

# **BASELINE STUDY OF LAND USE MANAGEMENT AND DECISION MAKING PROCESSES WITH A FOCUS ON NON-TRADITIONAL CROPS, SMALL FARMERS, AGRO-INDUSTRY, AND DEVELOPMENT POLICY IN COSTA RICA**

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## **Introduction**

Global economic forces, concerns for the environment, and social/cultural conditions are driving a process of change in the rural sector. The adjustments in the operations of farming and agro-industry are beginning, but the scenarios for future development clearly depend on decision making and coordination between various actors. In recent years Costa Rica has recorded sluggish or negative GDP, attributable in large part to the declining market prices for traditional export crops such as bananas, cacao and sugar cane. The government policy for change in the agriculture sector includes the following points:

- increase basic food products in accord with consumer taste and income;
- increase agricultural exports and improve productivity;
- develop and increase new agricultural products for export;
- promote registration of agricultural land and support services for small-scale farmers; and
- increase employment opportunities in the sector

## **Objectives**

This paper describes a case study that address specific questions in a specific region, but also illustrates how the micro-level decision processes determine the overall course of fundamental change in agricultural development. The focus is on collaboration and coordination among key actors in the rural sector. Specifically, the paper provides a perspective from small farmers, agro-industry and government. Based on surveys with each of these groups, we try to represent the current conditions in the field and reveal the current kinds of information and methods which are used by decision makers as they diagnose problems and evaluate alternatives for future investment and action. The paper documents current conditions and decision processes. The study provides systematic feedback from selected target groups that can help guide the research and development program. It also provides a benchmark or baseline against which future decision processes and development results can be evaluated. Ultimately, the impacts of development will be evaluated using four criteria (Emmy Simmons, 1997): people, food, trade and economic growth, and the environment.

## **Building Upon a Research Base**

The case of peach palm (*Bactris gasipaes* H.B.K.) research in Costa Rica illustrates how agricultural research can be an engine for future economic growth. With leadership from agricultural scientists at the University of Costa Rica especially Dr. Jorge Mora Urpi, Carlos Arroyo and others, Costa Rica has for 25 years built a knowledge base on 'pejibaye' (peach palm; 'pupunha' in Portuguese). Research has addressed different questions such as: production of

heart of palm, production of palm fruit, industrialization of heart of palm and palm fruit, production of palm wood, hybrids, nurseries, agronomic characteristics, etc.

The nation is beginning to harvest the benefits of this agricultural research in the form of an emergent pejibaye industry, but the future prospects are dependent on careful coordination and decision-making by key actors in the system. This new industry combines production, processing and marketing, providing various opportunities for employment of both men and women, and generating economic values through the stream of value-added activities. Collateral industries have developed to supply cans, boxes, and related material for the processing industry. Intermediaries are important for collecting the material at the farm sites and hauling it to the processing plants. This scenario of development is a departure from traditional practices of agricultural exports (cardamon, macadamia, flowers) with minimum value added processing and collateral services. Unlike other non-traditional export crops, pejibaye production is not dominated by international investors.

The latest estimates from the government and industry are that 1,091 farmers are producing pejibaye for heart of palm on 10,169 ha (Table 1). The vast majority of the farmers (88.4 percent) are producing pejibaye on small plots of less than 5 ha. The distribution of pejibaye production is expanding throughout much of wet zones of the country, with the greatest concentration of production centered in the region of ‘Huertar Norte’. This region was originally colonized in the 1960s when forest was cut and seeded to grass as an improvement to secure land tenure. This process was encouraged by the “hamburger connection” wherein international investors provided resources to expand beef production to supply growing international markets. During the last ten years, pasture lands were abandoned, reforested, or converted into agricultural crops including ‘palmito’ (heart of palm). In Huertar Norte, 885 farmers are producing pajibaye on 6,999 hectares which accounts for 69% of the national production.

Table 1. Area and estimated production of heart-of-palm (pejipaye) in Costa Rica

<b>YEAR</b>	<b>AREA</b>	<b>PRODUCTION</b>	<b>GROWTH</b>
	ha	million units	%
1994	3,930	33.3	--
1995	5,750	48.7	46.2
1996	7,370	62.4	28.1
1997	10,200	86.2	38.1

Sources: Programa Nacional de Palmito, DEMASA, and IICA, July 1997

As our survey results will show, many more farmers have recently planted pejibaye on pasture lands and, as these lands become productive, they will add substantially to the production totals. Annual growth rates in national production between 1994 and 1997 have averaged approximately 37% (Programa Nacional de Palmito, 1997). Exports of palmito between 1994 and 1996 increased from 5,853 to 9,990 metric tons (Figure 1). During the first five months of 1997 the volume of exports was 3,921 metric tons.

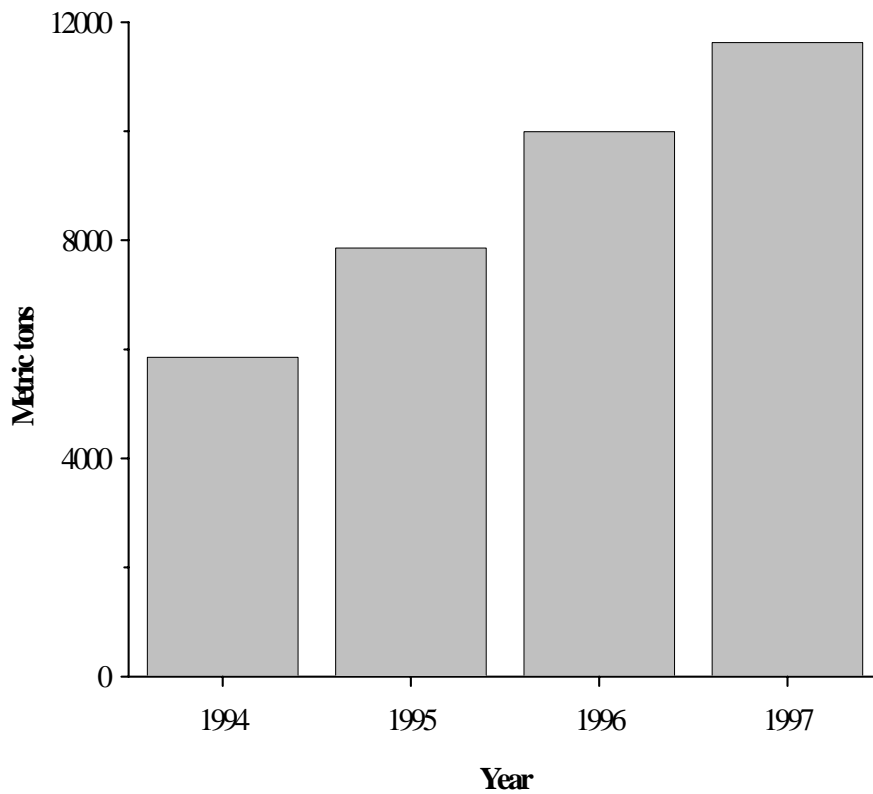


Figure 1. Growth of ‘palmito’ export volume from Costa Rica between 1994 and 1997.

