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COOPERATIVE RESEARCH PROJECT ON AGRICULTURAL TECHNOLOGY IN LATIN AMERICA "PROTAAL"

TECHNOLOGICAL CHANGE AND SOCIAL RELATIONS OF PRODUCTION: THE SMALL FARMERS OF PEJIBAYE, COSTA RICA.

A. Case Study Summary

B. Ideas on Technological Policy Emerging from a Case Study

James A. Chapman
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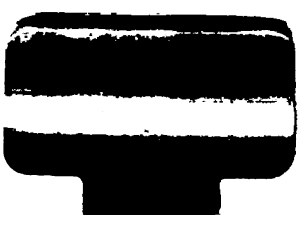
IICA
INTER-AMERICAN INSTITUTE FOR COOPERATION ON AGRICULTURE

San José, Costa Rica, June, 1983



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BACKGROUND INFORMATION ON THE PROTAAL PROJECT

The Cooperative Research Project on Agricultural Technology in Latin America (PROTAAL) aims to develop a series of research efforts dealing with the nature of the agricultural technological change process in the region. Until June 1983 this effort was being carried out with the collaboration of the Inter-American Institute for Cooperation on Agriculture (IICA) which acted as the executive agency, the Ford Foundation, the United Nations Development Programme (UNDP), and the International Development Research Centre (IDRC) of Canada.

The Project views the process of generation and transfer of technology as a phenomenon endogenous to the society in which it develops. Through an integrated analysis of the process, research efforts aim to provide information that will improve the understanding of the technological problem and, consequently, the definition of policies, organizational models and actions that will contribute to technological progress and the development of the agricultural sector.

Project activities began on January 1, 1977 and organizationally, they developed for the most part with the participation of research teams in a number of countries on the continent.

Within the same general framework, the PROTAAL Project has also conducted a special research project entitled "National Agricultural Research Systems in Latin America: A comparative analysis of human resources in selected countries", which received funding from the Rockefeller Foundation and IICA.

Finally, in May 1980, a second phase of the Project (PROTAAL II B: "Technical Change in the Small Farm Sector") began with special funding from the Government of Holland. It aims to intensify the analysis of the technological process in the campesino farm sector. Case studies for this new phase are expected to take place in Brazil, Peru, Ecuador, Colombia and Costa Rica, and provide information that will facilitate better management of the technological variable in rural development programs and projects.

In order to disseminate the research findings, and to generally improve the exchange of information, the Project publishes the following three types of papers, monographs and books:

a. Papers on methodologies and on empirical research findings resulting from central Project activities.

b. Papers dealing with activities related to the Project.

c. Papers written by Project staff, and eventually by other authors involved in Project activities, which prove useful to the development of the Project.

Inasmuch as the papers are not usually published in final form, critical comments are welcome.

PROYECTO COOPERATIVO DE INVESTIGACION SOBRE TECNOLOGIA AGROPECUARIA EN AMERICA LATINA (PROTAAL)

LISTA DE PUBLICACIONES DISPONIBLES AL 1 DE AGOSTO DE 1983*

DOCUMENTO PROTAAL no. 1 PIÑEIRO, M., TRIGO, E. y FIORENTINO, R. El proceso de generación, difusión y adopción de tecnología agropecuaria en América Latina. IICA. Publicación Miscelánea no. 163. 1977. 58 p.

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DOCUMENTO PROTAAL no. 16 — Este trabajo se incluyó en el documento PROTAAL no. 43.

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PART A.

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The second phase of the PROTAAL Project entitled: "Technical Change in the Small Farm Sector", focussed on the analysis of the role of technological change in the process of small farm and rural development and of the effects of public policies in this process.

Besides this document, which includes a summary of the Costa Rican case study and ideas for future technological policy, other similar ones were produced in Brazil, Colombia, Ecuador, Peru, Uruguay and Paraguay. The development of each study was the responsibility of national teams comprised of researchers experienced in the study of technology and small farmers, under the general supervision of Martín Piñeiro and Eduardo Trigo, Coordinator and Co-Coordinator, respectively of the PROTAAL Project.

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Coronado, junio de 1983.

A. Case Study Summary

TECHNOLOGICAL CHANGE AND SOCIAL RELATIONS OF PRODUCTION:

THE SMALL FARMERS OF PEJIBAYE, COSTA RICA

A CASE STUDY SUMMARY

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I. INTRODUCTION

The objective of this study is to contribute to the state of knowledge regarding the process of technological change on small farms in Costa Rica. The analysis presented herein is based on a study of small-scale producers of coffee, maize and beans (products typically found on small farms) in the Southern Pacific region of the country. The research examines the socio-economic conditions found on these small farms (micro level), the nature of the relationships established between small farmers and other agricultural system participants (regional level), and the public policy environment affecting small farmer behavior (macro level). This set of conditions, together with the ecological environment faced by farmers, influence the technological change process, as well as the possibilities for the development of the small farm sector.

