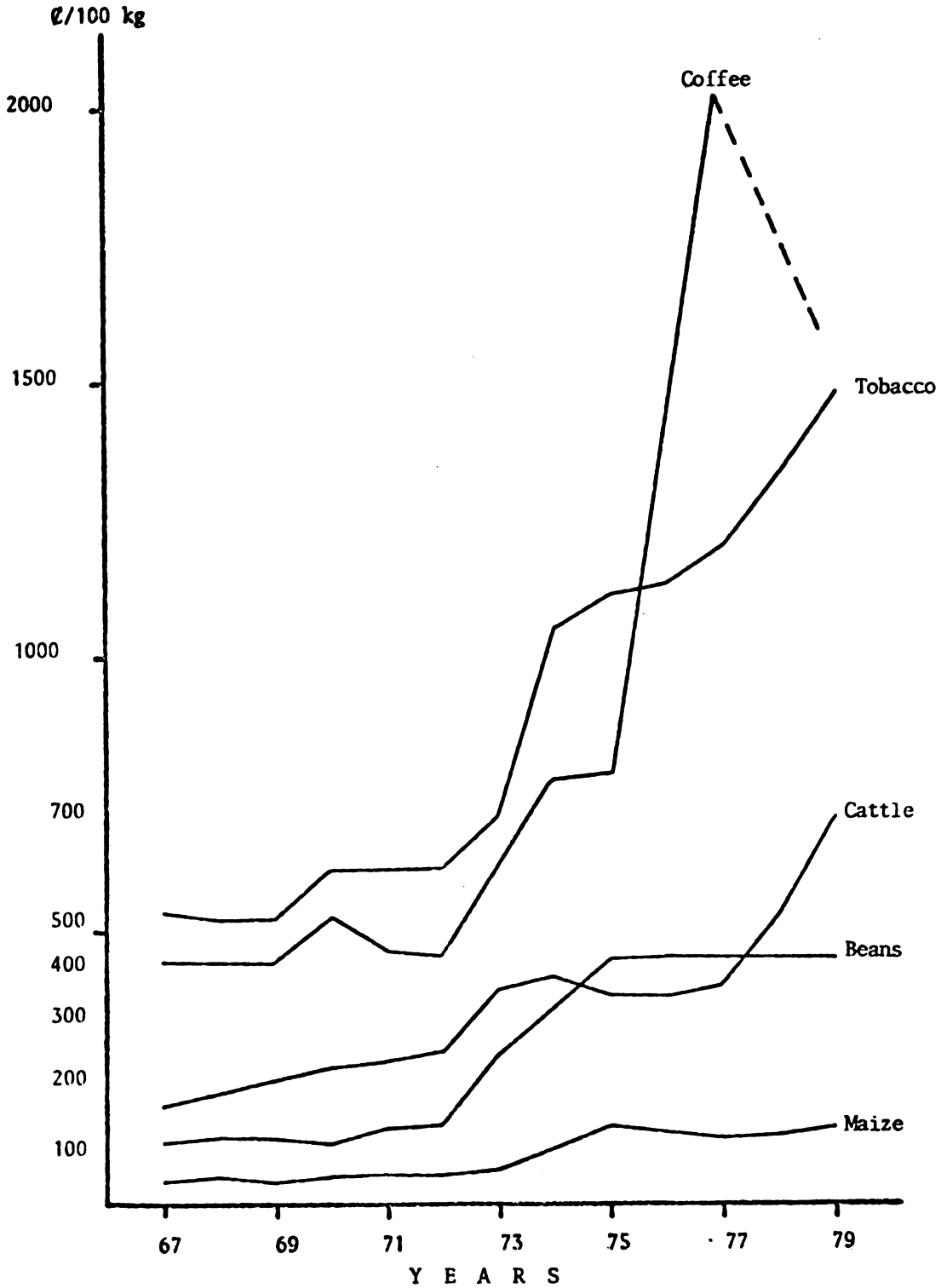
1) PROGRAM OF INTEGRATED RURAL DEVELOPMENT (BNCR/BCCR). Orange market, Acosta county, San Jose, 1980. p. 4

2) Calculated according to the formula: $\sqrt[q]{\frac{Pn}{Po}}$ q = number of years, Pn = price of last year, Po = price of the first year

3) Calculated according to the same formula as (2) from the General Price Indexes for Low and Middle Income Consumers in the Metropolitan Area for 1967 and 1979 (BCCR).

Figure 4.4.1 Variation of average farm-level prices between 1967 and 1979



Source: Central Bank of Costa Rica (BCCR). Data on agricultural production

Acosta's most important product, oranges, has the same problems with price fluctuations as other fruits and vegetables. The price is low from November to March, rises steadily to its peak at the end of June and then drops again. The price of sour lemons has an inverse cycle: it reaches its peak at the end of February/March and becomes low again from June to November[1].

4.5 Grain Storage

The maize is bent in order to dry the maize cobs in the field. The ears of maize are kept in different types of bins with the cornsilk on. Insects present the biggest problem. To combat them, clordine or lime is sometimes applied. The beans used for consumption are stored in sacks or tanks. In one zone of Puriscal, the beans are sprayed before they are stored. Very little attention is given to grain and seed storage in the more remote zones of Acosta[2].

4.6 Availability and Prices of Inputs

Santiago de Puriscal, has three warehouses that sell fertilizers and agro-chemicals, while San Ignacio de Acosta, has only the Coopejorco Warehouse. Availability of these products does not seem to be a problem with the exception of urea.

Figure 4.6.1 shows the development of prices of some inputs from 1966-1980 (until October)[3]. The price of diesel is only interesting to the 15% of those interviewed who have a truck or pick-up truck. However, the development of the price of diesel is important as it concerns other products which are made from or with petroleum.

But nevertheless, one must consider that diesel (the same as the balanced mixtures for animal feed) has a fixed price (maximum sale price)

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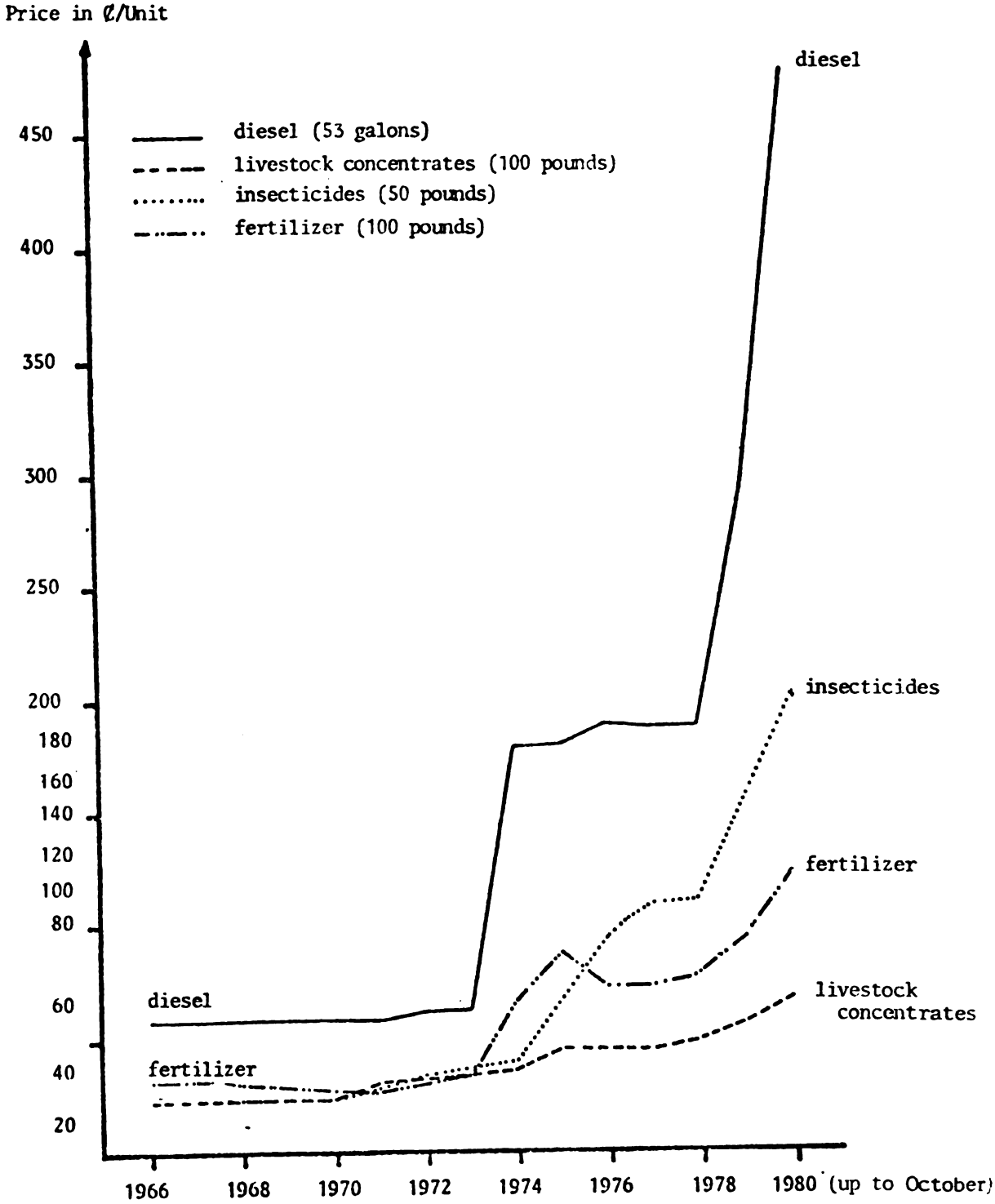
1) Calculated from the averages for 13 years (1966-1979): BCCR, wholesale prices.
2) According to a Coopejorco employee and MAG extension agent.
3) Data from BCCR, wholesale prices.

Figure 4.6.1 Variation of average whole-sale input prices between 1966 and 1980



Source: Central Bank of Costa Rica (BCCR).

decided by MEIC. It is evident that the price of diesel rose a lot beginning in 1973 (with an average annual growth rate of 33.7%). The major increases were from 1973 to 1974 with 187% and from 1978 to October 1980 with 59%[1] as an annual average. The latest increases are not yet included.

The price of mineral fertilizers had an average annual growth rate of 19% between 1973 and October 1980 with prices that went down or were maintained between 1975 and 1978.

The rate for prices of powder insecticides in the same period was 27%[1]. Comparing the input prices (wholesale prices) with the prices of farm products (see Figure 4.4.1), it can be seen that the average annual growth rate for the latter prices (average prices for all of Costa Rica paid to the farmer between 1973 and 1979 for tobacco, livestock/internal consumption, maize, beans and yuca) was between 10-14%[1], which was less than the growth rate for inputs. Only coffee had a rate of 21% in this period, but that has also changed recently. Whether the economic situation of the farmer has deteriorated or not during the last year can only be said after conducting a whole farm budget analysis.

4.7 Availability and conditions of credit

Credit institutions include a BCR branch office in Santiago and a BNCR agency in both Santiago and San Ignacio. In addition COOPEJORCO gives credit to its members.

At the first of the year, the Central Bank of Costa Rica (BCCR) decides on a credit program for the farming sector. Credit conditions are established for the different farm activities such as preparation per hectare, area to be planted, type of financing and interest rate. A special credit exists for the small farmer[2] with an interest rate of 8% exempt of payment for stamps, pledge of documents, mileage and travel allowance for the extension

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1) Calculated according to the formula $q\sqrt{\frac{Pn}{Po}}$ q = number of years
Pn = latest price
Po = price of first year

2) The bank's definition of a small farmer is the following: (according to a BCR employee 21.1.81): works in farm activities-subsistence of the family depends solely on working the land.
- annual net income does not exceed ₡40,000
- operations carried out with SBN do not exceed ₡150.000.

agent. In comparison, regular credits (28.1.81) now have an interest rate of 24%. Interest in COOPEJORCO is 18%. The payment period depends on the activity (duration of production cycle) and on the guarantee - whether it be financial or real (mortage or pledge).

Credit availability diminishes toward the end of the year. For some activities, the resources are prepared according to the BCCR program as they are exhausted very quickly.

4.8 Agricultural Service Institutions

4.8.1 The Regional Agricultural Center

The Regional Agricultural Center (CAR) in Puriscal is located 4 Kms from Santiago on the road to San Jose. Its work area includes the counties of Acosta, Aserrí, Parrita, Puriscal, Quepos, Santa Ana and Turrubares. CAR attends the agricultural agencies of these counties, and other functions include research and the introduction of new varieties.

Beginning this year, the extension system in the CAR zone of Puriscal has changed with the introduction of the "Training and Visit" system which proposes to create a two-way relationship between the farmers and research.

- frequent visits (bi-weekly) by extension agents to the same farmers; (chosen as farmers of enlace); these visits will serve as centers of communication for the farmers, neighbors, and extension agents.
- technical assistance on the farmer's plot.
- frequent and periodic training of extension agents by the specialists and self-training methods.
- zonal and regional coordination.

CAR Staff and Equipment

Personnel:

1 director (Ingeniero Agrónomo - University graduate in agriculture)
4 specialists (in zoology, veterinary medicine, fruits and basic grains)
2 ingenieros that work in forestry
1 perito in charge of plant nursery (perito - graduate of 3 years agricultural school, at college level)

3 peritos working as forestry inspectors
1 auxiliary veterinarian
2 secretaries, 1 janitor

Vehicles: 11 cars

4.8.2 MAG Agricultural Extension Agencies

MAG Agricultural Extension Agency in Acosta

Personnel:

1 ingeniero agrónomo
1 4S promoter
1 perito agrónomo working as agricultural extension agent
1 secretary
1 janitor

Vehicles: 2 cars (at present only 1 car is available). One extension agent is responsible for 1,697[1] farms.

MAG Agricultural Extension Agency in Puriscal

Personnel:

1 ingeniero agrónomo
6 peritos agrónomos working as agricultural extension agents
1 4S promoter
1 secretary
1 janitor

Vehicles: 4 cars, 1 motorcycle (at present only 2 cars and the motorcycle are in use). There are 6 extension agents for 2,112[2] farms or in other words, 1 extension agent for 352 farmers.