### **Favorable Characteristics of Pejibaye**

Pejibaye is well adapted to conditions of the humid tropical ecosystem. It is a crop that can be managed by small farmers with limited resources. As a perennial with harvested products throughout the year, it provides for stable income. Much of the production area is marginal for other agricultural activities and is not well suited to mechanization; this provides some measure of protection to small scale producers against competition from large corporations. The better lands, are already dedicated to banana production. Production rates depend on nutrient management. Pejibaye represents a substantial improvement over grasslands both economically and environmentally. Heart of palm is a product of high nutrient value, low caloric content, high fiber and water. These characteristics make it appealing as a diet food that is produced with a minimum of agro-chemicals in an industry that is environmentally friendly and sustainable.

## Coordination of Pejibaye Research and Development

The Ministry of Agriculture promotes a macro-economic policy for development and trade based on principles of free and fair markets. This policy seems to be working well both for national as well as domestic interests. Continuation of the laissez-faire, market-oriented policy serves the rural sector well. The government also assumes a useful role in coordination of research and technology transfer through both formal and informal mechanisms. Unlike other products pejibaye management systems and processing were developed locally by farmers and researchers, and the market is not yet well established.

Government, private producers, industry and researchers are involved in different aspects of pejibaye production through the following organizations:

- 'Ministerio de Agricultura y Ganaderia' (MAG), the Ministry of Agriculture;
- SEPSA, the planning division of the MAG is interested in multiple goal planning for regional land use;
- MIDEPLAN (Ministry of Planning) is presently collecting information and will participate actively in the formulation of development scenarios;
- IDA (Agricultural Land Development Institute) is responsible for colonization and support services to new settlements;
- 'Corporacion Bananera Nacional' (CORBANA) is the local banana producers association; in addition to its activities in marketing, statistics and policy, CORBANA has a significant research component, funded from self-imposed tax on banana exports with the primary research objective of exploring alternatives to banana (i.e. they desire diversification);
- DEMASA (a Mexican company, originally in corn and rice tortilla production) at present have diversified and enlarged operations to include the largest plantation and industrial processing facility for palmito;
- 'Instituto Nacional de Aprendizaje' (INA) is a government financed institution for non-degree training;
- 'Consejo Nacional de Produccion' (CNP) is a sector of MAG, originally set up to handle grains (rice, beans, corn);
- 'Consejo Nacional de Investigacion y Transferencia de Tecnologia Agropecuaria' (CONITTA, National Council for Agricultural Research and Technology Transfer) has a board of directors with representatives from the private sector, government, and universities. CONITTA is made up of PITTAs which are independent commodity program coordinating committees typically led and supported by MAG officials;
- PITTA for pejibaye;
- 'Centro Nacional de Ciencia y Tecnologia de Alimentos' (National Center for Food Science and Technology) at the University of Costa Rica (UCR) is the research leader in chemical characterization of the products, thermal treatments, processing and consumer use.

The above mechanisms need to be strengthened and coordinated. The linkages between the private sector and university researchers or government extension activities are minimal.

Industry representatives are unaware of relevant research and respond that they have not used information from research or extension to support their activities. Decision support systems are unavailable and information integration tools to assist with analysis and decision making are non-existent.

### **The Atlantic Zone (Sarapiquí Region) of Costa Rica**

The Sarapiquí region in the Huetar Norte/Atlántica province of Costa Rica was selected as the project's intensive testing site by the UCR/U.S. collaborative team (Osmond et al., 1997). It has been the focus of recent and ongoing colonization and related rapid deforestation. The region is booming with strong influence of international companies oriented towards export of bananas and other agricultural products.

The region is relatively flat (>85% with <100 m elevation above sea level) but includes large environmental differences. It is dominated by acid soils of volcanic origin in the very wet tropics (3,000 to 5,000 mm/year). Rainfall is distributed over a nine month wet season with 225-375 mm/month, and a 3-month "dry" period (Aug. - Nov.) with 100-200 mm/month. A more complete description of the soils and physical characteristics of the site are available in the reports of the site selection team (Alvarado and Salas, 1997; Osmond et al., 1997).

Figure 2, is a digitized map (scale: 1:750,000) of the general area which indicates road infrastructure, local communities and river systems. Villages in the area are road-side (10%), colonies (25%) or scattered (65%). Roads serving the banana plantations, though unpaved, are in comparatively good condition. Other roads, however, are in bad condition and often impassable due to rainfall. Electrical service is extended to almost all farm households in the settlements. Telephone service is generally not available but parts of the region close to the regional towns have cellular telephone service.

Within the Sarapiquí region there are several commercial farms producing pejíbabe for heart of palm. The commercial farms provide opportunities for local farmers to work under contract and supplement their household incomes. A significant collateral benefit is that employees are trained by the industry in crop management techniques which can be transferred back to family plots.

### **Methods and Procedures for the Study**

A participatory rural appraisal was planned and conducted within the Sarapiquí region. Coordination of the team activities was by the 'Centro de Investigaciones Agronómicas' at UCR in San José. The survey was planned to answer many of the unknowns about small farm systems, farm level decision making and coordination of on- and off-farm activities. As a first step in design of the survey, a panel (n=18) of international investigators were asked to rate the importance of different kinds of information for building and eventually for evaluating a nutrient decision support system (Appendix A). The next step was to draft a set of questions appropriate for small farmers, that would elicit the kinds of information deemed most important. Additional questions were added to address other important matters that emerged in discussions with policy makers and others. The survey focus on small farmer and decision practices was new to most of the educators, researchers and policy-makers. The new perspective led to suggestions by the team for additional questions to address gaps in knowledge or to confirm ideas that are held but not verified by field data. The final version of the surveys, therefore, reflect the priorities and concerns of the diverse team and was put in language comfortable to the local population.

Two principal zones or clusters (Guapiles and Horquetas) within the region were selected for the sampling. Within each cluster were numerous farms which were accessible by a road system (Figure 2). Survey takers selected a number of road systems within the area and surveys were made with a selection of farmers along a particular road segment. The sampling of households combined two procedures. The first procedure can be fairly characterized as a random cluster sample derived from random selections of households served by selected road segments within selected clusters. Other surveys were completed with farmers coming to the cooperative offices to receive payment. Since most farmers in the Guapiles area were associated with the cooperative, this procedure provided approximately equal probability that any farmer would be included in the survey. This second sampling procedure, therefore, allowed for inclusion of farmers not represented by the cluster sampling described above. It is not expected that the two sampling techniques would effect systematic differences in the survey results.