In the region under study, coffee production has undergone major technological changes, which are all the more impressive in that coffee, a perennial crop, by its very nature inhibits the adoption of new techniques, and that the ecology of the zone is not really very suitable for coffee-growing. This development can be more legitimately traced to: a) government policies establishing a distribution of coffee-generated income in favour of growers; b) suitable channels for marketing and financing; c) the availability of appropriate technologies for small-scale farmers. This combination of

factors made coffee a very profitable item and thus spurred the expansion of coffee production via the adoption of new technology and through increases in planted area.

The techniques utilized for growing maize and beans in Pejibaye, on the other hand, have not undergone major changes. In contrast to coffee, government policies have maintained prices for these commodities at low levels. The crop is aimed more at home consumption than at the market. Furthermore, there is a lack of technology appropriate for the economic and ecological conditions under which the crops are grown.

II. CHANGES IN THE COSTA RICAN ECONOMY AND THE SETTLING OF PEJIBAYE

In the early sixties, Costa Rica was still basically an agricultural country. Its main economic activities had to do with producing and exporting coffee and bananas. Government policy was oriented accordingly.

During the mid-sixties the post-war experience, the new Central American Common Market and a general, continent-wide trend created the conditions for the "modernization" of the economy. The development of an industrial sector was fostered, and import substitution, especially of nationally produced consumer goods, was encouraged. A part of the surplus generated in the farm sector was needed to finance the new industrial sector. The objective of government policy was therefore to depress farm commodity prices (except commodities traditionally intended for export) and to establish a system of incentives for the production of manufactured goods[1/].

Reduced opportunities for employment in agriculture and the monetary incentives provided to the industrial and service sectors, normally located in urban areas, brought about a process of rural/urban migration giving

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1/ This policy was reflected in the fact that prices for agricultural products grew at a substantially lower rate than those for industrial goods. This permitted the appropriation by the industrial sector of part of the economic surplus produced in the agricultural sector. A detailed description of this process is presented in Banco Central de Costa Rica (1978).

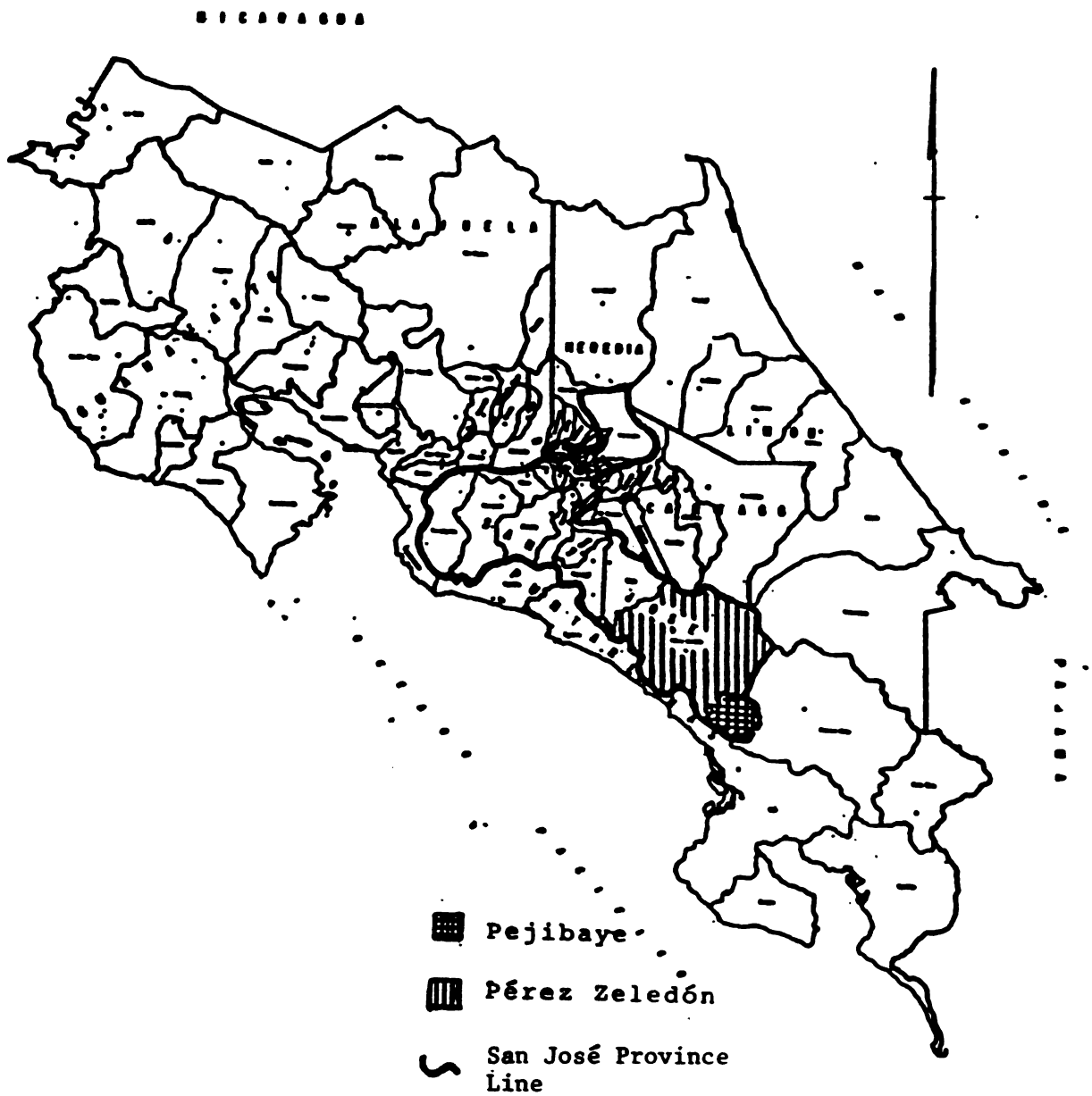
rise to a large urban labour pool whose reproduction costs, and therefore wages, were low, due largely to the low prices of staple foods and other basic necessities. In this manner, the industrial incentives and low-cost labour favoured the industrial sector, enabling it to accumulate a large portion of the farm-generated economic surplus.