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1) GENERAL ADMINISTRATION OF STATISTICS AND CENSUS. National Census of 1974, Livestock, San Jose, 1974.
2) GENERAL ADMINISTRATION OF STATISTICS AND CENSUS, 1974, op, cit, p. CR 1

4.8.2 MAG Agricultural Extension Agency in Santa Ana

Personnel:

1 agricultural student

2 4S promoters

1 secretary

1 janitor

Vehicles: 2 cars (at present only 1 car is in use, the other only once in a while). This means there is 1 extension agent for 560 farmers in Santa Ana.

4.8.3 Regional Agency of the Tobacco Defense Board in Puriscal

Personnel:

1 ingeniero agrónomo

6 peritos agrónomos working as agricultural extension agents. These give technical assistance to farmers that cultivate tobacco and try to visit each farmer three times in the production period.

The Tobacco Defense Board[1] is in charge of fulfilling the Regulatory Law of Relations between Farmers and Tobacco Industrialists. Its functions are to:

- recommend to the CNP the buying prices in each harvest; fix prices before planting.
- recommend to the CNP the annual production quota[2] that is the basis of contracts between enterprises and farmers.
- revise the contracts
- supervise the quota distribution
- recommend pertinent dispositions for the improvement of tobacco production; procure a better understanding between farmers and industrialists.

4.8.4 Integrated Rural Development Program (BNCR)

Until last year, this program of the BNCR and the BCR operated in

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1) MUÑOZ, C.J.M. The Tobacco Activity in Costa Rica, San Jose, 1962. p. 39
2) In reality the quotas are fixed by the cigarette companies.

San Ignacio de Acosta in an effort to organize activities for various institutions. Its other projects included citrus crops, citrus marketing, purchase of coffee hampers, etc.

Personnel:

1 ingeniero agrónomo
1 agricultural student
1 secretary

The program no longer exists in San Ignacio de Acosta.

4.8.5 National Center of Community Development (DINADECO)

DINADECO has activities in both regions. Their objectives are: to start community associations,to have neighbors meet to discuss and solve community problems, such as student transportation, farming and housing difficulties, etc. The two types of associations that support DINADECO are:

- the integrated association that requires more than 100 people over 15,dealing with all comunal problems.
- the specific association that needs only 25-100 people over 15, working to solve specific problems.

Personnel:

DINADECO has 5 promoters in Acosta (3 for Aserrí, 2 for Acosta) and 7 promoters in Puriscal.

4.9 Cooperatives

The most important cooperative in the region is COOPEJORCO. It is a cooperative of coffee growers with a processing plant in Vuelta de Jorco. In addition, it has an Input Warehouse in the processing plant and one in San Ignacio. COOPEJORCO has 2,500 associates who live both in and out of the area and it deals with 25,000 metric tons of coffee annually[1)]. In Puriscal there is a cooperative of tobacco producers that no longer works in the

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1) von PLATEN, H. Basic Information for the Selection of Areas in Costa Rica, Turrialba, 1980, p. 18.

agricultural field but rents its installations for processing tobacco to the TICOCIGARRO enterprise.

4.10 Channels of Communication with the Farmers

There are different ways to communicate with the farmers. The basic schools found in almost every community provide the means to reach them through the teachers or their children. The district guards have a telegraph and can communicate with the county guards, who in turn can pass on information to the farmers.

In addition, there is MAG as a channel of communication, and the 4S members who have meetings with the farmers and visit them. The farmers can also be contacted in the small grocery stores or bars in the area.

5. Characteristics of Farms

Henning von Platen[1)]

5.1 Farm resources

5.1.1 Family structure and labor force

As can be seen in Table 5.1.1., the families have an average of 7.2 persons; the average in Acosta (7.3) is not much different from the Puriscal average (7.0).

Table 5.1.1 Family structure of the farmers Interviewed in Acosta and Puriscal

	ACOSTA	PURISCAL	TOTAL
Number of farmers interviewed	178	108	286
Persons per family	7.3	7.0	7.2
Men older than 14 years	2.6	2.5	2.5
Women older than 14 years	2.2	2.4	2.3
Children	2.5	2.1	2.3

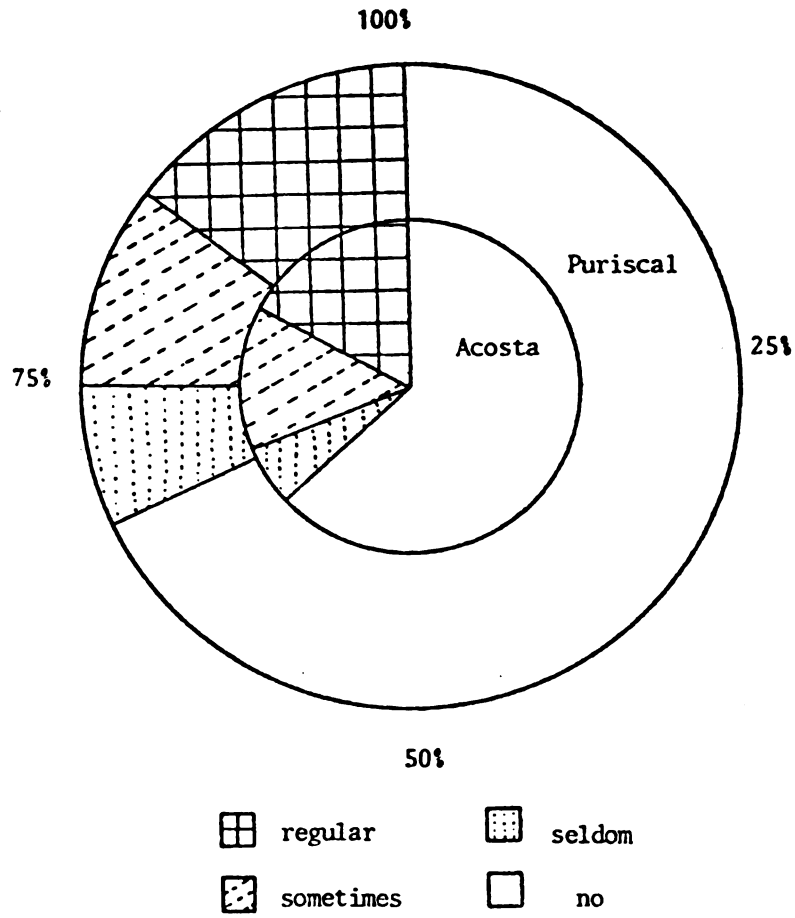
The distribution of persons per family of the 286 farmers indicates that 53% have more than 6 family members and 23% have 4 to 6.

Available family members for work on the farm can be estimated at two persons per farm, and apparently there are no great differences between the two subareas. This figure is calculated with the fact in mind that between 24-30% of the farmers work regularly or occasionally outside of the farm. Furthermore, the women and children help only during the coffee harvest and therefore are not included in the family members available for farm labor.

The following percentages refer to the farmers working on and off the farm in Acosta and Puriscal respectively: on-farm work only, 63.5% and 68.5%; off-farm work regularly, 17% and 14%; off-farm work occasionally or rarely, 15% and 18% (see Figure 5.1.1.).

1) Agricultural Economist for CATIE/GTZ Project.

Figure 5.1.1 Off-farm work of farmers in Acosta and Puriscal



These farmers, that have mainly small farms with less than 4 hectares, work as laborers on large farms and in businesses (grocery stores, intermediares). (Compare also with Chapter 5.5).

5.1.2 Size of Farms

The average size of the farms belonging to the 286 farmers interviewed is 9.5 hectares of land[1]. There are big differences in size between the farms in Acosta (7.2 ha) and those in Puriscal (13.3 ha) and also in farm sizes within the 2 subareas, especially in Puriscal. The average of the total farm size in the Barbacoas district is estimated at 4.6 ha in comparison to 23.7 ha in the Mercedes Sur district.

The distribution of land in Acosta and Puriscal can be seen in Table 5.1.2.1.; 53% of the farmers in Acosta have less than 4 ha and in Puriscal 42% are in this class.

Table 5.1.2.1 Land distribution in Acosta-Puriscal
(% per class)

CLASSES (in ha)	ACOSTA	PURISCAL
Less than 2	29.7	25.9
2-4	23.6	15.8
4-7	18.5	21.3
7-10	9.6	13.0
10 or more	18.5	24.1

Of the two areas, Puriscal has more farms in the range between 4 and 10 ha, and in the largest class with 10 or more ha. The average farm size in this last mentioned class is 23 ha in Acosta in comparison with 43 ha in Puriscal. The concentration of land is therefore greater in Puriscal as can be seen in Figure 5.1.2. Twenty percent of the farmers in Puriscal have 70% of the total surface; in Acosta the latter figure is around 60%.

1) The house area is not included.

Figure 5.1.2 Relationship between number of farms and cultivated area in Acosta and Puriscal

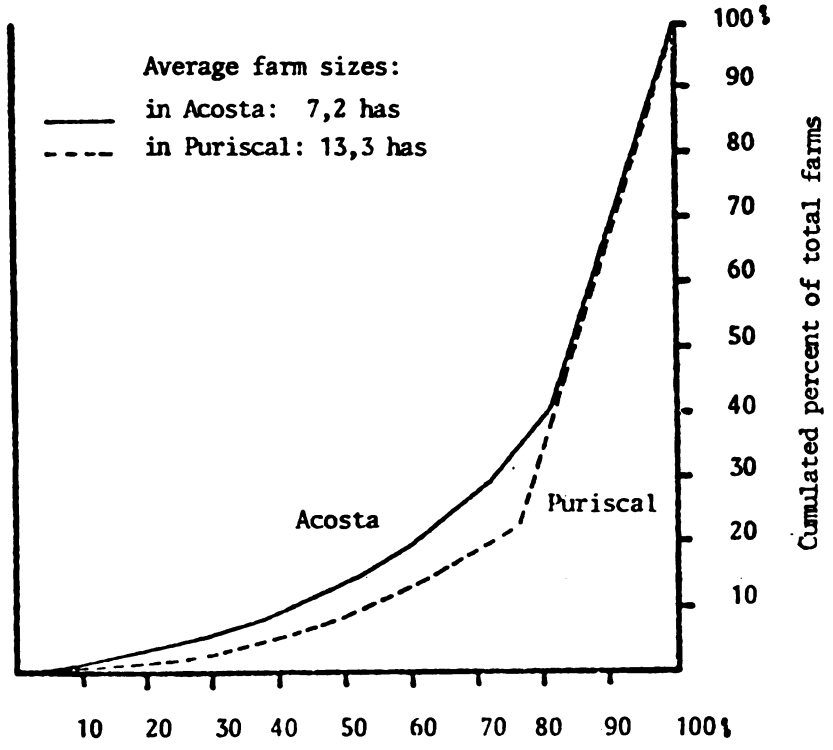


Table 5.1.2.2 Gini Ratios, various crops[1)]

	ACOSTA	PURISCAL
Total size	0.53	0.60
Annual crops	0.40	0.39
Sugar cane	0.46	0.38
Pure coffee	0.49	0.35
mixed coffee	0.43	0.37
Pasture	0.59	0.51

1) A coefficient "0" indicates equidistribution. Formula $\frac{1-\Sigma^{X_i \cdot Y_i + X_i \cdot \Sigma Y_i - 1}}{5000}$ for Xi = % of farms and Yi = % of land in the respective farm size classes.

On the other hand, Table 5.1.2.2. indicates that the equidistribution of the land, according to the crops, in greater in Puriscal. The two areas appear to be equal only in annual crops due to the small sizes that are used especially for subsistence. From all this two factors emerge:

- the figures have value only for smaller or medium-sized farms; in both areas some fairly large farms were not counted.
- pastures play an important role; in Acosta, of the 178 farmers with an average of 7.2 ha, 100 of them have an average pasture of 6.8 ha. Of the 108 farmers interviewed in Puriscal with an average of 13.3 ha, 71 of them have an average of 15.5 ha (see Chapter 5.2).

5.1.3 Farm Capital

Vehicles, machines, and animals are included as farm capital. Another relatively large inversion is the construction of fences for pastures and perennial crops (mainly coffee).

Collection of data concerning the importance of fences was not possible during the preliminary survey, but will be included during the multi-visit survey.

Figure 5.1.3 shows the percentages of farms with vehicles, machines and animals. Almost 9% of the farmers have motorcycles, and 15% have pick-ups, jeeps or trucks. Apparently, most of the vehicles were bought during the years 1977 and 1978 when coffee prices were very high and diesel prices were still low in comparison to the present situation (see Chapter 4).

In Acosta, 43% of the farmers have a spray pump and in Puriscal 57%. These figures are consistent with the others on the use of herbicides and other agro-chemicals (see Chapter 5.4), and on technical assistance, that appears to be better in Puriscal.

Sugarcane mills are found on 11% of the farms and 6% have a motor-saw. At present, irrigation installations are not important in the study area.

In respect to animals, great emphasis is placed on livestock in the two subareas. In Puriscal, 63% of the farmers have an average of about 12 animals; in Acosta 50% have an average close to 10 animals.