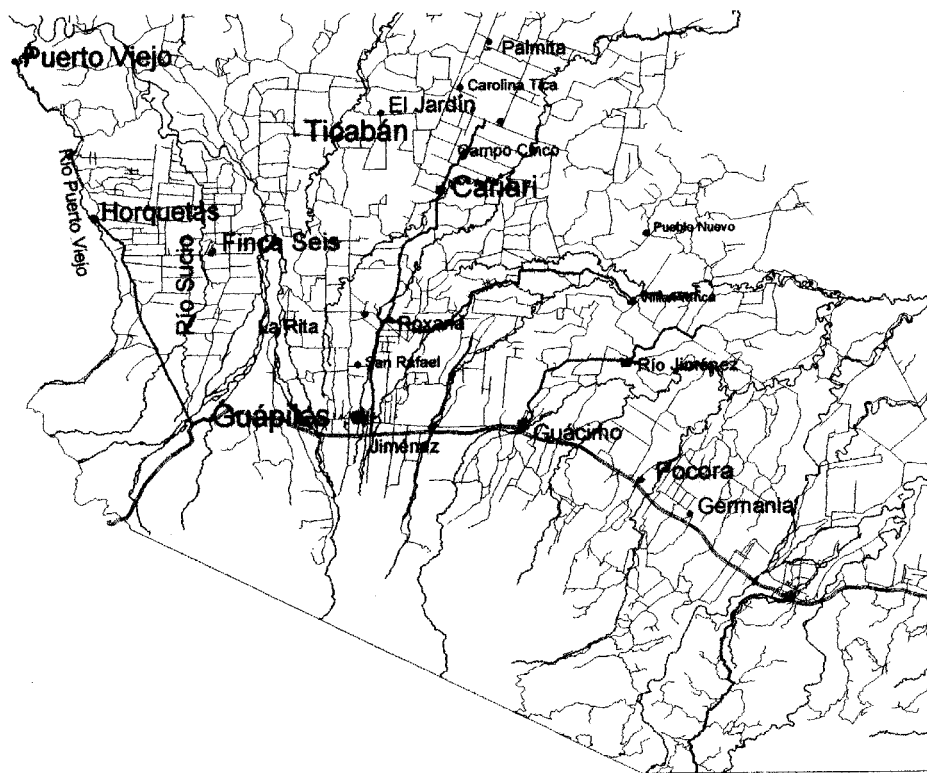


Figure 2. Road infrastructure, local communities and river systems within the survey area.

Eight different people were involved in administering the surveys to the farmers. The team of interviewers consisted of three technicians from the local farmers' cooperative, two extension workers from MAG, the PITTA coordinator, one professional from the UCR agricultural research center, and one of the visiting international scientist of the SM-CRSP. Overall, cooperation of the farmers was excellent. Farmers were selected and approached by a

team of 1-3 persons including a local contact and were given a brief explanation of the purpose of the survey and asked if they would be willing to participate. One hundred percent agreed and participated. The interviews were conducted at the farm site or cooperative offices and, given the rainy conditions, under a umbrella, porch or shelter. Often the questions produced long and revealing stories of circumstances on the farm and clearly of interest to the farmer. In total 38 interviews with small farmers were completed. Given the clear patterns emerging from the farmers sampled, it was considered that the sample provided sufficient numbers and reliability for the purposes of the case study.

At the conclusion of each interview, the interviewer rated the survey on a 3-point scale: 1=very good with no problems; 2=good with few problems; 3= questions and potential problems in the data. The average rating given for interviews was 1.5 with a standard deviation of 0.68. Extreme values on interviews rated 2 or 3 should be treated with caution or excluded in calculation of means and standard deviations. Observations were recorded, to flag potential problems with the survey instrument, questionable responses, or general disinterest of the farmer. There were only a few isolated indications of problems with data. Overall the survey procedure seemed to work quite well and elicit the appropriate farmer response.

The resulting sample is quite consistent with the available national data. A large majority (89%) of the farmers had land holdings of less than 10 ha. The minimum land size was 0.5 ha and the maximum land size was 176 ha (primarily pasture, only 7 ha of pejibaye). One should not be misled by average land areas, since extreme values pull the mean to levels that are not representative of the common farmer. The average family size was 5.82 and the standard deviation was 2.36. The husband and wife on average had similar levels of education (6 years). They aspired to support their children to higher levels of education ( $\bar{x}$ =10.6 years; SD= 4.16) ranging to a maximum of 16 years (professional training). The average respondent had 25 years of experience in agriculture and about half that much (12 years) in pejibaye. Only 8% were currently financing operation or expansion costs of their farms; all with private bank loans at reported rates of interest between 19-28%/yr. Half of the farmers (50%) were independent producers and most of the others (42%) were affiliated with a local farmers' cooperative/association. As will be seen in the results of the survey, cooperatives and intermediaries are particularly important in post-harvest transport and marketing activities. Results of a farm management survey in the region reported that 80% of farm households depend upon off-farm income generating activities to provide an average of 50% of total income.

An English translation of the survey questions are attached in Appendix B. The complete dataset for the farmer survey is coded in an Excel spread sheet and is attached to this paper (Appendix C). The following sections present the findings and discuss the implications for future program action. Farmer names and locations are recorded as part of the dataset. This will enable for systematic follow-up using a panel study design in subsequent years of program development.

### **Current Agricultural Practices of Small Farmers**

Most farmers (76%) were planning to increase their areas of pejibaye, thus reflecting their optimism and the relative attractiveness of this crop. With regard to the question about the principal problems on the farm, 45% of farmers report significant losses from rodents (*Geomys* spp., locally known as 'taltuzas'); plant nutrition was identified as a problem by five percent of farmers. Other problems that were mentioned that may merit further study include losses due to

unspecified bacteria or soil drainage. When asked specifically about how they rate their soil, 39% said good ('bueno'), 55% said fair ('regular') and only 3% said poor ('pobre'). Soil analyses in the region show generally acid and low fertility levels, so again these farmers are rating the soil subjectively and in relation to what they know and what they can produce, namely pejibaye. Most farmers surveyed (63%) apply what they call the "formula completa" (18-5-15-6-2 of N-P-K-Mg-S) of fertilizer. The applications are made by hand. The application rate is 2-3 sacks (46 kg each)/ha/month for most of the year. The applications are somewhat less during the 3-month so-called dry season when the rainfall is somewhat less. The survey data shows production rates are also significantly less during this dry season. Other fertilizer formulas of common use are 10-30-10 (N-P-K), 12-24-12 (N-P-K), or 'Nutran' (33.5% N). Applications rates and timing are about the same as above. Thirty-seven percent of farmers also report applications of lime with rates ranging from 10 to 40 sacks (46 kg each)/ha/year. Some 24% also report applications of purchased organic matter (mainly chicken manure). Most, 82%, are also applying herbicides (2,4-D, gramoxone, Roundup) especially in recently planted stands of pejibaye.