The economic boom did not last long, however. Outside factors such as the 1973 oil crisis and the weakening of the Central American Common Market, to name just two, sapped the vigor of the industrial sector. The slump gave rise to unemployment, inflation, and a deficit in the balance of payments. This situation, which persists today, forced a reevaluation of the role of the agricultural sector. The present government has drawn up a programme with policies designed to strengthen the agricultural sector and de-emphasizing in a relative sense the industrial sector.

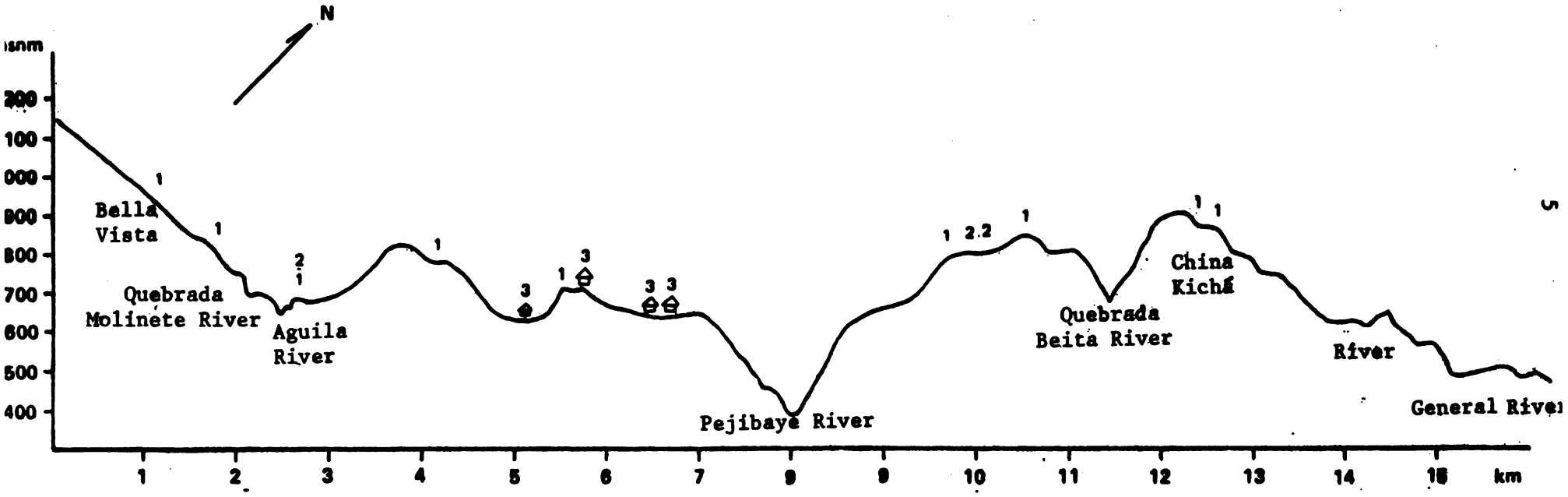
Although urban areas did offer better chances for income generation during the industrialization development phase, in real terms this advantage was neutralized by the failure of wages to cover urban living expenses-wages which tended to remain depressed given the pool of surplus, unspecialized labour. The situation forced workers to turn again to agricultural activities. Added pressure on the land evolved which, added to the process of urbanization (occurring over the fertile Central Plateau land), pushed population out to peripheral parts of the country.