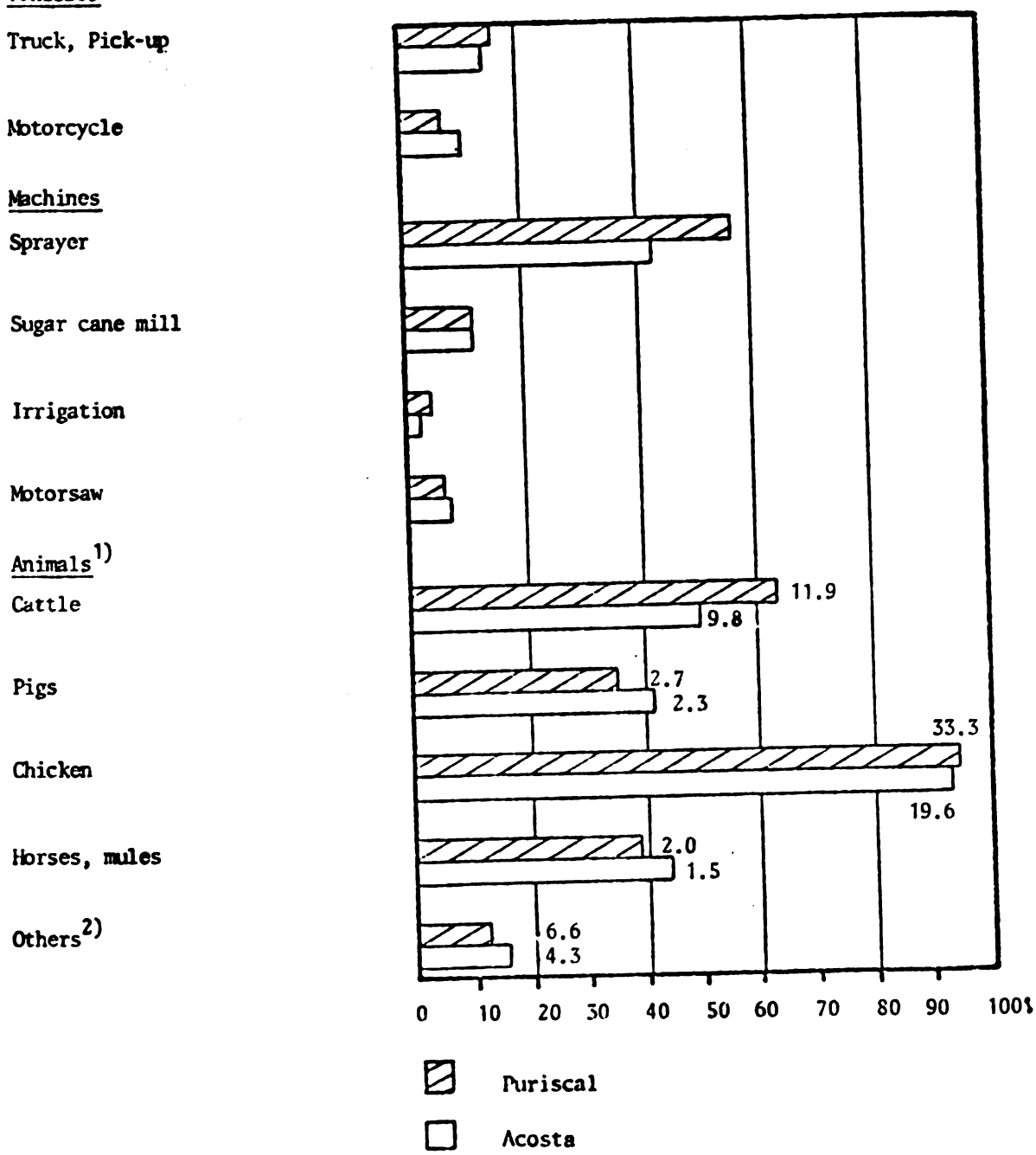
Livestock distribution according to the number of animals per farm is regular in all the area. (See Table 5.1.3).

Table 5.1.3 Livestock distribution according to the number of animals per farm in Acosta and Puriscal

Number of Animals	ACOSTA	PURISCAL
	Percentages of Farms	
2 or less	24.7	32.4
3-4	16.9	13.2
5-7	20.2	10.3
8-11	12.4	13.2
More than 11	25.8	30.9

In Acosta and Puriscal, the most important classes are the first and last ones which signify a great difference in cattle resources. Table 5.1.3., also indicates that livestock owners in the zone are small producers because 74% in Acosta and 69% in Puriscal have less than 11 animals.

Figure 5.1.3 Farm capital. Percentage of farms with vehicles, machines and animals



1) The figures indicate mean values per farm.

2) In most cases turkey.

When the number of animals is compared with the area of available pastures (see Chapter 5.2.1), it is evident that livestock production is more intensive in Acosta than in Puriscal. The carrying capacity is 1.4 and 0.8 animals per hectare for Acosta and Puriscal respectively.

Almost all the farms have fowl; the average in Puriscal is quite high, 33 chickens compared to 20 in Acosta. The number of chickens in Puriscal is influenced by some farmers who have specialized in egg production. The majority (70%) of farmers have less than 20 chickens.

Approximately 40% of the farmers have two or three pigs and one or two horses or mules, the latter being used mainly for the transportation of people and products.

5.2 Use of Land

In the study areas, land is mainly used for annual crops, coffee, coffee associated with other crops, sugar cane, and pasture. In addition, there is always some land that is not in use or, in other words, in fallow, forest, etc. In Puriscal, various farms have tobacco and few have fruits and vegetables.

Averages for the respective land areas can be seen in Figures 5.2.1. There is no great difference between the regions except in pasture. The farms with pasture in Acosta have an average size of 6.8 ha and those in Puriscal 15.5 ha. The average area for annual crops is slightly larger in Puriscal (1.9 ha) than in Acosta (1.5 ha)[1], same as the area for coffee planted by itself (1.3 ha and 1.0 ha) and coffee planted with bananas (1.1 ha and 0.9 ha)[1]. For other land uses, the average in Acosta is a little higher. Percentages referring to land use are presented in Table 5.2.

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1) The "F-test" indicated that differences between averages are not significant.

Figure 5.2.1 Average size of cultivated crops and pasture in Acosta and Puriscal

- Figures indicate number of farms with this observation

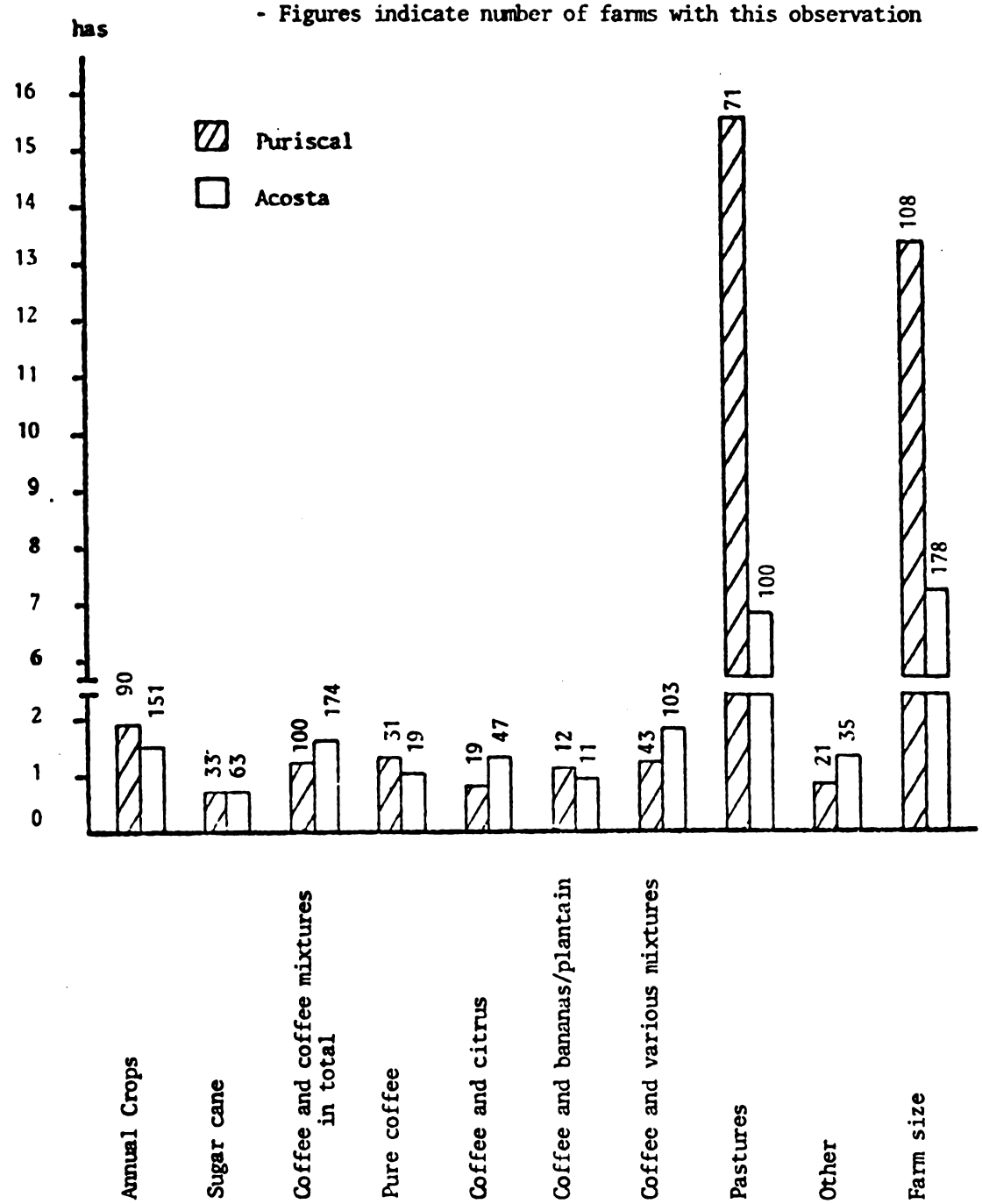


Table 5.2 Land use in percentages of total farm-land and number of farms

	ACOSTA		PURISCAL	
	% land	% farms	% land	% farms
Annual Crops	18	85	12	83
Perennial Crops	25	98[1)]	10	93[1)]
Pasture	53	56	77	66
Other uses	4	20	1	19

1) Mainly farms with coffee. Also 35% (Acosta) and 31% (Puriscal) of the farms have sugar cane.

In Table 5.2., apart from pasture, perennial crops are more important than annual crops in Acosta; in Puriscal the opposite is true although the difference is small.

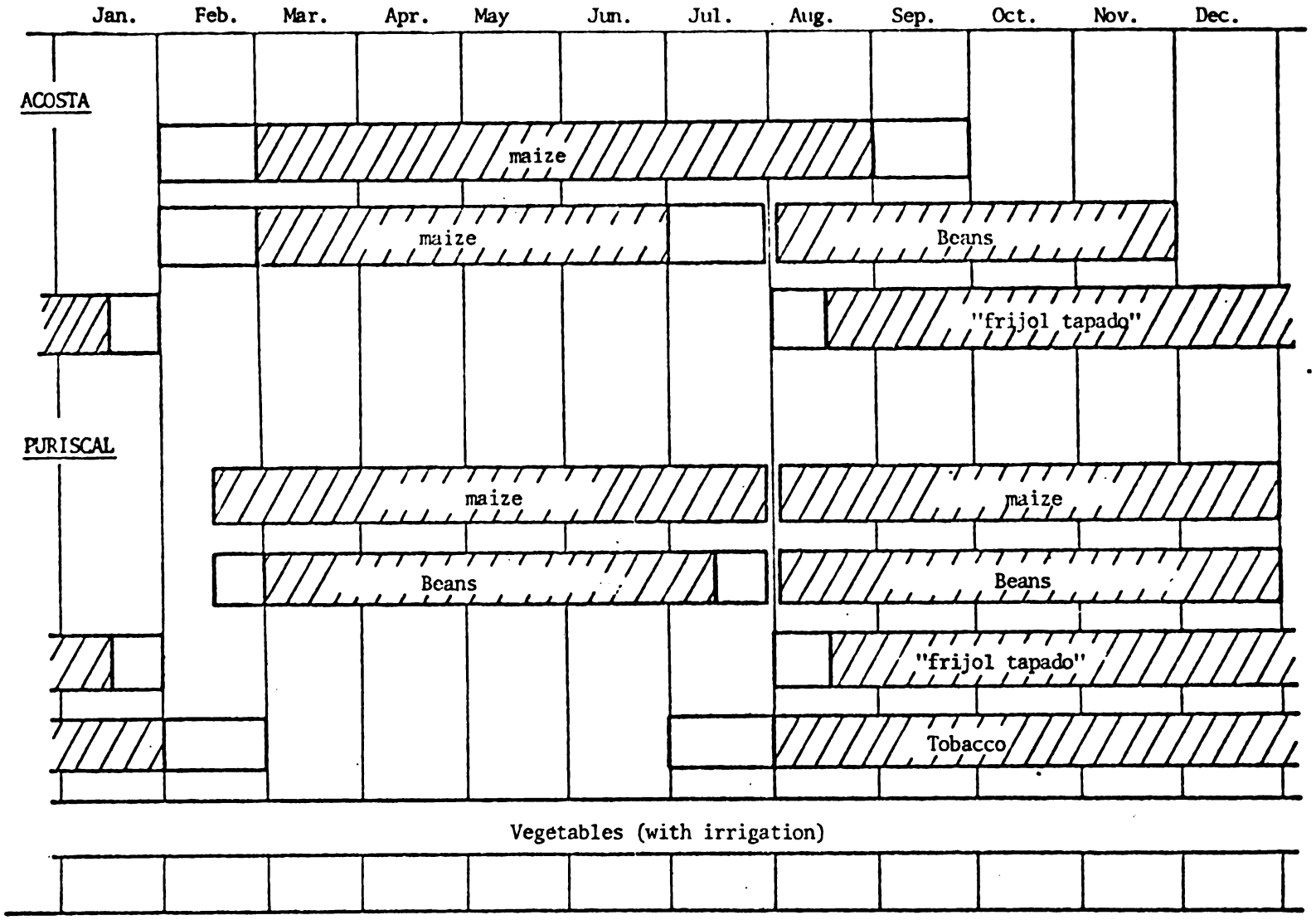
Annual crops have more importance in Puriscal because of the large quantity of tobacco which is a typical cash crop. Maize, the most important food crop is normally planted in rotation with tobacco.

Annual crops such as maize, beans, fruits and vegetables are best planted in the first planting season. "Covered beans"[1)] (the majority of farmers, 75% in Acosta and 43% in Puriscal use this practice) and tobacco are planted mostly in the second planting season[2)]. (see Figure 5.2.2).

An important result is the small variation of land under annual crops. The area with annual crops does not increase or decrease with a variation of the total farm size. Due to the lack of mechanization, the land under annual crops depends directly on the hand labor available.

1) "Covered beans" (frijol tapado) is a practise of seeding beans without land preparation. After seeding the vegetation is cut with a machete (cane knife). The beans start to grow under the thick mulch cover. This method prevents drastically soil erosion.
2) The first planting, with variations between the two areas, is before the April rains; the second is around September/October.

Figure 5.2.2 Use of land during the year in Acosta and Puriscal



5.3 Technology

José Araya Sánchez[1)]

5.3.1 Annual Crops

5.3.1.1 Maize

The land is prepared manually by different methods: 1) burning, 2) slashing and burning , 3) herbicide applications, 4) and in some areas around the center of Puriscal shoveling (palear).