Production rates for heart of palm vary considerably with the season. In the wettest period the yield average and standard deviation were high ( $\bar{x} = 1288$  units/ha;  $SD = 888$  u/ha). Comparable findings for the dryer season were an average yield of 810 u/ha ( $SD = 453$  u/ha). Overall average yields were 975 u/ha with a standard deviation of 506 u/ha. In dryer areas within the country (Buenos Aires province) south of the intensive testing site, the pejibaye plant produces less "shoots" and the shoots grow more slowly during drought stress conditions. This supports the survey findings of reduced yield and heart of palm quality (harder) during the "dryer" season for the Huertar Norte region.

The reported planting densities were fairly uniform (5,000/ha) following recommended practices of the local experiment station and large scale plantations. Actual plant densities were lower due to losses of plants to rodents, drainage or other factors. Replanting was a frequently mentioned issue. Most often (53%) the plantings are made without association of other crops or ground cover. Some farmers, however plant maize, beans, or cassava for harvest while the pejibaye is being established.

Most farmers were self-sufficient in terms of labor (59%); the remaining 41% would occasionally contract or barter for temporary labor. Field work in pejibaye was performed primarily by men (an average of 2.29 men working per household). On most farms it was reported that no women were involved in field work, but on some farms women participated in the field work, especially during periods of high labor requirement.

All small farmers buy fertilizer and other inputs for palmito production. Access to inputs was measured as the distance from farm to point of purchase. The range of access was 0 to 44 km with an average of 8.42 and  $SD$  of 10.47. The average price of fertilizer was 3056 c/46-kg sack with a range reported of 4000 to 2400c (the exchange rate, at the time of the survey was 245.85 c/\$US). The variance is primarily attributable to different fertilizer formulas. The average price of lime was 380 c/46-kg sack with a range of 480 to 250c.

Access to product markets was also measured in kilometers between the farm and point of sale. Many farmers (87%) sold their product at the farm to intermediaries or cooperatives. One farmer hauled his product 30 km, another 18 km to sell, but this was clearly the exception. The average price of sale was 60.65 c/heart of palm unit with a 12-month range in average price from

70 to 53 c/unit. Quality is a factor in product pricing, especially with regard to substandard product which receives a discounted price. Also farmers typically reported the current net price (63 c/unit after 5 c/unit transportation costs had been deducted); producers reported the price paid at the plant (68 c/unit including transportation costs). The 5 c/unit transportation charge was paid to the private haulers or cooperative. The local markets (industries) set the standards for quality of products. The product must meet a minimum size to receive the standard product price. The optimum unit size for the industry is diameter greater than 15 cm and length of 60 cm. When processed 40 units at optimum size fill a case of 24 jars or cans.

Most farmers (78%) report steady monthly income from sale of heart of palm. This provides a steady cash flow for the small farmer to meet requirements for the home, schooling or reinvestment in the farm. The cash income generated by production of palmito was allocated to cover necessary expenses of the household (66%) but also to reinvest in the production system (55%). With roots and tuber crops, or cattle this was not the case and farmers suffered as a result. Previously, the traditional options in the wet tropics of Costa Rica were timber harvesting (non sustainable) on the banana plantation in the morning and home gardening (planting taro, yam, corn, beans or rice) in the afternoon. Another alternative was livestock. Now small farmers have an option that provides them greater independence.

### **Decision Processes of Small Farmers**

With regard to the issue of decision making, farmers were asked to describe how they diagnose problems with their crops and how they decide what corrective measures are necessary to alleviate the problem. These were difficult concepts to communicate in simple terms to farmers, and some of the unsupervised interviews of the technicians produced some strange responses. Yet these are very important questions that go to the heart of what a decision support system is all about. The survey provides some insights and suggests more work is needed in this area. Farmers responding suggested that they rely on plant color indicators, production rates, evidence of rodent infestation and general farming experience. Some 29% turned to specialists (MAG, DEMASA, CORBANA) and even soil or foliar analysis for diagnosis and recommendations for corrective actions. When asked about where they learned how to plant and manage pejibaye 26% said they were self-taught and 16% learned from their neighbors/farmers. The remainder learned from their work with one of the commercial plantations, local cooperatives or courses received from INA. When asked specifically, who can help, in case of problems on the farm, 24% said they had no access to help, 16% turned to the farmers cooperative for help and 24% would turn to MAG.

Focusing on soils, we asked about access to information about soils and markets. We expected to find that access to information was limited and difficult. However, the 68% of farmers reported that they had access to information on nutrition, and 71% had access to market prices. We expect that farmers have some access to limited kinds of information and are thus responding in the affirmative to survey questions which intended but did not achieve a more substantive measure of information access. This remains an issue for future research. In a similar vein, farmers expressed confidence in their information sources, but their perspective on information quality is limited to their own experience and they are not aggressive or demanding of better information about which they have no knowledge.

When asked what is the most important kind of information to increase production, 24% said plant nutrition information, 24% crop management, and 24% market information (Figure 3).

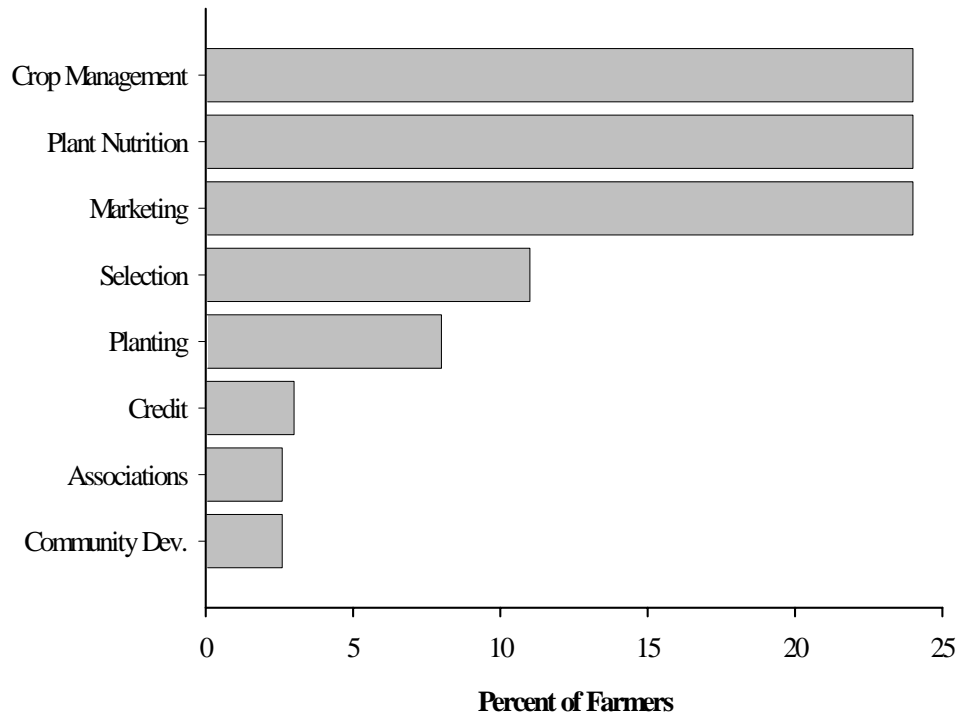


Figure 3. Indication by farmers of the most important information needed to increase heart of palm production.