The growth of the population of the district of Pejibaye by settlement took place as part of the process of expansion and occupation of new lands. Pejíbaye belongs to the district of Pérez Zeledón, one of the few rural cantons in the country to have experienced positive migration trends in the last thirty years. Figures 1 and 2 indicate the location of Pejíbaye within Costa Rica and the general topography of the study area. The canton began to grow slowly but steadily in the thirties. By 1973, 84 percent of the arable land was being farmed. The first occupants of the area produced almost exclusively for home consumption, most of the cultivated land being planted to staples like rice, beans and maize. Communication with urban areas was improved in the fifties by the opening of all - weather roads. Production continued to focus on

Map 1. Location of the Pejibaye district



Map 2. Topographic profile of Pejibaye



NOTES: Horizontal scale : 1:50.000
Vertical scale : 1:10.000

SOURCE: Developed from 1:50.000 maps from the National Institute of Geography.

1. Roads
2. Trails
3. Houses

basic grains, but it did become increasingly market-oriented. Better communications and access to the area also influenced farmers to begin to grow coffee, one of the most active commodities in the economy of the country. The population of the district of Pejibaye, especially during the sixties, was composed basically of small farmers growing coffee, beans and maize.

During the same period, State coffee policy heavily favoured coffee production. An objective of this policy, however, was to maintain coffee production in the ecological areas most suited to coffee-growing and specialize marginal areas like Pérez Zeledón in the production of basic grains to cover consumer needs in both the urban and rural areas of the country. Technical assistance, credit and marketing programmes for ths area were therefore oriented towards commodities such as maize and beans. In the specific instance of Pérez Zeledón, government policy did not encourage coffee-growing. Despite this, the crop offered sufficient financial incentive to ensure a considerable increase in the amount of land planted to coffee.

III. GOVERNMENT POLICIES, THE SOCIOECONOMIC CONTEXT OF THE REGION AND PRODUCTION TRENDS IN PEJIBAYE

This section offers a three-tier analysis of the variables affecting peasant production: a) state participation; b) regional factors; c) production trends and technological change on small farms of Pejibaye.

The three crops in question -- maize, beans and coffee -- play different roles in the economy of Costa Rica and this has affected the formulation of government policies for each crop, production trends, and technological change taking place on small farms. The analysis presented in this section therefore considers each commodity separately so as to identify and bring out the differences observed.

A. Government Support of Peasant Production

1. Crop policies

a. Coffee: a major export commodity[1/]

The production of coffee, an export crop, has for more than a century constituted the basis of the organization of the domestic economy in Costa Rica. It is currently the agricultural activity which generates the greatest production value and the most employment (together with banana production), and is a major provider of foreign currency upon which Costa Rica's buying power depends.

The participation of coffee in the gross national agricultural product rose from 18 percent in 1950 to 25 percent in 1979. The mean annual output growth rate during the same period was 6.3 percent, a figure exceeding that for all agricultural products combined (4.2 percent). Roughly 85 percent of the harvest is exported each year. The remainder is intended for the domestic market and is considerably cheaper than export coffee[2/]. Most coffee is produced on small and medium-sized farms. The 1973 census showed that farms under 50 ha constituted 93 percent of the coffee plantations and accounted for 66 percent of the area in coffee production[3/].

State participation in regulating coffee grew out of the confrontation between large coffee processors and growers over the distribution income generated from coffee export and sales[4/]. In 1930, the coffee

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1/ Much of the information used to develop this sub-section is from Aguilar, Barboza and León, 1982.

2/ Most beans intended for the domestic market are of poor quality.

3/ The atomized structure of coffee production in Costa Rica contrasts with the concentrated nature of banana production, which occupies extensive areas under plantation arrangements. However, atomization is not inherent to coffee, as coffee production can be quite concentrated. Such is the case in many other Central American countries.