Local maize seed is used for 80% of the plantings; the planting period varies between March and April, and the planting distance ranges between 0.9 and 1.5 square meters using 3 to 5 seeds per hole. Fertilizer applications vary widely. The farmers use complete formulas and nitrogen fertilizers indiscriminately with little programming; it is common to find farmers applying nitrogen 60 to 80 days after planting. This presents a serious problem; the farmers should be taught how to use this input correctly. Furthermore, the soils are very low in phosphorus; the majority contain less than 10 ug/ml, and the pH is usually lower than 5.5 (see Chapter 3.3).

Weed control is one of the more serious problems in the zone as it is among the factors most responsible for production drop-off. The present weed control appears to be ineffective. Since it is carried out according to weed size and in most cases is done after the 30-day critical period is past, resulting in extreme damage. High wages for laborers make weed control expensive and is the principal reason for the insufficiency of weed control.

Diseases in general are not a problem or have not been calculated as to their effect on production, except for the ones that attack the ears of maize such as *Gibberella sp, Fusarium sp., Physalospora Zeae.* These can reach a level of 25% in attack and losses.

Pests that produce the greatest damage are: Whorlworm (*Spodeptera frugiperda*), Cornstalk borer (*Elasmopalpus lignosellus*). The first is controlled by the farmers, but damage by the second pest is unknown by most of them. It is necessary to point out that damage by these insects is cyclic, or in

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1) Specialist in Basic Grains, Regional Agricultural Center.

other words, they do not attack every year with the same intensity.

Harvesting, storage, and shelling are manual jobs and in 75% of the cases are done in the dry period. Storage presents problems with insects which cause up to 35% or more in losses.

5.3.1.2 Beans

Between 85% and 90% of beans in the zone are produced with zero-tillage practise (covered beans) that consists of throwing 25 kg/ha of seed in a random manner and later cutting the vegetation so that it covers the seed. The farmer returns after 2.5 to 3.5 months to harvest the beans. This process does not require inputs and its main problems are Leaf beetles (*Diabrotica sp.*), Slugs (*Vaginulus plebeius*) and White grubs (*Phyllophaga sp.*).

Diseases that cause the most damage are: spider web (*Thanetephorus cucumeris*), rust (*Clromyces phaseoli and Clromyces appendiculatus*) and angular leaf spot (*Isariopsis griseola*), which can result in 100% bean loss. Two facts aggravate the problem: first, fungicides can not be used because of the planting system; and second local seed used by the farmers is susceptible to these diseases. The harvest is manual and storage problems are identical to those previously described for maize.

5.3.2 Perennial Crops

Gerardo Rodríguez P.[1)]

5.3.2.1 Coffee

Most of the plantations are over 15 years old; some of these have been pruned because of their low production with the result that the successive axes produce less than the original plant. This practise is more frequent in the Acosta zone and on a lesser scale in Puriscal.

In respect to characteristics of the more frequently used varieties, it can be said that the "Typica" or "Costa Rican Hybrid" are similar in size, but in production the hybrid is better. The "Caturra" variety is small in size, but high in production; in recent years, many coffee growers are renovating their plantations with this new variety.

Establishment of seed beds:

In general, the coffee grower in this zone makes his own seed bed. But he lacks sufficient technical knowledge to consider important factors such as land selection, land preparation, laying out the field, planting, fertilizing, irrigation and drainage.

Most seed beds are heavily attacked by fungus diseases destroying in some cases up to 75% of the plantation. The lack of minor elements in the soils contributes also to the poor quality of seed beds.

Establishment of coffee plantations:

It is very common to find coffee plantations planted with a distance of 1.30 meters between plants and 2.10 meters between rows. Coffee farmers show a definite interest in adequately preparing the land for planting coffee, and they generally do a good job.

Very few farmers use lime. Soil conservation practices consist mainly of individual or bench-terracing and the use of "gavetas" (structures for slowing water run-off).

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1) Agricultural Engineer of the CATIE/GTZ Project in Acosta-Puriscal.

Banana trees serve as temporary shade; and citrus, guava and different species of poro (*Erythrina poeppigiana*) and casoarina are used permanently to shade the coffee. There is no set rule for proper shade.

Management practices include pruning which is generally done when necessary on the main branches, the lateral branches, or the whole plant. In some cases plantations are totaly renovated but rarely does the coffee grower replant. Fertilization is usually done, but with small quantities of fertilizer per plant. There is no soil analysis to guarantee that the formula used will be adequate for the needs of the soil.

Weed control is done manually (shovelling) by about 85% of the farmers, and the rest use herbicides. The control of pests is an important practice in the zone because of the many problems. Attacks by nematodes sometimes threaten to partially or totally destroy the plantations if not controlled in time. The farmers can do very little to improve the situation; they need more technical assistance in regard to agricultural chemicals, sufficient economic resources and adequate training in order to solve these problems.

5.3.2.2 Citrus

Farmers in the Acosta region mainly use citrus trees as shade for coffee plantations. Citrus also provides them with additional income as the Acosta area is an important source of citrus production at the national level.

The quality of citrus in regard to size is not the best in Acosta; nevertheless the flavor, color acidity, etc., are quite acceptable. That the fruit is not high quality is due to the fact that adequate labor practices such as pruning, plant sanitation control, improved varieties, and fertilization programs do not exist.

In Puriscal, citrus is rarely found as shade for coffee since other species of trees are used.

5.3.3 Livestock

Danilo Boja Mora[1)]

Livestock activities in this area are principally dedicated to breeding and fattening beef cattle using Zebu, Brahaman and Creole breeds.

Few dairy cattle are found on each farm and these provide milk for the farmers' own consumption. Rarely is the milk sent to processing plants such as Dos Pinos, Plaza, etc. The milk is used locally to make cheese and sour cream; in addition, the whey serves a double purpose: as feed for the farmers' pigs and for the growth of their beef calves. The calves produced are sold each year to pay off bank loans.

The land is very sloping and generally has natural pasture. On a small scale, improved pasture varieties are being introduced which are adaptable to soil and climatic conditions, such as: african star, *Brachiaria ruziziensis*, elephant grass, ratana and the most abundant jaragua grass. However, most of these pastures are poorly managed and costly to maintain. The cattle farmer in general has a low income and depends on bank credit to buy his animals.

Technical assistance is limited and rarely reaches the cattle farmer; some assistance is given by MAG technicians, veterinary agents, and representatives of commercial firms who most frequently visit the entire zone.

Local marketing of livestock is done only between cattle producers on the farms, or in the local market places, or directly with the butchers. The cattle are also taken to the Montecillos market in Alajuela where they are directly sold. In many cases these cows are bought at very low prices by middle men who make a large profit. The existing infrastructure is very small and few farms have adequate installations. The construction of sheds, corrals, salt-troughs, watering troughs, loading platforms, etc., has only recently started.

The cattle feed on low-quality pasture, mostly natural pasture or jaragua grass.

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1) Animal Husbandry Specialist, Regional Agricultural Center.

The livestock producer is accustomed to practice preventive vaccination against diseases which appear on a small scale such as blood poisoning, anthrax, black leg, mastitis; other more common diseases like uterine collapse and placenta retention; and problems with calving, which are mostly due to nutritional and feeding deficiencies, especially vitamins and minerals.

The lack of adequate technology applied to farm activities is a major problem for farmers in this zone, resulting in low farm productivity and low farm income.

5.4 Use of inputs

5.4.1 Use and knowledge of inputs

Fertilizers are applied by 82% of the farmers in Acosta and Puriscal. This percentage varies between 50% and 100% in the districts and is lower in outlying areas. There is no significant difference in the average size of the farms that use fertilizers and those that do not[1].

The use of herbicides and other agro-chemicals (such as insecticides, fungicides, etc.) is more variable. Percentages in the districts vary between 0% (other agro-chemicals, Toledo) and 87% (herbicides, Tablazo) in Acosta, and between 0% (other agro-chemicals, Pedernal) and 100% (various products) in Puriscal. The respective input percentages can be seen in Figure 5.4 and are higher in Puriscal than in Acosta. Again it can be observed that in remote areas, the application of these products is lower. Insecticides and fungicides are especially used on coffee plantations and for tobacco production.

Improved seed is used very little. Only 13% of the farmers in Acosta, and 25% in Puriscal make use of it. There is no relation between the average of farm areas (in total and annual crops) and the use of improved seed in the two regions. These problems will be discussed in detail in the following chapter.

In general, the knowledge of inputs, in the study area appears to be higher than the application of the same. The various farmers are now ask-

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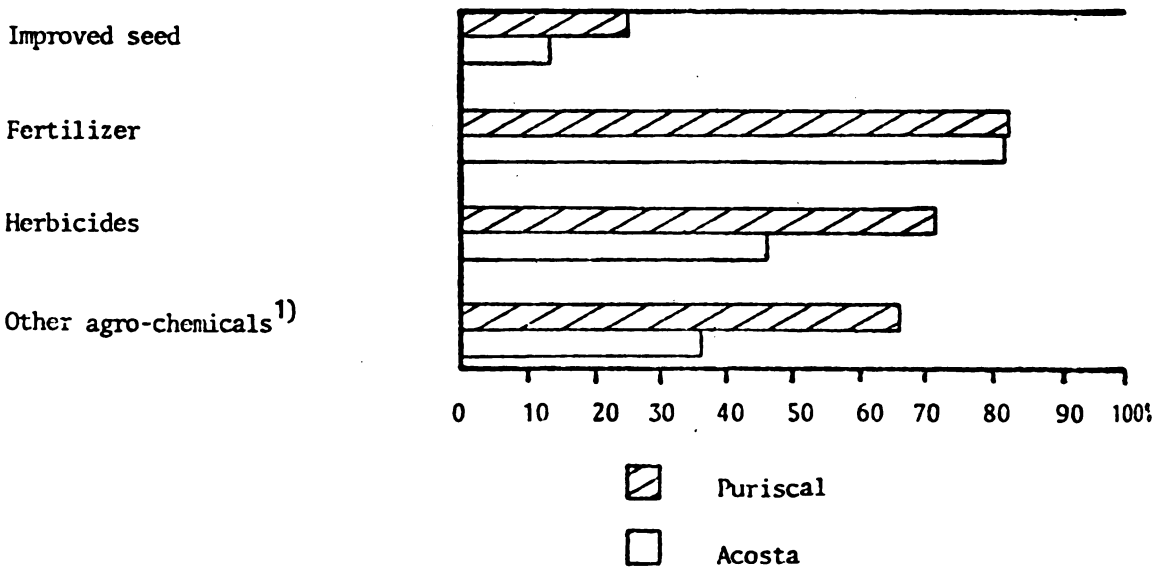
1) According to the "F-test".

Figure 5.4 Percentage of farmers using various inputs



1) like fungicides and pesticides.

ing for a soil analysis so they can know which formula to apply. They are familiar with many of the agro-chemical products and the different varieties of improved seed as well. At times there are mistakes in application, especially with herbicides; the fertilizer applied is generally not sufficient.

Survey questions did not include other inputs, such as concentrates and minerales for animals. These inputs are also familiar to the farmer and are used for pigs and chickens, but in small quantities because of high costs. The basic food for these animals still comes from the same farm (bananas, tubers, fruits, sugar cane, etc.).

The development of the use of inputs cannot be estimated for the future because the relationship between input and output prices is deteriorating (compare Chapter 4.4.).

5.4.2 Limiting factors in the use of seed

Heiner E. Goldbach[1)]

5.4.2.1 Use of improved seed

Contrary to previous information, very few of the consulted farmers in the survey mentioned that they used improved seed on a regular basis. Mostly seeds of grain for consumption are being used as seed, with a little selection. Only one farmers is buying seed every 4 years for beans (probably cv. Mexico 80) and every 3 years for maize (cv. unknown, probably "Creole" type). Some farmers made a preliminary selection of more promising plants and kept the seed derived from these. This seems to be done frequently with tobacco in the Puriscal zone. Contrary to offical information, the farmers consulted in the survey do not buy tobacco seed; according to various reports, the seed that the farmers had bought was low-quality and high-priced.

In new coffee plantations, "Caturra" coffee is mainly being planted. The seed is bought in the coffee office or from neighbors, or taken from the same farm.

5.4.2.2 Grain and seed storage

The general practice is to dry the grain in the field (doubled corn) which seems to be the only existing. Maize ears are stored with their husks intact in different types of bins. Sometimes, to control insects, clordine or lime is applied, scattered over the husks, but quite often the maize does not receive any treatment. Beans used for consumption are kept in sacks or bins.

The Puriscal zone apparently received more assistance from the extension service, because there it is a common practice to store grains and seeds (at least the beans) in bins after fumigation (probably Phostoxin).

On the other hand, in the more remote zones of Acosta, very little attention is given to grain and seed storage; apparently the application of additional treatments is not often considered. Rodent damage does not seem

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1) Seed Physiologist, CATIE, Turrialba, Costa Rica.

to be a problem.

Steps in improving the storage system:

- control insects with appropriate insecticides
- fumigate grain (Phostoxin, etc.)
- store dry and disinfected grain in better constructed sheds or bins
- dry the best grain (sun-drying) before storing it
- store seed and grain for consumption separetely (seed with insecticide or in cans/bins).
- dry seed in the shade before packing it
- treat seeds with appropriate fungicides to control diseases transmitted by the seeds.

5.4.2.3 Losses of seed viability and grain for consumption

Generally, farmers seem to be less conscious of the losses that occur in the seed's viability and in the seed's value for the planting period. When consulted on this point, they needed time to recall the problems of seed germination. As can be observed in almost all developing countries, seed receives less attention than other production factors, even though it is a relatively cheap and frequently decisive input (if accepted and adapted crops are available). It seems advisable to make an estimation of losses that occurred prior to planting, taking seed samples from all the farmers of the survey. In this way, the samples can be evaluated in the seed laboratory and the results can be used in recommending planting practices or introducing better quality seed.

Once there is more data on present losses and on how the seed is usually handled, more efficient conservation methods at farm level can be developed and recommendations can be given to the farmers.

It is possible to alter the present system of seed conservation, but generally this implies more work at harvest time. The feasibility of changing the system will have to be determinated in a detailed survey.

5.5 Labor peaks on the farms

Labor peaks (see Figure 5.5) occur mainly during coffee harvest and tobacco processing periods. These "peaks" appear to be a serious limitation for production, considering that it is difficult to find laborers. Another more moderate peak occurs during the months of March and April, when the soil is prepared for maize and bean planting and during the planting period itself. Pruning in coffee plantations as well as activities such as weeding etc., require extra labor also.