Only 27 % report having a method to integrate diverse information types for decision making. Again this is a difficult question to communicate and the responses probably overestimate because the criterion measure of integration was unstated and would be difficult to state.

With regard to participation in decision making, it is significant that 76% of farmers consult with their spouse. From casual observation, one might conclude that women have little involvement in production of pejobaye, but these data suggest an important management role of women even though they are rarely involved in meetings of the cooperative or activities in the field. As will be seen in subsequent sections, women have a dominant participation rate in the processing industry for heart of palm. Participation rates for community members, industry representatives, technical specialists and others in on-farm decision making are much less: 29%, 37%, 39%, and 27% respectively.

In order to quantify the interaction and assistance given between neighbors/farmers, two questions were asked, “how many neighbors do you help”.....”how many neighbors help you”. The range of responses to both questions was 0 to 40. Forty is the average participation in the

periodic meetings of the farmers in the cooperative. The statistical averages on these measures is 3.32 and 2.37 respectively, but the standard deviations are relatively large (SD= 6.68 and 6.59, respectively) reflecting a few extreme values which pull the means up. Again, this is an area that needs further work and will be important in estimating the multiplier effects of technology transfer to farmers.

With regard to risk factors in making decisions about future investments in pejibaye, 76% expressed concerns about over-supply, price reduction or related market events beyond their control. The principal concern was not the international market demand and related issues of trade, but as one would expect the local demand and price offerings of the processing industries. Again, it is interesting that farmers always are concerned with rainfall and, in one of the wettest regions of the world, some farmers still identify drought as a significant risk factor because they now less rainfall reduces production drastically. This is another example of how judgements and perspectives are shaped by the needs and principal activities in the local context.

Decisions of small farmers are influenced by prevailing conditions and problems that are viewed as beyond their control. The poor condition of roads and transportation was identified as a limiting factor by 26% of farmers. The amount of land was a constraint mentioned by 42% of farmers. Also mentioned by farmers was limited access to necessary farm inputs (13%), temporary labor (11%) and poor markets (18%). Human skill was also identified as a limiting factor. Most (66%) reported having had some type of training in production of palmito, but all but two farmers out of 38 (95%) had specific requests for additional training in the form of courses or written information. The course topics most frequently requested were crop management (24%) and nutrition (13%).

### **Perspectives Based on Interviews with Industry Representatives**

Virtually all indications from industry point to optimism and new investment in industrial capacity. Industrial processing can be set up as large or small scale operations. Currently, within the country there are 7 large plants and approximately 10 small plants. 'DEMASA of Pococi' is the largest of the producers and industrial processors. From the grey literature, the plant capacity is 18.7 million palmitos per year, of which 13.5 million are produced within the Huetar Norte and 5.2 million from other zones. 'Conservas del Valle S.A.' has 500 ha of pejibaye, but produces only 25% of what it processes. The company has a 10 year history in the canning industry, but only six years with palmito. Small farmers supply 75% of the palmito for their industrial processing. The procedures for payment of the small farmer is very simple and direct. Farmers deliver their product which is registered (unit quantity and quality) and for which they receive a check or cash.

The growth rate of the palmito processing has been phenomenal, as evidenced by unit daily production in one firm in presented in Table 2. The company has approximately 420 employees (120 men; 300 women). As the company expands industrial capacity it will need to make proportional increases in new hires and training. Turnover was reported not to be a significant problem. There also is abundant labor in the area. Training in the plant is continuous. First stage training is concerned with corporate culture, work habits, conscientiousness and hygiene. Vocational training is a part of the on-going work and supervision of plant activities.

Table 2. Trend in palmito processing volume for 'Conservas del Valle S.A.'.

YEAR	UNITS
	heart of palm/day
1992	5,000
1993	15,000
1994	25,000
1995	35,000
1996	35,000
1997	50,000
1998 (estimated)	100,000

The technologies for processing palmito (both fresh in plastic bags and canned in tin or glass), its fruit, and by products are being developed by UCR in collaboration with the private sector. The fruit is consumed fresh or canned, and can be processed into meal for human and animal consumption. At one plant (Conserva de Valle, S.A.) the soft residues of processing are being used to feed cattle. The hard external layers of palmito are being composted with chicken manure and later used as bedding material for production of edible mushrooms (*Agaricus* spp.). Remaining material from the beds are used as organic fertilizer and applied to pastures. In another company (Palmito de Costa Rica, S.A.), the same composting process is in operation, but the material is being commercialized.

Typically, the processing industries are privately held, and decisions are discussed and made in a committee of the owner, marketing director, industrial operations manager, company administrator and company industrial engineer/programmer. Opinions vary among industry representatives with regard to the possibility of shared financing for research to improve palmito production. Some are receptive others are not. Strategies for the future call for expansion of industrial capacity, improvements in quality and reductions in unit costs. The industry has access to bank financing at the standard rate (22%)

The fertilizer industry has a well established presence in the region. The major fertilizer supplier in the region ('El Colono') has 5 outlets within the Guapiles zone, each with at least one agricultural scientist. In addition, approximately 16 agricultural sales agents serve the zone. Fertilizer sales in 1997 were reported to be 50% over 1996, much of this attributable to expanding production of palmito. The dealers extend farmers a 30 day grace period for payment of fertilizer. Thereafter, an unspecified interest rate is applied. There is no specific formulation of fertilizer for palmito. Rather dealers sell 10-30-10 (N-P-K) or 18-5-15-6-2 (N-P-K-Mg-S). The dealers will provide transportation for larger orders.

#### **Perspectives Based on Interviews with Government Representatives**

Interviews were conducted with the Vice Minister of Agriculture, the Director of Agricultural Research, and selected professional staffers. The government does not have a

specific promotion policy for pejibaye, rather it promotes a macro-economic and trade environment that permits clear market signals. The government also facilitates coordination in the form of national communities programs. The national programs are coordinated by a committee composed of government, business and professionals. They plan education and technology transfer programs. The government also negotiates international agreements and certifies quality ('Unidad Sanidad Vegetal') of imports and exports. In all these functions of government, services suffer from inability to coordinate and extend services as needed throughout the rural sector.