4/ It should be pointed out that the interests of these two groups do not always conflict, since some large growers are also processors.

growers founded the National Association of Coffee Producers (Barrenechea, 1956). The conflict was resolved with the formation of the National Institute for the Protection of Coffee in 1933 and the promulgation of Law 171 the same year. This law, broadened and amended in June 1961 and October 1977, provides the frame of reference for determining the economic relations between those participating in the production and marketing of coffee. Table 1 describes the distribution of income from the sale of coffee in certain selected years. As can be seen from the Table, growers generally receive around 70 percent of the sale price.

The importance of coffee to the economy of Costa Rica has led it to enjoy a privileged position with respect to credit, as evidenced by its percentage-wise share of the available credit. During the last three decades, coffee accounted for between 20 and 25 percent of the gross national agricultural product; it attracted roughly half the credit earmarked for agriculture during the same period. This kind of credit also enjoyed subsidized interest rates of 8-11 percent p.a.[1/]. Another factor which has favored the coffee business is that harvest financing is not bound to loan ceiling[2/], which virtually ensures full financing of the crop in the major coffee-producing areas[3/].

The state, however, has undertaken efforts to restrict the growth of coffee production. International coffee prices began to drop after the 1957-58 harvest, impelling producer countries to ratify the International Coffee Agreement in 1962 for the purpose of regulating the world coffee supply by assigning export quotas to producer countries. In response to this situation, Costa Rica defined a new domestic production policy, the salient feature of which was to freeze the land area under coffee at roughly 81 500 ha. Instead of prohibiting additional coffee planting, the state concentrated the resources available for coffee in those areas

1/ These are nominal figures. In years where inflation exceeded the figures, the real rate of interest was negative.

2/ Credit ceilings are limits set by banks to the total amount of funds available for agriculture -- a sort of credit rationing.

3/ Credit is provided on easy terms, and the pressure for repayment of loans is often lax. This constitutes an additional incentive to coffee production.

TABLE 1. Costa Rica: distribution of coffee-generated income among growers, producers, exporters and the Government (selected harvests) (%).

Years	Total revenue[a]	Growers	Processors	Exporters	Government	Loan institutions	Coffee oard
1964-65	100.0	70.66	15.03	2.85	6.08	3.66	1.72
1965-66	100.0	68.51	14.61	3.31	8.81	3.05	1.71
1966-67	100.0	73.88	13.46	2.23	4.44	3.99	2.00
1967-68	100.0	76.03	13.44	2.19	2.23	3.97	2.09
1968-69	100.0	76.03	13.04	2.14	2.24	4.40	2.15
1974-75	100.0	69.59		18.70[b]		11.71[c]	
1976-77	100.0	73.16		10.12[b]		16.72[c]	
1978-79	100.0	71.93		9.14[b]		18.93[c]	

Notes:
a. From 1964-69, per harvest coffee income (figures in relative values). From 1974-79, average price weighted between the FOB price of the part intended for export and the auction price of the domestic portion, according to quotas set for each harvest (figures in relative values).
b. Participation of both processors and exporters.
c. Total state income share derived from coffee production.

Source: Organización Internacional del Café, 1970; Jiménez, 1979.

most ecologically favourable to coffee, especially the Central Plateau. "Marginal" areas were denied access to state-sponsored technical and credit assistance[1/].

Despite restrictions on the amount of land which could be put under coffee, production grew at a rate comparable to that of preceding years. This was mainly due to increased yields, traceable to the adoption of techniques developed since 1950 (Table 2).

Coffee research in Costa Rica began at the close of the forties with the establishment of the Coffee Division under the Ministry of Agriculture and Livestock. During the fifties, IICA and the University of Costa Rica began to do research on coffee, and the National Banking System increased its financial support for coffee-growing. During the same period, the programme of the Inter-American Service for Technical Cooperation in Agriculture (STICA) introduced new research and agricultural extension methods and trained technical personnel.

Moreover, many of the most important technical innovations during the fifties were developed. Caturra and Mondo Novo varieties were brought to Costa Rica from Brazil in the early fifties, and new varieties were developed locally (Tico Hybrid and Villa Sarchí). The latter varieties gained wide acceptance among coffee-growers, and are still the dominant varieties in certain areas of the country. Large-scale adoption of the Brazilian varieties began during the second half of the sixties, however, together with the first attempts to restrict the area planted in coffee. The reason for this acceptance was that seed densities can be increased with these varieties.

Research took place on chemical technology and improved cultural practices. The basic application rates for nitrogen, potassium and phosphorus were worked out, recognizing the crucial importance of such minor elements as boron and zinc. Optimal herbicide and pesticide rates were also determined. Recommended planting densities were increased (made possible by

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1/ Government policy notwithstanding, private coffee buyers and processers came to the "marginal" areas and supplied the credit needed to expand the cultivation of coffee.