The difference in data between Acosta and Puriscal show that the coffee harvest is later in Acosta, and that tobacco processing (drying, selecting) causes another labor peak in Puriscal. There is no present explanation for the peak in May in Acosta.

5.6 Sale of agricultural products

To find out the importance of farm products as sources of cash income, the survey included a question on sales (Figure 5.6.1); and for information on marketing channels, one question concerned the destination of sales.

As can be seen, annual crops are principally produced for auto-consumption. Tobacco (Puriscal) is the only typical cash crop and is planted under contract with tobacco companies. The quantities sold of other annual crops are usually those portions left over after internal farm consumption; in other words, the farmers always plant a little more than the family consumes of an average harvest. They do this so that in bad years the harvest still provides enough for the family's necessities. In average and good years there is always an excess which is sold. However, sales in the Puriscal area are always a little higher, which shows that farmers are now beginning to regard annual crops as a source of cash income. Furthermore, soil and topography are factors influencing sales in the Puriscal zone which is more appropriate for these crops. Two farms that produce directly for the market are responsible for a relatively large portion of fruit and vegetable sales.

Among the perennial crops, coffee is a typical cash crop. Only the very small farms fail to sell the majority of their coffee harvest.

Figure 5.5 Labor Peaks on the Farms in Acosta and Puriscal

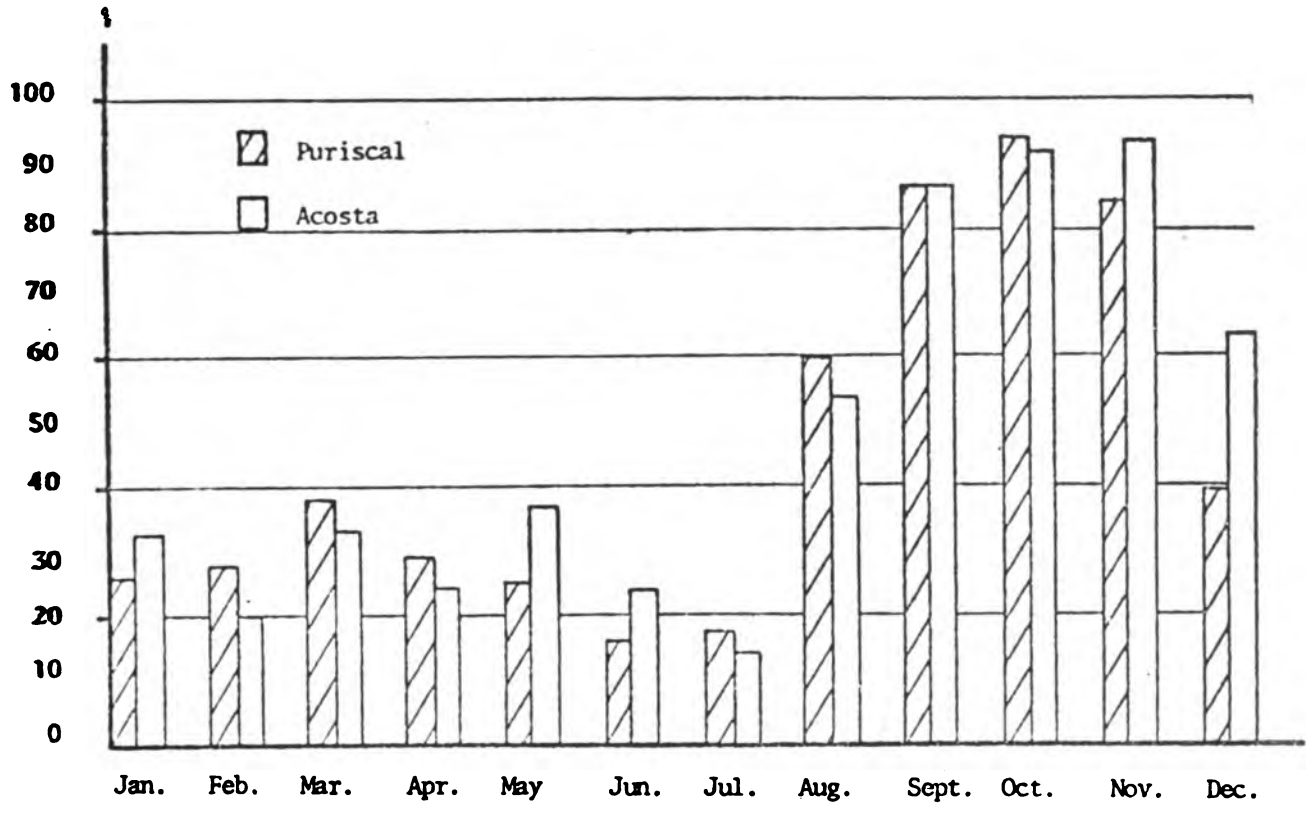
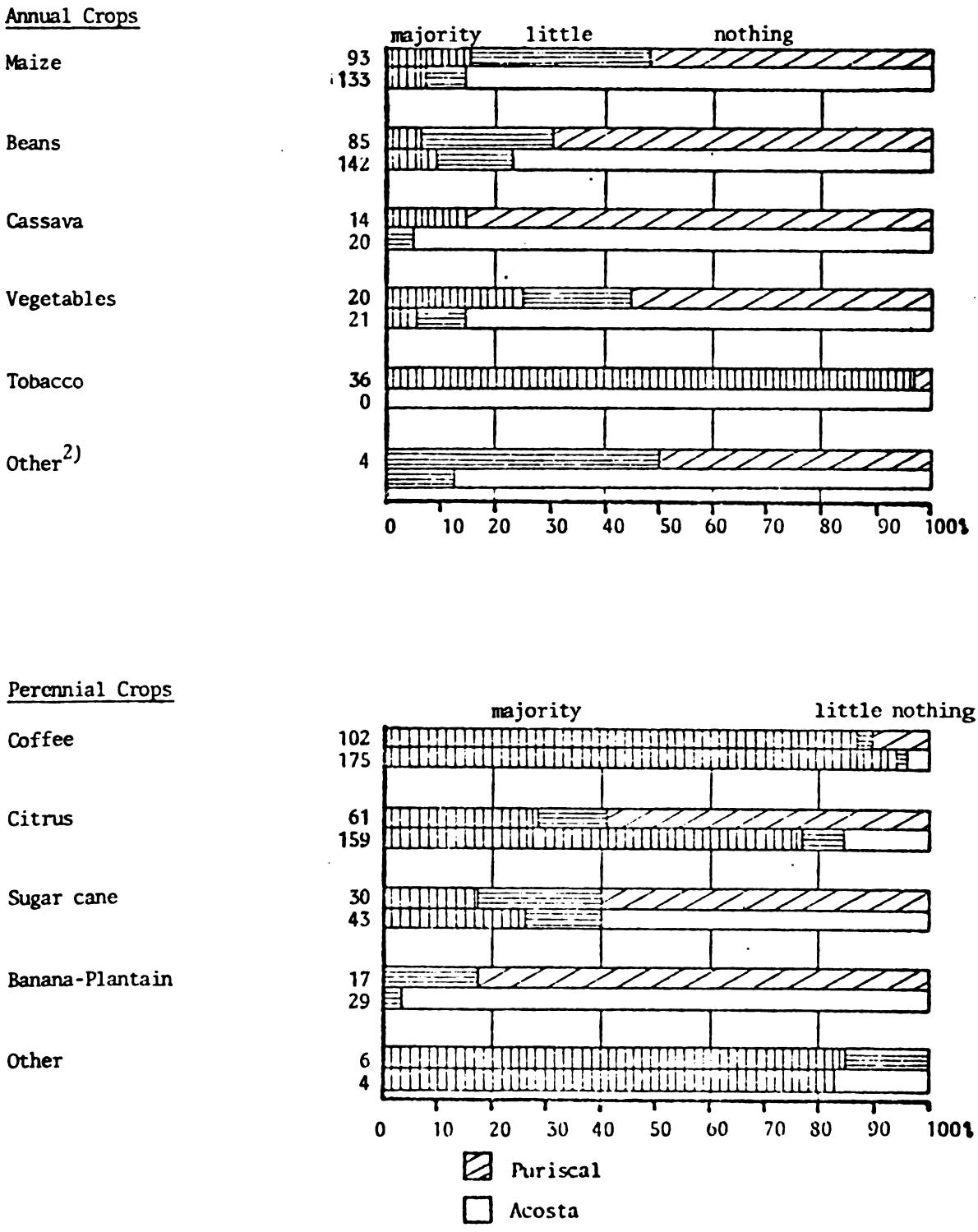


Figure 5.6.1 Sales of annual and perennial crops in Acosta and Puriscal[1)]



1) With number of farmers who cultivate the different crops
2) Rice, pepper, chayote, ayote, achiote

Citrus:

In order of importance, the sweet orange, sour lemon, tangerine and sweet lemon are mostly products for self-consumption with a small portion for sale. Citrus is more important in Acosta (90% of the farmers grow these fruits, 77% sell the majority) than in Puriscal (56% of the farmers grow citrus, 28% sell the majority). Although a high percentage is sold, much is lost; in other words, it is still possible to increase sales, especially in Acosta.

Sugar cane:

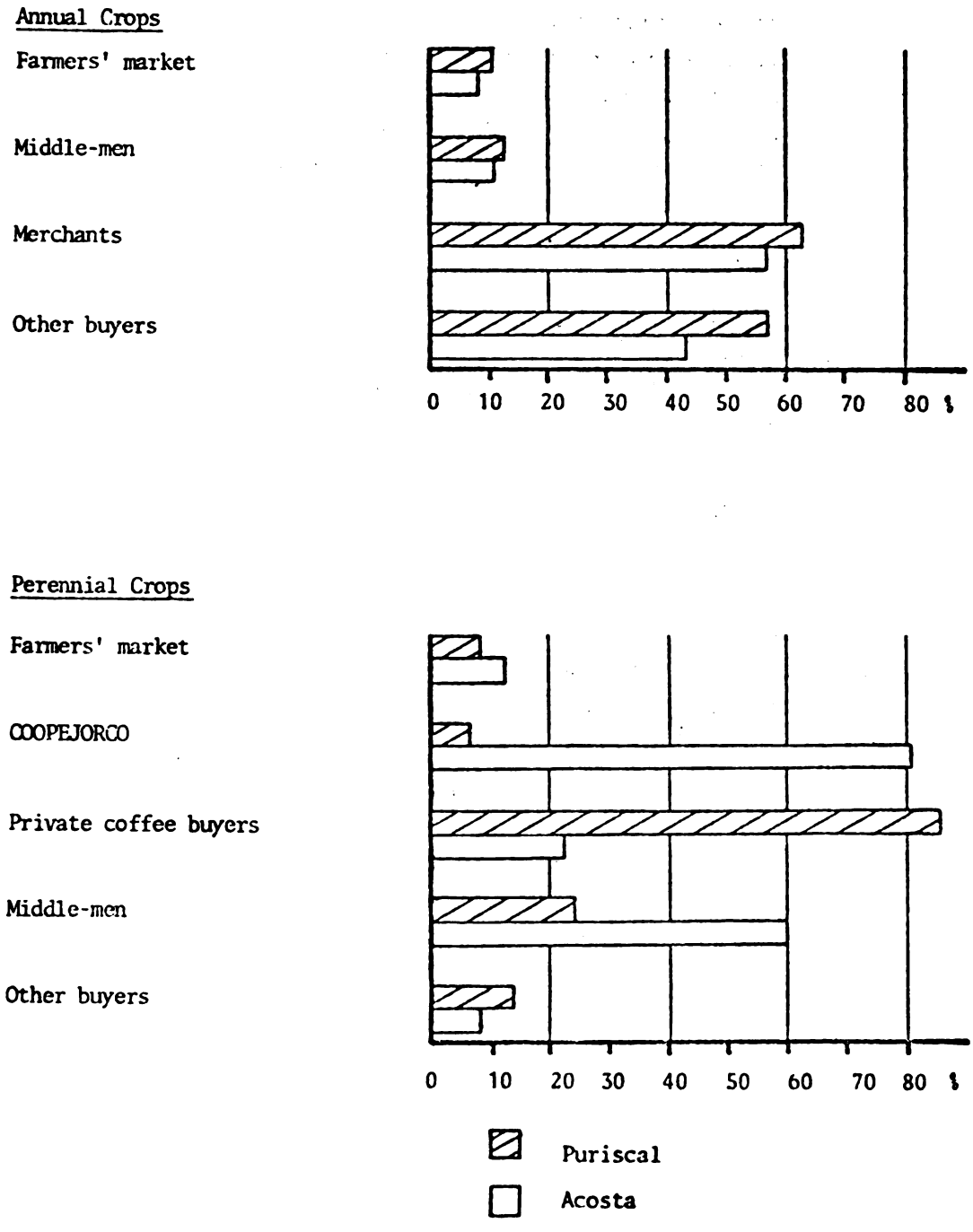
Mostly the elaborated "tapa de dulce" (a block of brown sugar) is sold; various farms have sugar cane mills. The majority of the raw cane is still used for local consumption (animal feed, for example), the same as plantains and a few bananas.

Of the other products, the most important is the "Itabo flower" (*Yucca elephantipes*). The plant is used for fences and its flower is sold for food.

Merchants, intermediaries, and other buyers are especially important in the destiny of sales of annual crops, due to the fact that these products are sold more or less spontaneously. The farmer's market still has little influence in the destiny of sales, but this is increasing. More farmers in Puriscal sell their products in comparison to those in Acosta.

In perennial crops, it is necessary to differentiate between the various products. Coffee, of course, is sold mostly to processing plants of which the "COOPEJORCO" is more important in Acosta; there are other processing plants in Puriscal. Little citrus is sold in the small markets; intermediaries or middle-men buy the majority. A certain amount is sold directly in the San Jose markets, transported by commission or by chartered vehicles (compare Chapter 4.3).