Palmito has become a strategic part of the government initiative for sustainable development, with international investments from the European Economic Community and Canada. New industrial facilities are now under construction in the southern part of the country and also in the Upala region of Huertar Norte. The plan is that these industries will be owned and managed by cooperatives of small producers.

### **Technology Transfer and Training**

Pejibaye is an indigenous crop - people know how to plant, manage and use it. Technology transfer then tries to capture existing knowledge and add value through technical analysis. Major areas for technology transfer include selections of genetic material, enlarging the planting area, improved management including fertilizer, weed control and improved processing systems. Training takes place in many different venues and by different organizations. Farmer training is provided by INA and MAG. Vocational training for the processing industry is provided by the industry through on-the-job training and supervision. The University of Costa Rica is the leader of professional level training both in production and processing technology.

The 'Instituto Nacional de Aprendizaje' (INA) has made training in pejibaye a priority in recent years. The number of courses has increased steadily from 1994 when 9 courses were offered to 1997 when 15 courses were offered.

Table 3. Nondegree training courses in heart of palm production.

<b>REGION</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>
Brunca	3	3	3	5
H. Atlantico	2	4	4	3
H. Norte	4	4	5	7
Total	9	11	12	15

Source: 'Instituto Nacional de Aprendizaje, Nucleo de Formacion Y Servicios Technologicos Agropecuarios'. The average number of trainees per course is 15.

The University of Costa Rica has been the center for much of the basic research on pejibaye soil management and food processing. An international course on pejibaye has been offered each of the last three years and has been well attended by professionals from around the world. The 'Centro Nacional de Ciencia Y Tecnologia de Alimentos' (food science), based at UCR has collaborated with the 'Colegio Agropecuario de Pococi y JAPDEVA' to install a model small-scale processing industry in Guapiles that is used for training and produces products for

export. New technology is being developed for dehydration of palmito for the production of bases for creams and soups, for preservation of fresh palmito using preservative solutions, and flexible packaging for preservation of acidified palmito.

In the private sector, many low skilled laborers are being trained in processing of the product (continuous training), organizational culture, hygiene, grading and international standards. In the plants we observed laborers used hair nets, coats, boots, gloves, and some also used eye goggles as protection from the spines of the palmito. Employees were not allowed to eat or smoke in the production areas.

Training materials and training tools are not evident. There is clearly a need to package training materials and related information for distribution to the various target groups and venues of training.

### **Markets and Uncertainties**

Because the product is non-traditional and the market is essentially new no one really knows what the future market may be. Exports to Europe and especially France (10,191 metric tons in 1995) have been impressive (Eurostat and PROCOMER, 1997). The U.S. market is a new frontier (2,477 metric tons in 1995), but one with obviously great potential, as consumers come to appreciate heart of palm as a product of high nutrient value, low caloric content, and high fiber.

Farmers depend on industrial infrastructure for processing heart of palm. The product is highly perishable and the primary markets are international - beyond the reach of small farmers. Farmers, industry representatives and government policy makers are cautiously optimistic about the future market for pejibaye. Farmers are appropriately attuned to market prices and buyers of their product. With all the recent growth in production and new plantings, farmers are concerned that there may be a over-supply of the product and a consequent crash in the price for their product. This concern, is validated to some extent by the fact that product prices have declined in the last year (from 77 to 68c).

Industry representatives are increasing capacity of existing plants and new plants are being planned. The industry representatives suggest that the trend in prices over the last year may have a salutary effect of dampening unrealistic expectations of growth among producers causing some moderation in rates of new plantings. Over the intermediate term and longer term the new industrial capacity will provide for growth in production volumes and stabilize or improve prices to farmers. The actual growth rates of one industry have averaged 100%/year over the last five years, and the industry is projecting continued growth of approximately the same rate over the next several years. Several large scale producers expressed concerns about the availability of local labor.

Most of the product is exported to Europe (the U. S. market is ripe for expansion) although there is also growing domestic consumption for the products of pejibaye. Farmers eat the heart of palm, they sell it directly to local restaurants, or in local farmers' markets. It is commonly consumed in salads, veggie snacks, soup, substitutes for ingredients in lasagne and other dishes which adapt to local tastes and customers (example cerviche).

Costa Rica in 1995 was the world export leader of heart of palm. This is a significant achievement for a small country of many small scale producers. Other producing countries in order of their export volumes are Brazil (6,960 mt), Venezuela (3,000 mt), Colombia (1,416 mt) Guyana (1,200 mt), and Ecuador, Bolivia and Peru each with less than 1000 mt. For Costa Rica

the price/kg has increased steadily from 1.69 to 2.30c, between 1994 and 1997. The value of palmito exports in 1996 was US\$21.68 million and continues to increase at an annual rate of 31.23%.

One concern expressed is that the size of the current market is small and, consequently, the entire market could be captured by one or a few large producers in Brazil or elsewhere. Currently, most of the production of pejibaye is by small farmers, but as with the case of banana, it might be possible for large scale producers to achieve efficiencies and market domination to the disadvantage of the small scale producers.

### **Conclusions**

Farmers are the final decision makers in agricultural production, selecting cropping systems on the basis of their resources and goals, while being conditioned by the socio-economic environment. As decision makers, however, they have very little access to technical information or analytical tools.

The Ministry of Agriculture and its offices are unable to provide needed technical services to farmers due to budget and personnel constraints. Current, agricultural practices are based on a technology package developed by a few large farming operations and copied by farmers in the surrounding region. There are many questions about how to improve the system and thereby contribute to a sustainable development of the region.

The benefits of growth in the pejibaye industry are considerable for both men and women. Primarily men have benefitted from contract work with commercial plantations. Significant numbers of women are working in the processing industries. In each case, the processes are labor intensive and provide opportunities to workers who may have minimum education or vocational training. On the plantation, planting, selective harvesting, weed control and fertilizer applications are manual and, thus, labor intensive. In the processing industry, the peeling, cutting, washing, handling and packing are mostly manual (non-mechanized).

Coordination between government, industry, farmer organizations and research institutions is poor. Each component of the system is preoccupied with its own concerns. One benefit of the site visit was to serve as a catalyst sharing information across groups about areas of common interest and opportunities for collaboration. Integration of technical databases and shared contact information about who is doing what will help consolidate the emergent system and create a stronger basis for sustained development of the rural sector.

### **Acknowledgments**

We thank the Vice Minister and his staff for their time and participation in the field survey. We also express our appreciation to industrial representatives who kindly shared critical information and showed us their facilities and operations. The UCR researchers and staff provided invaluable assistance in regard to information sources, maps, communication, computer analysis and logistical support. Thanks go to INA for providing data on farmer training in the region.