TABLE 2. Costa Rica: production per area under coffee and coffee bean yields

Harvest[a]	Output (fanegas)[b]	Area (ha)[c]	Yield[c] (fanegas/ha)
1950-51	384 533	48 837	7.87
1951-52	412 824	50 541	8.17
1952-53	656 523	51 907	12.65
1953-54	462 896	56 135	8.25
1954-55	681 525	56 345	12.10
1955-56	498 243	57 543	8.66
1956-57	695 065	58 741	11.83
1957-58	945 023	59 939	15.77
1958-59	1 061 795	61 137	17.37
1959-60	1 049 635	62 335	16.84
1960-61	1 147 434	63 533	18.06
1961-62	1 287 728	64 731	19.89
1962-63	1 139 234	65 929	17.28
1963-64	1 293 043	67 127	19.26
1964-65	982 540	68 325	14.38
1965-66	1 221 868	69 523	17.58
1966-67	1 423 719	70 721	20.13
1967-68	1 605 953	71 919	22.33
1968-69	1 474 106	73 117	20.16
1969-70	1 771 683	74 315	23.84
1970-71	1 559 988	75 513	20.66
1971-72	1 903 117	76 711	24.81
1972-73	1 691 339	77 918	21.71
1973-74	2 051 334	80 418	25.51
1974-75	1 812 265	83 406	21.73
1975-76	1 700 179	81 750	20.80
1976-77	1 691 549	81 750	20.69
1977-78	2 025 001	81 000	25.00
1978-79	2 298 339	81 000	28.38
1979-80	1 970 121	81 750	24.10
1980-81	2 645 335	82 500	32.06

Notes: a. Period Sept-Oct.

b. One fanega (a grain measure) equals 257.6 kg.

c. Estimated figures

Source: Banco Central de Costa Rica, 1982

the introduction of short-statured Brazilian varieties) and new coffee-pruning and shading techniques were also introduced.

The improvement of coffee prices in the late sixties (Table 3) contributed to the acceptance of new technologies in the major coffee-growing areas. Agencies responsible for generating new technology, moreover, concentrated on improving the technologies introduced, rather than on developing new ones.

The data on per hectare yields included in Table 2 show a gradual, steady rise throughout this period. Average yields during the years 1978-81 were almost triple those of 1950-53. The area planted in coffee grew in more or less constant fashion until 1974, when it reached the ceiling set by the government in response to the demands of the International Coffee Agreement. What this situation illustrates is that the government measures did not contain the expansion in coffee production, as shown by the fact that production continued on an upward trend during the entire period of restriction.

The increases in coffee productivity achieved are impressive, especially when a comparison is made with other crops. Coffee is a perennial, and so technical changes work more slowly than with annual crops, especially when one important component of change is the introduction of new varieties. Coffee begins to produce four or five years after it is planted. This implies a considerable investment in time and money. And to a certain extent, this is a constraint on the complete acceptance of new varieties, which require replanting and a long waiting period before the first harvest [1/].

This is the reason why much of the change that occurs with respect to varieties takes the form of interplanting new varieties among the existing coffee plants ("retupición"), which constitutes a partial adoption of the technology. This kind of restriction is not operative with

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1/ This is a major point in the case of small coffee planters. Their precarious economic position forces them to produce annual crops to ensure the constant flow of food and money to cover the needs of their families. They can only plant coffee by introducing it gradually into the system at times when they have a surplus available for investment.

TABLE 3. Export and national consumption coffee prices for the 1964-1975 period (current colones per quintal)

Harvest year	Coffee prices	
	Export[a]	National consumption[b]
1964-65	291.68	211.83
1965-66	289.03	200.13
1966-67	249.77	183.39
1967-68	239.58	181.14
1968-69	240.30	184.32
1969-70	309.49	197.03
1970-71	276.39	177.63
1971-72	269.11	183.38
1972-73	387.09	201.16
1973-74	485.19	223.52
1974-75	449.96	226.89

a. Corresponds to the average price at point of origin.

b. Corresponds to the average price obtained at the National Coffee Exchange auctions.

Source: Oficina del Café, 1976.

annual crops such as maize and beans, where a switch from one variety to another requires only a few months.

b. Basic grains: commodities for domestic consumption

Economic policy affecting the production and distribution of maize and beans was not designed specifically for these two crops but for basic grains in general, which also include rice and sorghum. Basic grains have very little impact on the value of agricultural production: in the last twenty years, maize and beans have represented 20 percent of the 5-8 percent of the gross agricultural product contributed by basic grains. Despite this, the two commodities, especially beans, are a major item in the diet of Costa Rican families. How important they are can be seen in the high levels of home consumption (exceeding 40 percent of the farm output on farms under 20 ha) and in the fact that 60 percent of all farms in the country grow maize and/or beans. In addition, over 50 percent of the total domestic production of these crops is produced on small scale farms.