Figure 5.6.2 Destiny of sales of annual and perennial crops in Acosta and Puriscal



6. Problems encountered by the farmers

Henning von Platen[1)]

Various problems occurring in the study areas have been discussed in the previous chapters: a) topography as a limiting factor, especially for production of annual crops, but also affecting pastures and hence livestock production, b) infertile soils in certain places, c) pests and diseases attacking plants, d) difficulties in marketing products, e) poor relationship between input and output prices, f) difficulties in providing good technical assistance to farmers and g) emigration in the area, especially by young people.

In general, these are the problems mentioned by the farmers in reference to the survey question, "In your opinion, what are the biggest problems for farmers in this area" (with the possibility of three answers). The results can be seen in Figure 6.1. At the same time, the answers reflect the agricultural structure in the two subareas: high input prices affect the farmers severely, but more so in Puriscal where larger farms use generally more purchased inputs. The same with hired "manual labor" which 50% of the same farmers in Puriscal mentioned as a problem, in comparison to 28% in Acosta where the farms are smaller and use mostly family labor. On the other hand, twice the number of farmers in Acosta replied that technical assistance is a major problem. The tobacco companies, together with MAG, give technical assistance in Puriscal, at least to farmers who have tobacco. The farmers' answers indicate another big difference in regard to roads. Puriscal has better roads and better bus service.

The lack of markets does not seem to worry the farmers, with only 3.4% (Acosta) and 4.6% (Puriscal) mentioning this point. In both areas, coffee marketing is well-organized; the same goes for tobacco in Puriscal. On the other hand, citrus in Acosta seemingly has minor importance for the farmers. Cash income is regarded as additional on most farms, but this situation is presently changing.

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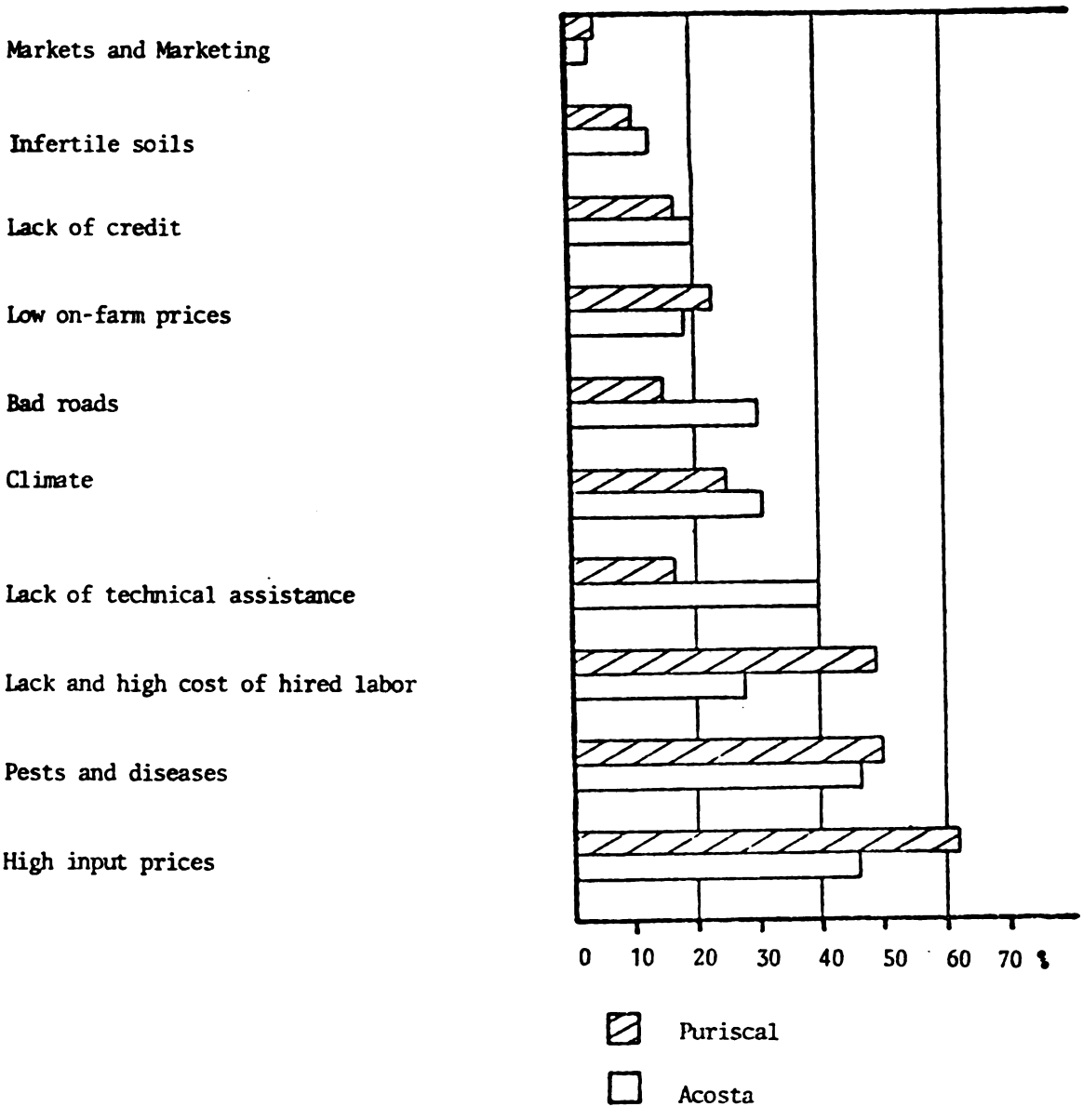
1) Agricultural Economist of the CATIE-GTZ Project in Acosta-Puriscal.

Figure 6.1 Most important problems encountered by the farmers of Acosta and Puriscal



7. Conclusions

Johannes Lagemann[1)]

The previous chapters represent a basic inventory on the region's environment, the resources and characteristics of the farms and their limitations.

In regard to development of innovations and their distribution, the question should be asked "What are the greatest limitations affecting maximum use of existent resources"?

These limitations have already been indicated in the text, but they are clearer when presented together in a table according to the different types:

Table 7.1 Limitations in agricultural production in the Acosta-Puriscal region.

Type of limitations	Specifications
1. Physical environment	
a) Climate	- heavy rains in summer (May-November; 2.200 mm) - well-defined drought - strong winds
b) Topography	- extremely broken land in the entire zone, especially in Acosta; mechanization impossible.
c) Soils	- phosphorus deficiency in the whole zone - deficiency in magnesium, sulfur, and zinc, principally in Acosta
2. Socio-economic environment	
a) Infrastructure	- danger of landslides after heavy rains - in some districts of Acosta lack of electricity

1) Agricultural Economist and Coordinator for the CATIE/GTZ Project.

b) Marketing
- wide fluctuation in prices of fruits and vegetables and citrus
- lack of information on market prices
- high costs of commercialization (small quantities,.long routes)

c) Inputs
- rising prices of diesel, insecticides and fertilizer since 1973 (100-800%)

d) Credit
- limited availability of credit for small farmers (with 8% interest)
- current credits with interest rate between 18-24%
- small farmers' inability to give sufficient guarantee

e) Service institutions
- impossible farmer-extensionist ratio, especially in Acosta (850:1)
- scarcity of vehicles and gasoline

f) Laws
- prohibited to cut trees in areas with more than 40% grade, negative effect of law on reforestation in the zone

3. Resources

a) Land
- 50% of the farmers with less than 4 hectares
- low productivity of land on extreme slopes (especially in Acosta) extremely eroded areas used for natural pasture and annual crops

b) Manual labor
- problem of finding laborers during peak work periods
- low productivity of manual labor because main activities are not mechanized

c) Capital
- few possibilities of self-financing "big investments" such as buying irrigation installations and renovating coffee plantations.

4. Management technology

a) Annual crops
- manual land preparation
- soil left uncovered for long periods, resulting in erosion
- rapid growth of weeds
- lack of knowledge in fertilizer application
- low population of maize plants (20-30,000 plants/ha)
- inadequate storage of crops, causing great losses through pests and diseases.

b) Perennial crops
- old plantations with low productivity
- lack of shade regulation
- lack of pruning
- lack of knowledge especially in disease control

c) Livestock
- natural pastures with low productivity on extremely eroded slopes, almost non-existent pasture management
- deficient animal sanitation

The list of limitations is long and it is not possible to solve all of them. Therefore they should be divided into two groups.

1. Environmental factors

- physical environment
- socio-economic environment
- farm resources

2. Management factors

- agricultural enterprises
- land preparation
- cropping pattern
- crop rotation
- pasture management
- varieties
- fertilization
- pest, disease and weed control

1. The environmental factors are exogeneous factors, which are outside the farmer's control (also short-term resources). Within the socio-economic environment, insufficient technical assistance and insufficient credit for small farmers are critical limitations.

After studying the collected information, the authors believe that the marketing system is presently inefficient. For verification of this hypothesis, more information will be collected this year.

2. The management factors (endogeneous factors) are controlled by the farmers, they are also the most important factors for extensionists and researchers. In annual crops, soil preparation appears to be a big limitation. The consequences are: danger of erosion due to lack of sufficient soil cover, rapid growth of weeds, and inability to increase the area with annual crops because of manual land preparation.

Concerning perennial crops (in this case coffee), old plantations with low-producing varieties create the biggest problem. The new varieties have greater potential. According to unofficial information, coffee production can easily be doubled.

Presently, 65% of the land in use is under pasture with a low production and danger of erosion in the sloping areas. The utilization of natural pasture is an important limitation as well as the manner in which it is used.

Based on experiences of some farmers with better pastures like "african star", the conclusion can be made that these have great potential. But the conclusions should be treated as preliminary. The information on management factors in the region's two subareas is still insufficient, especially facts

concerning production and productivity of the different agricultural enterprises, and of the farms as a whole.

This information will be collected during the multi-visit survey with 70 farmers from the region and in exploratory experiments.