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**Appendix A**  
**Report on Survey of Baseline Priorities**  
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**Context**

The SM-CRSP is beginning a 5-year research and development program based on a strategy of decision support for soil management and land use. As part of the project design, a baseline study is planned and will be implemented during the first year of operations. The purpose of the baseline study is two fold:

- to document the conditions at the intensive testing sites at the start of the 5-year period and establish points of reference on a standardized set of process and impact measures for interpretation of future impact; and
- to reveal factors which need to be taken into account in the design, testing and extensive use of decision support technology.

**Rationale**

The baseline study will be of limited value unless the principle investigators feel that the information generated by the study is useful to them as they formulate decision aids, plan field experiments and engage in training and extension activities. Also, given the needs for program evaluation and accountability, it is very important that the principle investigators themselves help select appropriate measures and designs for evaluation of program impact. Establishing consensus and clarity about these matters at the beginning of the project can help to make the project more successful.

**Procedure**

A survey of baseline priorities offered investigators an opportunity to rate the relative importance of information elements on a 5-point scale. Survey items were based on concepts and phrases extracted from the proposal document. They were grouped under descriptive headings:

- Measures of Agricultural Practices
- Measures of Land Use Planning Practices
- Measures of Social, Economic and Cultural Conditions
- Target Populations (for inclusion in the baseline sample)
- Criterion Measures to Assess Improvements in Decision Processes
- Criterion Measures to Assess Project Impact

Investigators were requested to comment liberally on the survey form, to suggest other information items, suggest alternative wording of items, or make any other comments on content or procedure.

Of approximately 25 persons participating in the Hawaii project workshop, responses were obtained from 18. Mean ratings, standard deviations, maximum and minimum values were computed for each item. The results are reported in the table attached.

**Results**

Most of the items were rated as important. Only 9 of the 37 were rated less than 3 on the 5-point scale. None of the items was less than 2.4. Although all items were considered important, clearly some items are more important and of higher priority than others.

Standard deviations of the items also helps to quantify the degree of consensus about the importance of an item. For example, with regard to the importance of inclusion of small farmers in the sample (Item 21), there was virtual unanimity— little variation, a standard deviation of .32 and a maximum rating of 5 and a minimum rating of 4. However, with regard to item 18 (measures of regulatory policy constraints), there was more inter-investigator variance— the standard deviation among raters was 1.55 and the maximum rating was 5 and the minimum rating was 1.

Comments and suggestions of investigators were helpful. Some observed that there were logical correlations (interdependencies) between some items. Some were unsure about the meaning of certain items because different disciplines use terms differently, e.g. nutrient factors. In general, the survey was an exercise that helped us learn more about our own priorities and those of our collaborators and how to express our common interests in terms we could all understand.

### **Implications for the Baseline Study and Beyond**

Clearly investigator participation is critical in baseline study design, but it is not the only group that has a stake in the project. The above results should be used in combination with input from others including donor requirements and interests of target beneficiaries. These results provide an early reading of the priorities and interests of key participants.

## Survey of SM-CRSP Research Collaborators

**The baseline study is for you!**

**Help determine the focus and content priorities for the baseline study!**

Within each of the general categories below, rate the importance of each type of information for inclusion in the baseline study. Please keep in mind that the baseline study is intended to provide useful information to guide program development and to serve as a point of reference for assessment of positive changes in decision processes and project impact.

5= top priority

4= very important

3= important

2=low priority

1=not important (lowest priority)

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### Measures of Agricultural Practices

1. \_\_\_\_\_ Use of lime and fertilizer
2. \_\_\_\_\_ Production volume
3. \_\_\_\_\_ Production quality
4. \_\_\_\_\_ Production stability (sustainability)
5. \_\_\_\_\_ Rotations
6. \_\_\_\_\_ Fallows
- \_\_\_\_\_ Other (please specify)\_\_\_\_\_

### Measures of Land Use Planning Practices

7. \_\_\_\_\_ Ease of access to information
8. \_\_\_\_\_ Subjective weights given to different information types
9. \_\_\_\_\_ Time allocations to decision-making
10. \_\_\_\_\_ Participation of target groups
11. \_\_\_\_\_ Integration of diverse information
- \_\_\_\_\_ Other (please specify)\_\_\_\_\_

### Measures of Social, Economic and Cultural Conditions

12. \_\_\_\_\_ Access to lime and fertilizer
13. \_\_\_\_\_ Price of lime and fertilizer (12 month range & peak price)
14. \_\_\_\_\_ Access to product markets
15. \_\_\_\_\_ Price of products (12 month range & peak price)
16. \_\_\_\_\_ Access to credit
17. \_\_\_\_\_ Interest rate (12 month range & peak rate)
18. \_\_\_\_\_ Regulatory policy constraints
19. \_\_\_\_\_ Institutional capacity constraints (market systems)
20. \_\_\_\_\_ Human resource constraints (training needs)
- \_\_\_\_\_ Other (please specify)\_\_\_\_\_

**Target Populations (for inclusion in the baseline sample)**

- 21. \_\_\_\_\_ Small-scale farmers
- 22. \_\_\_\_\_ Commercial scale farmers
- 23. \_\_\_\_\_ Agro-industries (nutrient factor suppliers)
- 24. \_\_\_\_\_ Agro-industries (product buyers)
- 25. \_\_\_\_\_ Government agencies
- 26. \_\_\_\_\_ Educational and training institutions
- 27. \_\_\_\_\_ Non-government organizations (NGO/PVO)
- \_\_\_\_\_ Others (please specify)\_\_\_\_\_

**Criterion Measures to Assess Improvements in Decision Processes**

- 28. \_\_\_\_\_ Changes from baseline in levels of target group participation
- 29. \_\_\_\_\_ Changes from baseline in levels of information integration
- 30. \_\_\_\_\_ Changes from baseline in ease of information access
- 31. \_\_\_\_\_ Narrowing of information gaps
- 32. \_\_\_\_\_ Changes from baseline in quality of information (reliability & validity)
- \_\_\_\_\_ Others (please specify)\_\_\_\_\_

**Criterion Measures to Assess Project Impact**

- 33. \_\_\_\_\_ Change from baseline in units of production (metric tons/hectare)
- 34. \_\_\_\_\_ Change from baseline in net economic returns
- 35. \_\_\_\_\_ Changes in land use policy
- 36. \_\_\_\_\_ Constructive interventions in lime and fertilizer pricing and distribution
- 37. \_\_\_\_\_ Distribution of benefits (equity) among target groups
- \_\_\_\_\_ Others (please specify)\_\_\_\_\_

**Please Make Any Comments or Suggestions in the space below:**

For purposes of follow-up and possible need for further clarification, you are encouraged to provide your name and contact information in the space below, but identifying information is strictly voluntary!