The state initially intervened in the production of basic grains when it established the National Production Council (CNP) in 1949, fundamentally for the purpose of regulating the level and stability of basic grain prices. The agency provides a real marketing alternative to producers of these grains, who can sell their commodities direct to the agency at prices set beforehand by the state.

Before 1949, there was considerable price instability with prices falling as the harvest drew near. Farmers lacked the basic infrastructure for on-farm grain storage; they needed money to pay their debts and provide for their families; and so they were forced to sell what they produced at low prices. The CNP built silos and opened purchasing agencies to pay "fair" prices during the harvest season and later sell the grains during the course of the year (Seligson, 1980).

In addition to regulating prices, the CNP also performed other important functions. One was to back loans granted by the National Banking System to small farmers lacking title to the land they worked. Another

very important function was the establishment, in many rural and urban localities, of retail outlets with fixed prices for items in the family consumption basket. This action was most effective in isolated areas, where it prevented the local corner grocers from taking advantage of the lack of competition to charge exaggerated prices for their merchandise. Table 4 shows prices paid by the government to maize and bean farmers, and those charged the consumer during the 1965-81 period. The CNP also furnishes good-quality seeds, of both new and traditional varieties, to farmers.

The development of maize technology began in 1950, with the establishment of the National Maize Programme under the Ministry of Agriculture and Industry. This programme worked closely until 1974 with the Central American Cooperative Programme for the Improvement of Food Crops (PCCMCA), of which the central objective was the production of maize hybrids for commercial use. During the mid-fifties, a maize seed production cooperative programme was set up, with the participation of the Ministry of Agriculture and Industry and the CNP. The objective of the programme was to multiply the seeds produced by new maize varieties (e.g Cornell 54) on Ministry of Agriculture plots and on those of selected farmers. The seeds were distributed to farmers by the CNP.

Research continued during the sixties, mostly on genetic improvement, fertilizers, the use of herbicides and pesticides, and improved cropping methods. But it was only in 1975 that a project was designed to evaluate and multiply open-pollinated maize, which is the seed type most small farmers use. This was part of a broader policy on basic grains intended to promote domestic basic grain production so as to break the dependence on imports of these commodities. Concerning maize, efforts focussed on technical and credit assistance to small and medium scale farmers as a complement to research activities. In 1975, the first domestic maize variety suitable for hot climates was produced (Tico H-1).

Government efforts to generate and transfer bean technology are very recent. It was not until 1975 that the National Basic Grains Programme recommended that the Ministry of Agriculture develop and implement

TABLE 4: Output prices for producer (P) and consumer (C) in constant colones/quintal. Farm years 1965-66 to 1980-81[a]

Commodity / Farm Year	Yellow maize		White maize		Beans	
	Price C	Price P	Price C	Price P	Price C	Price P
1965-1966	30.20	25.00	30.20	25.00	71.67	55.00
1966-1967	31.07	25.15	31.07	25.15	81.85	55.34
1967-1968	30.96	24.80	30.96	24.80	86.34	59.52
1968-1969	30.34	25.75	30.34	25.75	79.00	64.38
1969-1970	36.67	21.48	36.67	21.48	82.15	51.66
1970-1971	41.81	29.21	41.81	29.21	87.48	73.03
1971-1972	36.29	27.75	41.56	27.75	92.35	69.39
1972-1973	31.28	30.30	35.82	30.30	79.61	59.81
1973-1974	45.67	23.18	45.67	23.18	119.97	51.86
1974-1975	41.68	34.79	41.68	25.51	122.72	96.26
1975-1976	33.98	28.37	33.98	28.37	100.06	85.11
1976-1977	24.84	20.77	24.84	19.38	73.26	62.31
1977-1978	28.50	20.41	28.50	20.41	74.50	63.37
1978-1979	30.10	22.36	30.10	22.36	72.12	61.35
1979-1980	29.25	22.43	31.13	22.43	80.58	61.19
1980-1981	16.40	25.29	18.57	27.04	45.18	74.95

a. Deflated prices according to the implicit gross agricultural product (base year 1966). The farm year runs from 1 August to 31 July of the following year. Prices correspond to the seasonal average for the farm year. For instance, the consumer price for farm year 1965-66 corresponds to the 1966 average.

Source: Table derived from data supplied by CNP and the Ministry of Economy, Industry and Commerce.

a bean and grain legumes research programme. This was begun in 1977. The intention was to bring together all work which up to that date had been done in scattered, isolated fashion by such institutions as the University of Costa Rica, the CNP, and others.