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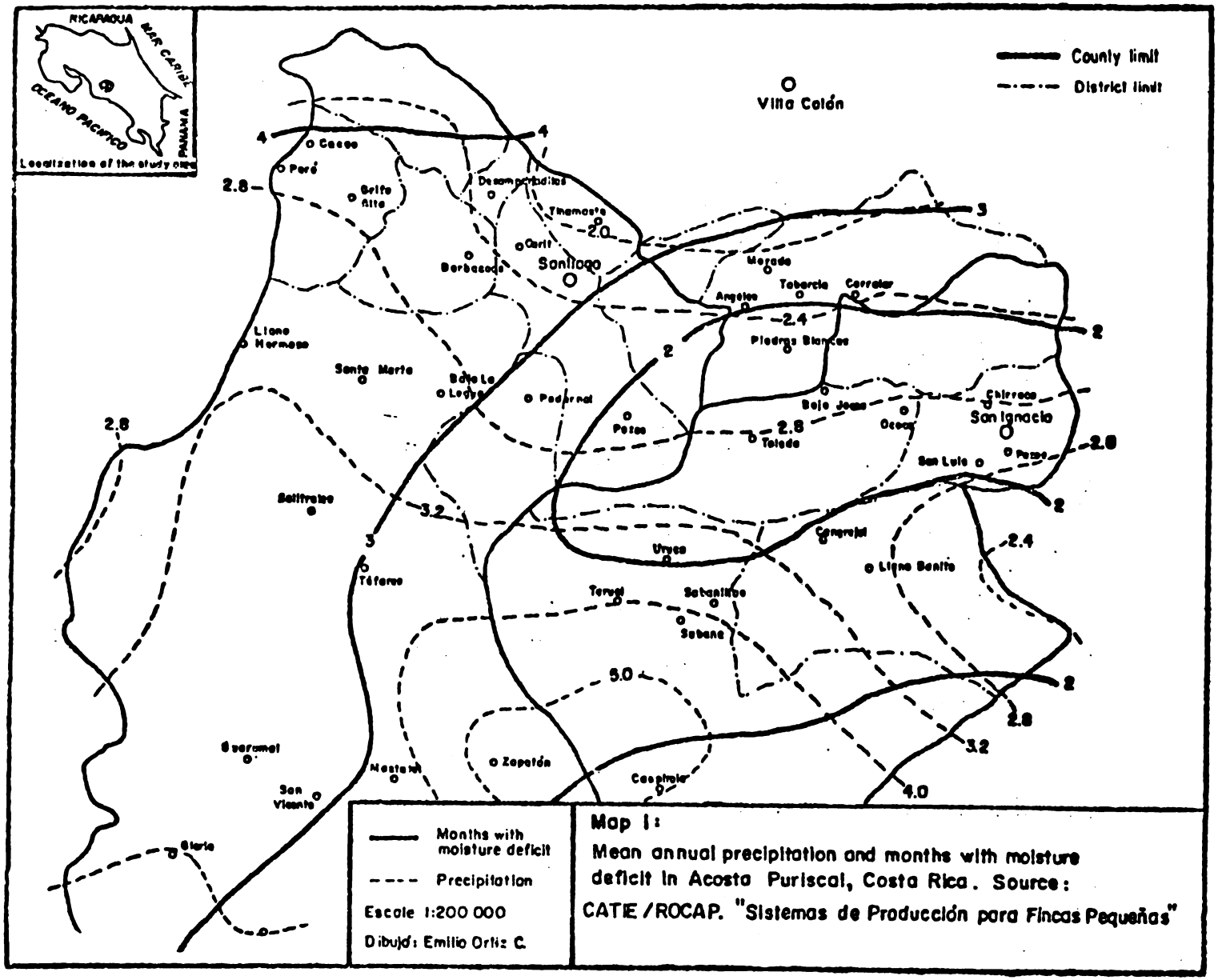
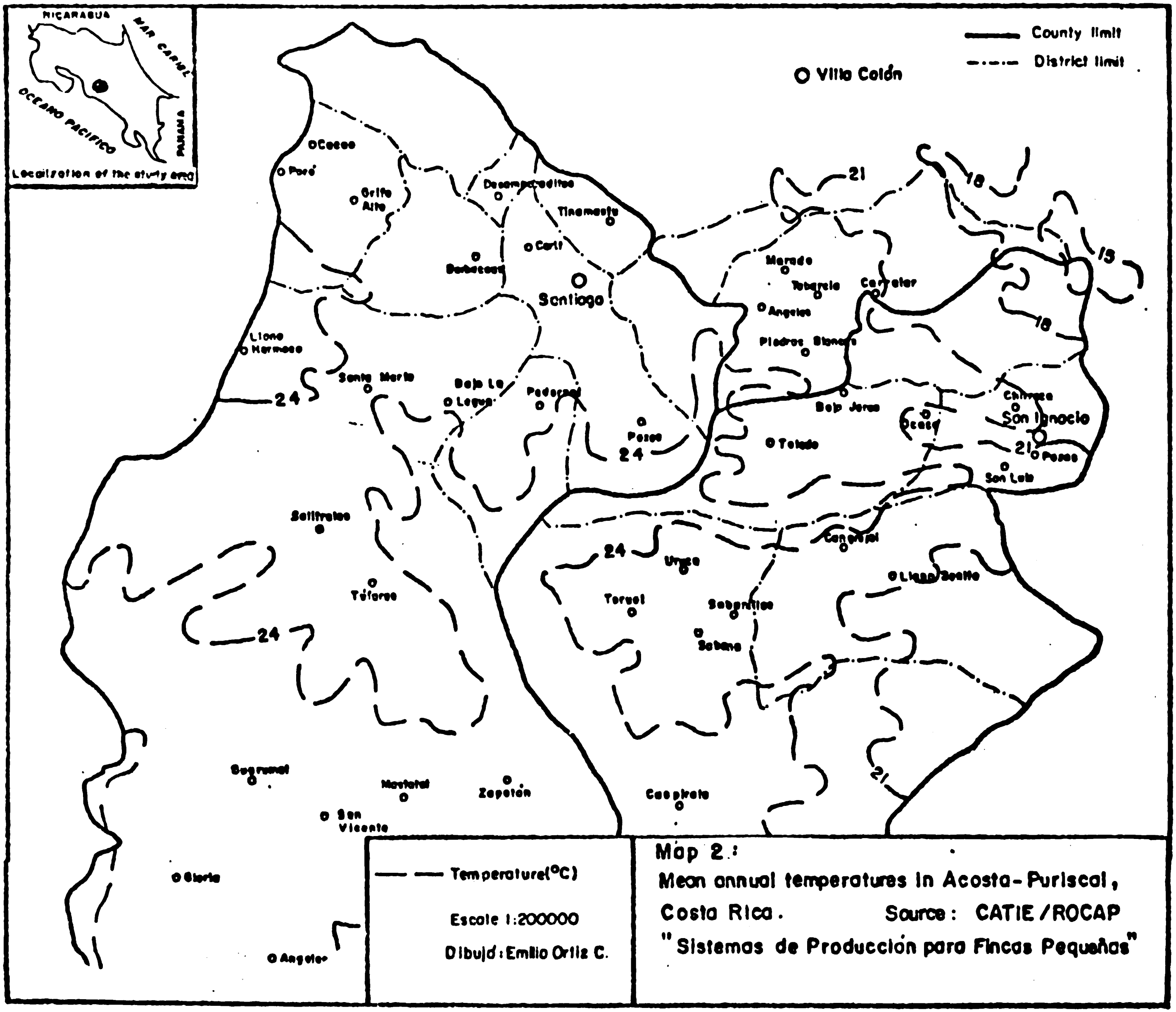
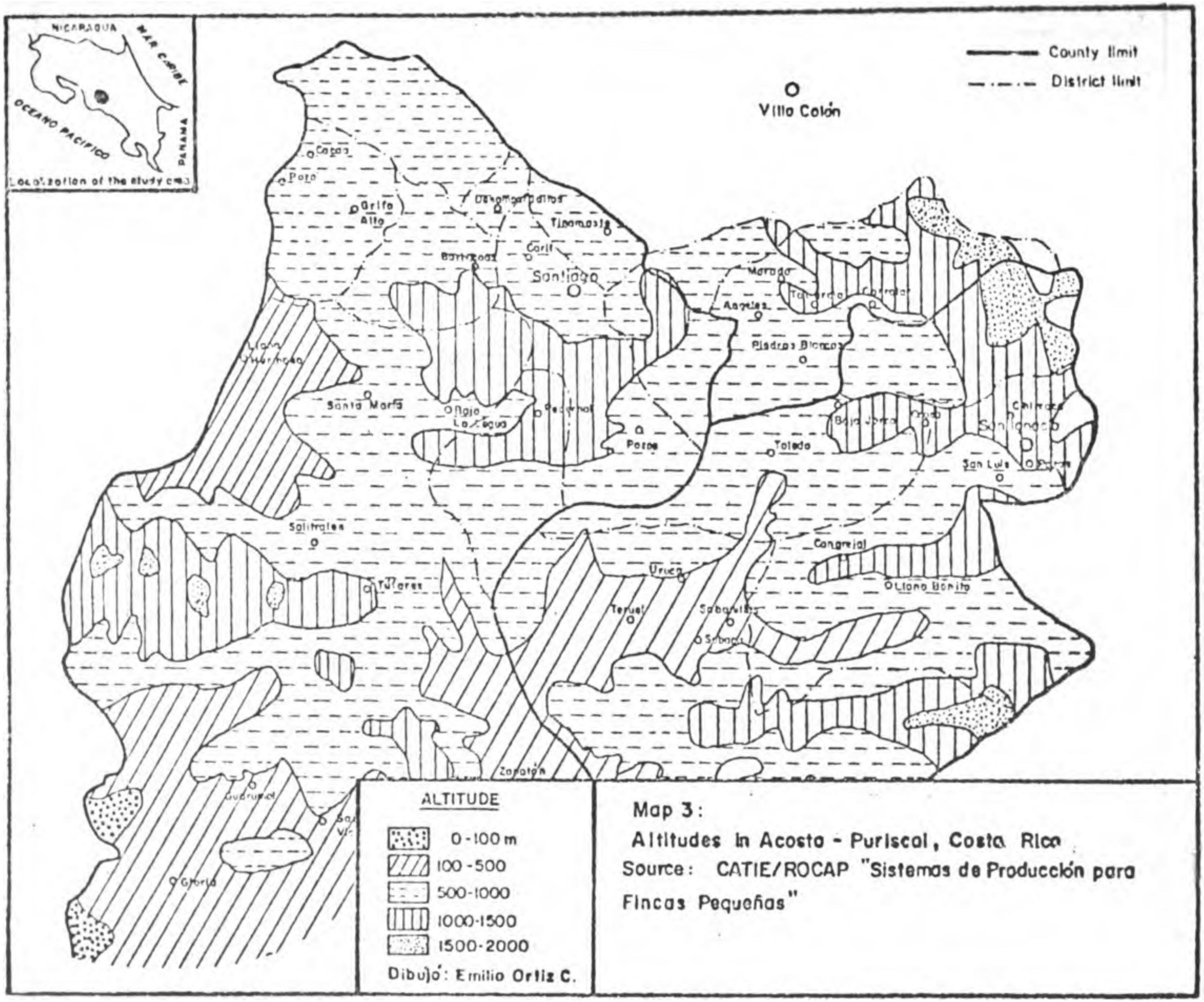
APPENDIX



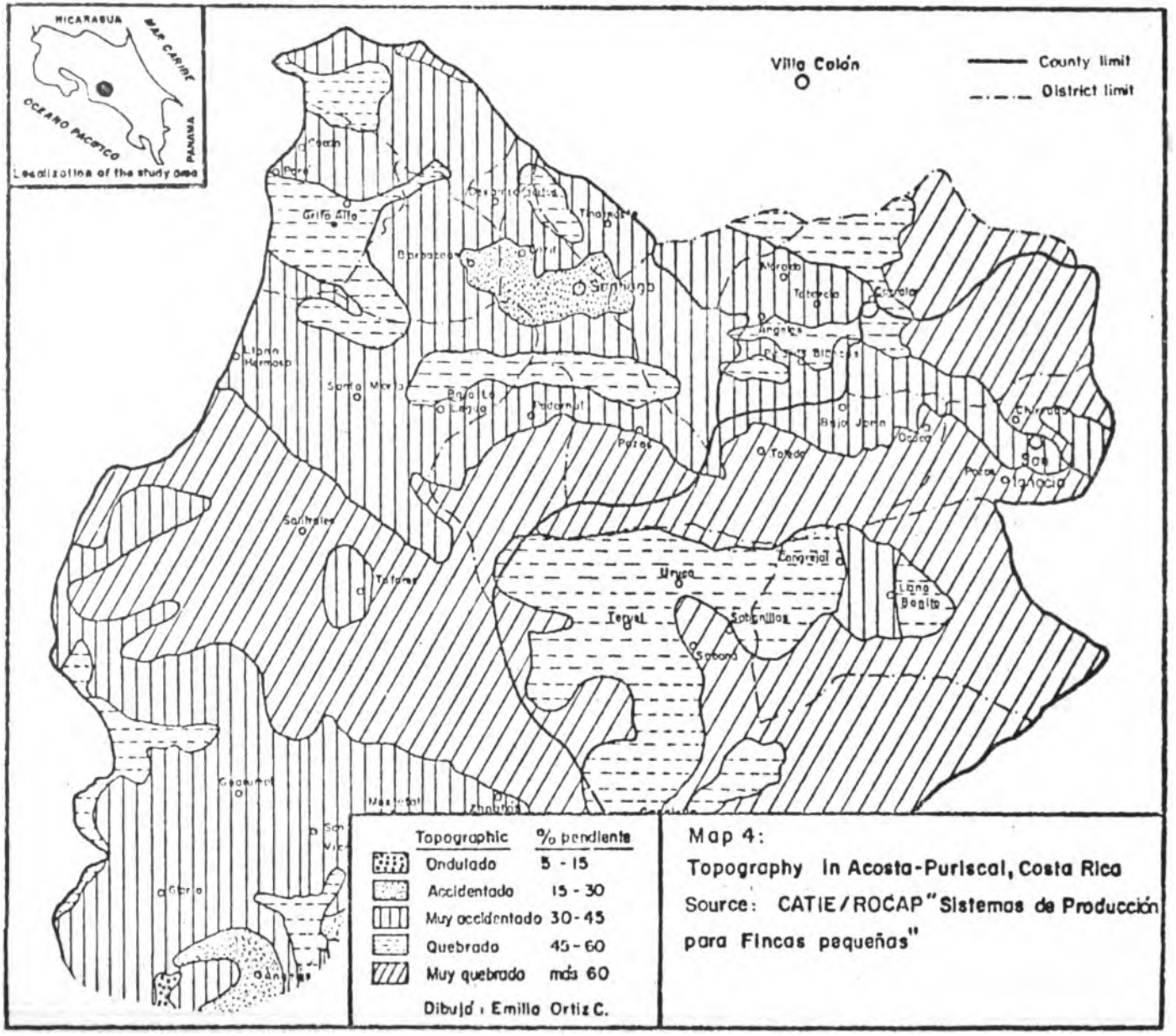
Map 1:
Mean annual precipitation and months with moisture deficit in Acosta Puriscal, Costa Rica. Source:
CATIE/ROCAP. "Sistemas de Producción para Fincas Pequeñas"



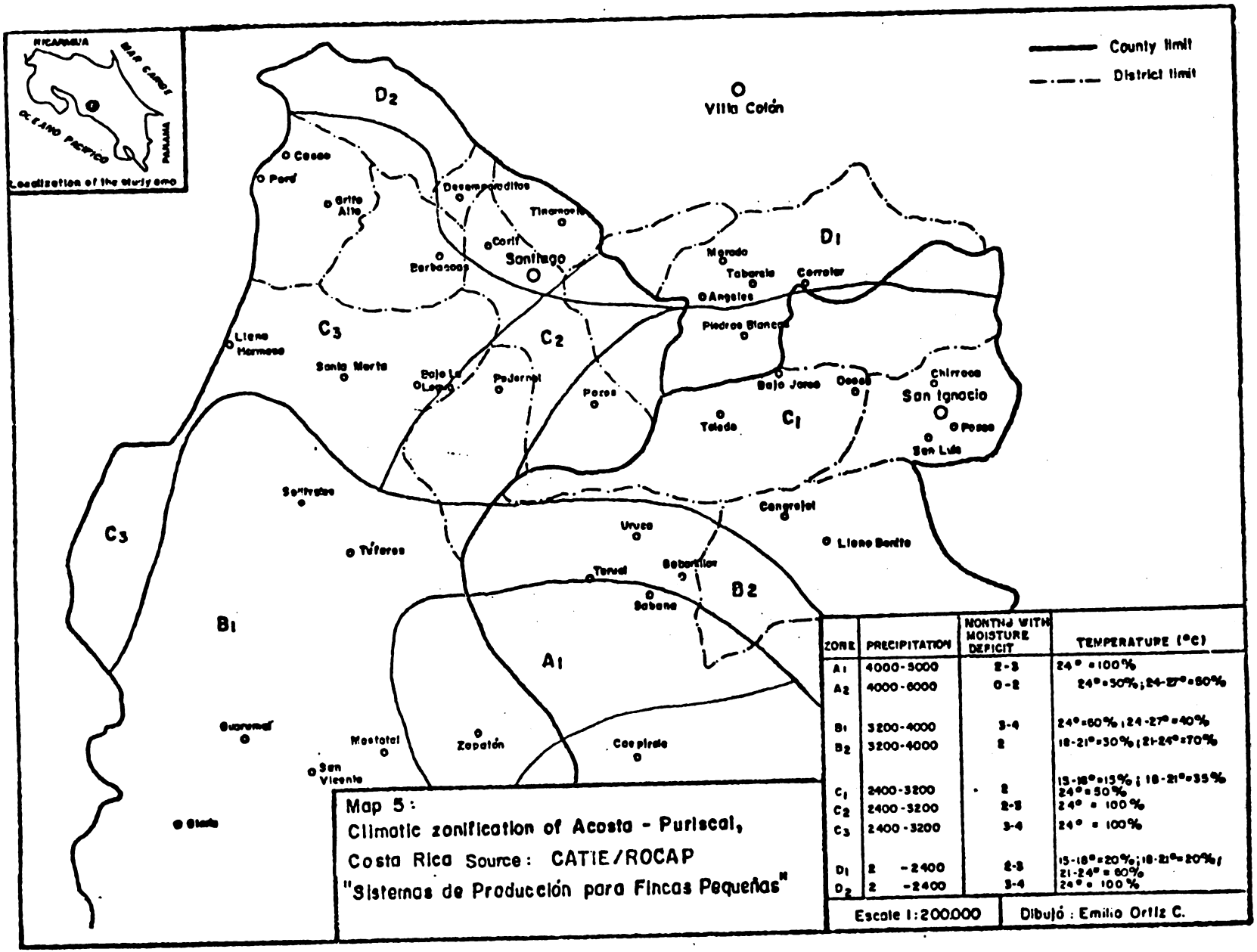
Map 2:
Mean annual temperatures in Acosta-Puriscal, Costa Rica. Source: CATIE/ROCAP "Sistemas de Producción para Fincas Pequeñas"