Name:

Contact Information (e-mail or fax):

**Table of Survey Results**

<b>QUESTION</b>	<b>MEAN</b>	<b>STD. DEVIATION</b>	<b>MAX. VALUE</b>	<b>MIN. VALUE</b>
1	4.67	.69	5	3
2	3.83	1.20	5	1
3	2.56	.86	4	1
4	4.00	.91	5	2
5	2.78	1.48	5	1
6	2.44	1.46	5	1
7	3.94	1.30	5	1
8	2.61	1.04	4	1
9	2.72	1.23	5	1
10	4.28	1.02	5	1
11	4.00	1.08	5	1
12	4.61	0.85	5	2
13	3.78	1.31	5	1
14	3.89	1.23	5	1
15	3.61	1.42	5	1
16	3.56	1.34	5	1
17	2.83	1.20	5	1
18	2.94	1.55	5	1
19	2.72	1.45	5	1
20	3.50	1.34	5	1
21	4.89	.32	5	4
22	4.06	1.16	5	1
23	3.44	1.34	5	1
24	3.22	1.44	5	1
25	3.67	1.33	5	1

<b>QUESTION</b>	<b>MEAN</b>	<b>STD. DEVIATION</b>	<b>MAX. VALUE</b>	<b>MIN. VALUE</b>
26	4.00	0.97	5	1
27	3.17	1.29	5	1
28	4.28	1.32	5	1
29	4.06	1.11	5	1
30	3.61	1.46	5	1
31	3.00	1.28	5	1
32	3.28	1.53	5	1
33	4.11	1.32	5	1
34	4.11	1.32	5	1
35	3.33	1.57	5	1
36	2.89	1.32	5	1
37	3.17	1.38	5	1

**Appendix B**  
**Survey of Farmers in the Sarapiquí Region, Costa Rica**

Name of farmer \_\_\_\_\_

Name of interviewer \_\_\_\_\_

Location of the farm \_\_\_\_\_

**Agricultural Practices**

1. Production area? \_\_\_\_\_ Principal Crops? \_\_\_\_\_
2. Area of pejibaye? \_\_\_\_\_
3. Changes planned for the next five years (increase or decrease in production, improvements)?
4. What are the most important problem on your farm?  
\_\_\_\_\_
5. How is the soil on your farm (poor or good)? \_\_\_\_\_
6. Do you apply fertilizer, lime and/or organic material:  
type \_\_\_\_\_  
quantity \_\_\_\_\_  
when \_\_\_\_\_
7. Do you apply other inputs? \_\_\_\_\_
8. How many heart of palm units do you produce per month?  
Dry season \_\_\_\_\_ Humid season \_\_\_\_\_
9. How many mother plants per hectare? \_\_\_\_\_
10. Average weight (size) of palm hearts? \_\_\_\_\_
11. Do you have steady income (each month) from sale of palm stems? Yes \_\_\_\_ No \_\_\_\_
12. If you plant pejibaye, do you plant in pure stand or in association with another crop or ground cover?

**Decision making relating to land use**

13. How do you determine if there is a problem with your crop? \_\_\_\_\_  
\_\_\_\_\_
14. How do you decide what corrective action is required?  
\_\_\_\_\_

15. Where did you learn to plant and manage pejibaye? \_\_\_\_\_
16. What are the principal risks associated with the production of pejibaye?  
\_\_\_\_\_
17. Who can you turn to for help in case you have a problem with your crop?  
\_\_\_\_\_
18. Can you easily obtain different kinds of information?  
Nutrients (NPK, lime) Yes \_\_\_ No \_\_\_  
Market prices Yes \_\_\_ No \_\_\_
19. Is the information sufficiently reliable for making on farm management decisions ?  
Yes \_\_\_\_\_ No \_\_\_\_\_
20. Do you help any neighbors with problems or management of their crop? How many? \_\_\_\_\_
21. How many neighbors help you with decisions about your crop? \_\_\_\_\_
22. What kind of information is most important (most necessary) for making decisions about whether to increase or decrease your production of heart of palm?  
\_\_\_\_\_
23. When making a decision, do you do so alone or do you consult with others:  
the family (wife) Yes \_\_\_ No \_\_\_  
the community Yes \_\_\_ No \_\_\_  
the industry Yes \_\_\_ No \_\_\_  
other specialists Yes \_\_\_ No \_\_\_
24. Do you have a method to evaluate and integrate information of different types and different sources?  
Yes \_\_\_ No \_\_\_

**Social, Economic and Cultural Conditions**

25. Number of persons in the family? \_\_\_\_\_
26. Years of schooling completed:  
You \_\_\_\_\_ Your spouse \_\_\_\_\_ Your children (educational goal) \_\_\_\_\_
27. How many years of experience do you have:  
in agriculture \_\_\_\_\_  
in production of pejibaye \_\_\_\_\_

28. Do you receive operational loans (credits)? Yes \_\_\_ No \_\_\_  
 Source? \_\_\_\_\_ Interest rate \_\_\_\_\_
29. Do you have sufficient family labor (or do you need to look for labor outside the family)?  
 Yes \_\_\_ No \_\_\_  
 how many men \_\_\_\_\_ how many women \_\_\_\_\_
30. Do you purchase fertilizer and/or other input for production of pejibaye?  
 Yes \_\_\_ No \_\_\_
31. Do you have easy access to agricultural inputs? (How many kilometers) km \_\_\_\_\_
32. Price of fertilizer:  
 12 month average price \_\_\_\_\_  
 12-month low price \_\_\_\_\_ high price \_\_\_\_\_
33. Price of lime: 12 month average price \_\_\_\_\_  
 low price \_\_\_\_\_ high price \_\_\_\_\_
34. Where do you sell your heart of palm? (How many kms do you travel to sell it) km \_\_\_\_\_
35. Price of sale: 12 month average price \_\_\_\_\_  
 low price \_\_\_\_\_ high price \_\_\_\_\_
36. What is the biggest constraint in you production system?  
 \_\_\_\_\_ poor condition of roads/transport infrastructure  
 \_\_\_\_\_ poor market facilities  
 \_\_\_\_\_ lack of agricultural inputs  
 \_\_\_\_\_ scarcity of manual labor  
 \_\_\_\_\_ size of available land  
 \_\_\_\_\_ other (please explain)
37. Have you received any training in management of pejibaye?  
 Yes \_\_\_ No \_\_\_
38. What kind of training/course is most necessary in order to improve production in pejibaye?  
 \_\_\_\_\_  
 \_\_\_\_\_
39. Are you an independent producer or do you produce in association with others (industry or a cooperative)?
40. How do you invest the income generated by sale of heart of palm?

Observations:

Draw a layout of your farm: (indicate total area, production area, area of pejibaye, fallows, forest, house and garden, streams/rivers)

**Appendix C**  
**Results for Farmers Surveyed in the Sarapiquí Region, Costa Rica**

The complete dataset of the survey results are included in a separate Acrobat Reader file (\*.pdf file) named “CRica\_Encuesta.pdf”.