Map 3:
Altitudes in Acosta - Puriscal, Costa Rica
Source: CATIE/ROCAP "Sistemas de Producción para Fincas Pequeñas"



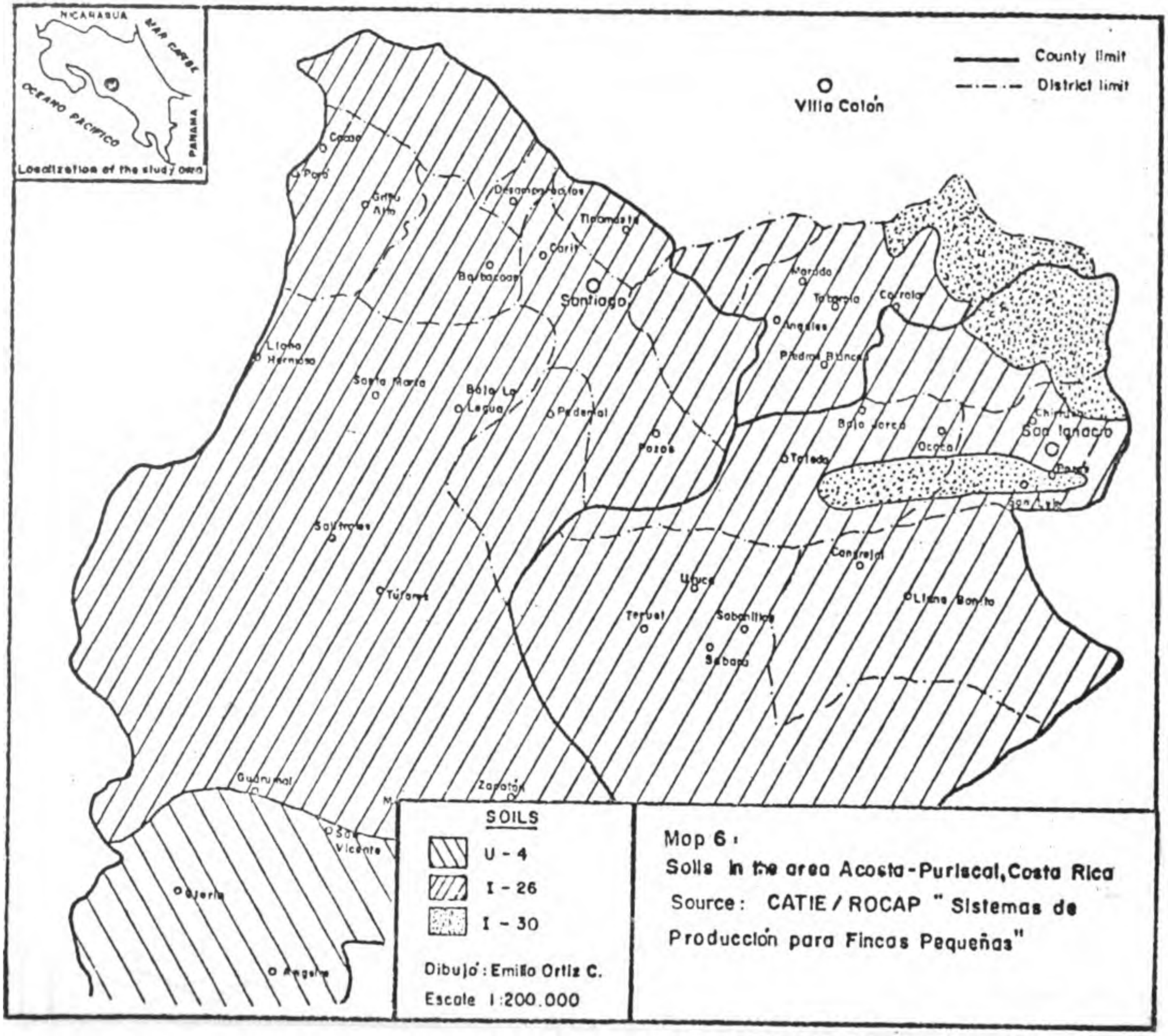
Map 4:
Topography in Acosta-Puriscal, Costa Rica
Source: CATIE/ROCAP "Sistemas de Producción para Fincas pequeñas"



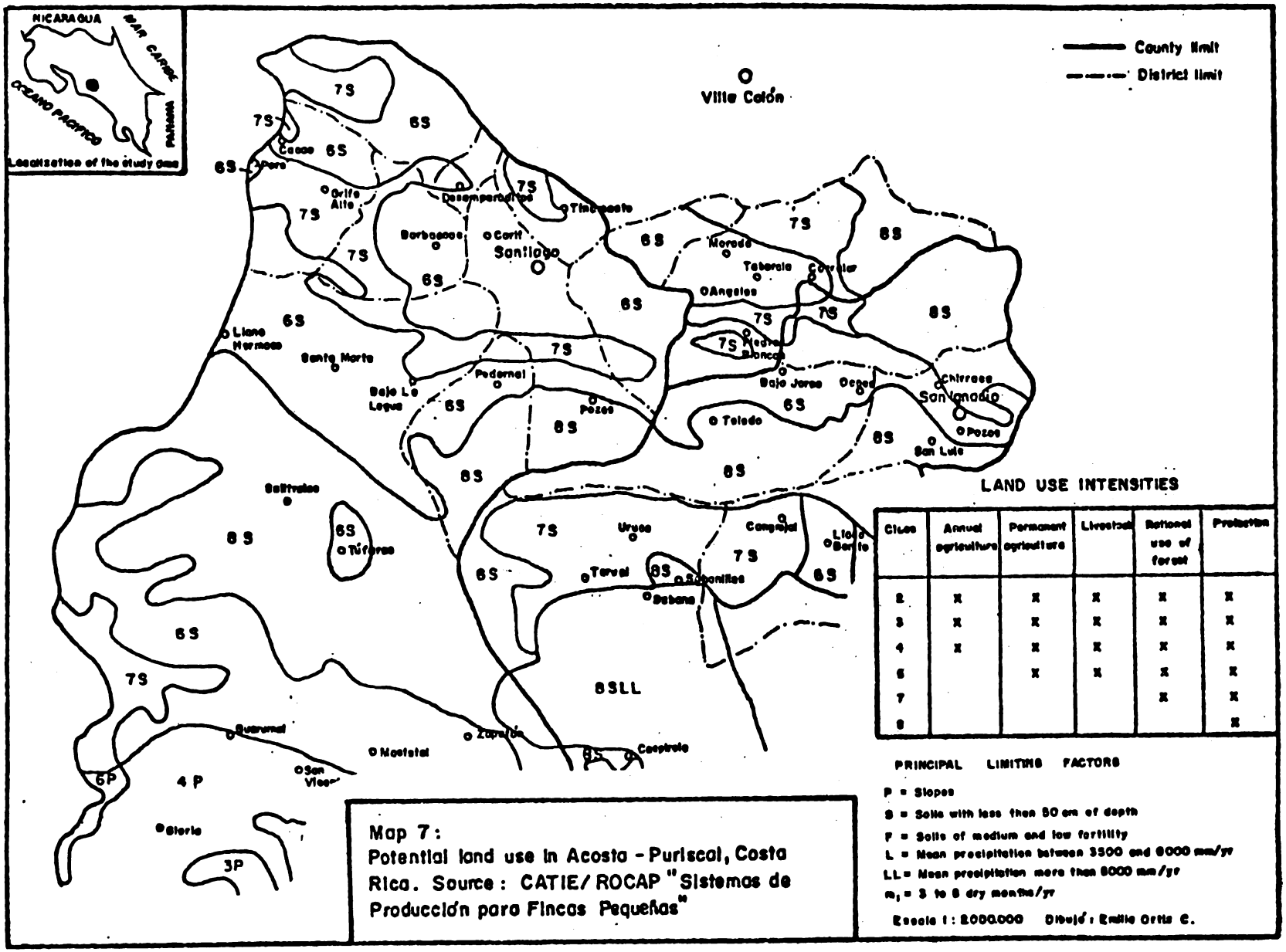
ZONE	PRECIPITATION	MONTHS WITH MOISTURE DEFICIT	TEMPERATURE (°C)
A_1	4000-5000	2-3	24° =100%
A_2	4000-6000	0-2	24°=30%; 24-27°=80%
B_1	3200-4000	3-4	24°=60%; 24-27°=40%
B_2	3200-4000	2	18-21°=30%; 21-24°=70%
C_1	2400-3200	2	15-18°=15%; 18-21°=35% 24°=50%
C_2	2400-3200	2-3	24° = 100%
C_3	2400-3200	3-4	24° = 100%
D_1	2 -2400	2-3	15-18°=20%; 18-21°=20%; 21-24°=60%
D_2	2 -2400	3-4	24° = 100%

Escala 1:200.000 | Dibujó : Emilio Ortiz C.

Map 5:
Climatic zonification of Acosta - Puriscal, Costa Rica Source: CATIE/ROCAP
"Sistemas de Producción para Fincas Pequeñas"



Map 6:
Soils in the area Acosta-Puriscal, Costa Rica
Source: CATIE / ROCAP "Sistemas de Producción para Fincas Pequeñas"



LAND USE INTENSITIES

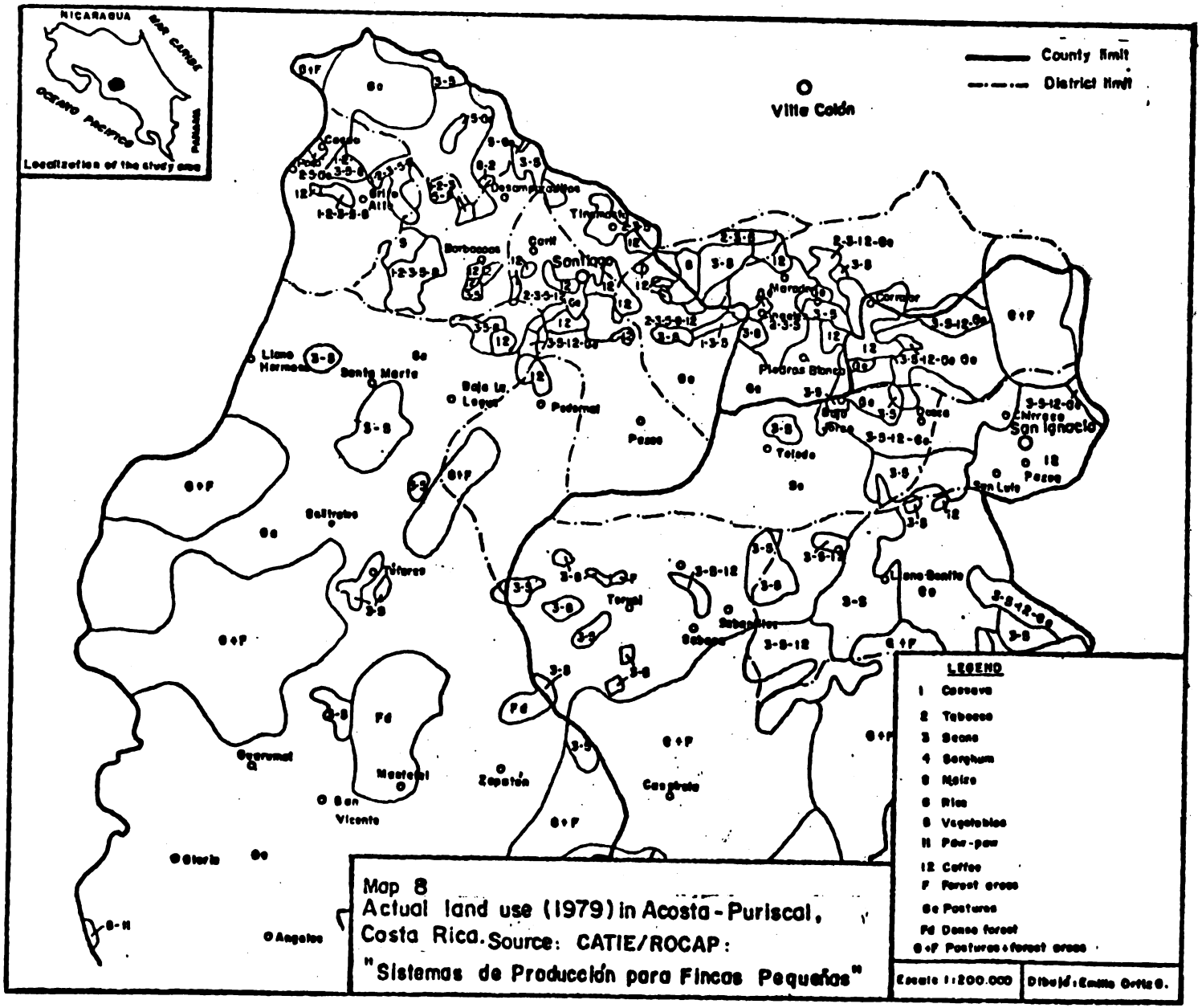
Class	Annual agriculture	Permanent agriculture	Livestock	Rational use of forest	Protection
2	X	X	X	X	X
3	X	X	X	X	X
4	X	X	X	X	X
6		X	X	X	X
7				X	X
8					X

PRINCIPAL LIMITING FACTORS

P = Slopes
S = Soils with less than 50 cm of depth
F = Soils of medium and low fertility
L = Mean precipitation between 3500 and 8000 mm/yr
LL = Mean precipitation more than 8000 mm/yr
m_1 = 3 to 8 dry months/yr

Escala 1 : 2.000.000 Dibujó : Emilio Ortiz C.

Map 7:
Potential land use in Acosta - Puriscal, Costa Rica. Source : CATIE/ ROCAP "Sistemas de Producción para Fincas Pequeñas"



Map 8
Actual land use (1979) in Acosta - Puriscal, Costa Rica. Source: CATIE/ROCAP:
"Sistemas de Producción para Fincas Pequeñas"