The planning of research on and transfer of new technology and of specific programmes as well, has since 1978 been the responsibility of a team made up of staff from the Ministry of Agriculture, the University of Costa Rica, the CNP and the National Seed Bureau. This date also coincides with the beginning of the work of the International Centre for Tropical Agriculture (CIAT) in the country. The main concern of the programme up to 1981 was genetic improvement and, to a lesser extent, improved cultural practices and phytopathology. The programme released the variety "Talamanca", which exhibits greater tolerance to pests and diseases than do the traditional varieties. The CNP distributed this variety to farmers just recently -- in mid-1980, so it is still difficult to assess the impact of these activities on bean production and yields.

Between 1958 and 1977, bean research was undertaken at the University of Costa Rica. The main effort consisted of the collection of local material for trials and conducting varietal crossings with cultivars brought from Mexico. The most important varieties released by the programme were San Fernando and Mexico 80. At the same time, in 1963, the Food Crops Unit of CATIE in Turrialba established a bean research programme. This effort focussed on genetic improvement, variety production and experimentation at the farm level. The programme also set up a germ plasm bank which it later donated to CIAT. This programme released the varieties Turrialba 1, 2, 3 and 4, which were widely distributed. The programme's activities ended in 1973.

The outcome of government action expressed through economic and technology policies has had little success with respect to basic grains production. The relatively recent appearance of strategies to develop techniques to increase maize and bean productivity has resulted in a slight increase in per hectare yields at the national level (Table 5). The economic policies applied (prices and imports) corresponded primarily to short-term

TABLE 5. Costa Rica: production, area planted (ha), and yields (kg/ha) of maize and beans

Harvest[a]	Beans			Maize		
	Produc.	Area	Yield	Produc.	Area	Yield
1965-66	12 935	51 716	250	62 724	54 601	1 140
1966-67	7 071	37 200	190	67 672	57 813	1 170
1967-68	4 240	22 305	190	71 408	61 007	1 170
1968-69	5 998	50 300	119	62 586	52 360	1 195
1969-70	3 947	42 122	94	61 361	50 604	1 212
1970-71	8 669	33 944	255	61 525	43 466	1 415
1971-72	10 308	22 770	453	64 696	44 010	1 670
1972-73	5 230	7 528	695	64 508	42 369	1 522
1973-74	4 792	7 213	664	87 037	60 503	1 438
1974-75	13 902	35 520	391	42 061	41 071	1 024
1975-76	16 212	35 525	456	91 770	64 770	1 417
1976-77	14 059	27 571	510	88 907	52 902	1 680
1977-78	14 010	24 192	579	77 524	43 756	1 772
1978-79	11 321	21 946	516	75 272	44 057	1 708
1979-80	11 504	24 894	462	65 102	38 843	1 676
1980-81[b]	13 570	24 728	549	83 712	45 420	1 843

a. August-July

b. Estimated figures

Source: Consejo Nacional de Producción, 1981.

needs and varied from year to year, bringing about extreme fluctuations in the areas planted, and therefore, in the total production (Table 6).

2. Specific policies for small farmers

The policies mentioned affected all farmers, but during the period examined here there were certain specific efforts aimed at the small farmer. The most important of these was a small-producer-oriented-credit policy.

The earliest attempts at support for the small farm sector began in 1914 with the establishment of the Farm Loan Offices, set up to provide a line of credit to a group not served by private banks. The Farm Loan Offices operated with capital obtained by the National Bank from private sources. The Bank paid those sources a 2 percent annual interest rate and financed the small farmers at a 4 percent annual interest rate.

The structure was changed in 1937, and reconstituted as the Farm Credit Board, which operated with funds from the National Bank obtained from the Central Bank and external sources. External sources currently provide most of the funding. Since 1974, the prevailing interest rates for these credits have been subsidized and are substantially lower than the interest rates on loans to other groups of producers (Table 7).

The major effort by the government concerning technological development has been to induce growers to change their cropping systems and adopt varieties and methods developed by the commercial sector. Only in the last 5 or 6 years has research been done on improving traditional systems. It has been recognized, for instance, that the bean planting method known as "frijol tapado", is tied to the availability of farm labour at the time of the coffee harvest. So, instead of recommending that this method be replaced by a more modern one, as was formerly done, research is now ongoing to improve the "frijol tapado" system[1/].

1/ So called because the bean, broadcast sown on a fallow field, is covered by the surrounding weeds and sprouts on top of the ground protected from the sun by the weeds covering it. The crop usually gets no care or technical assistance: no tillage beans.

TABLE 6. Costa Rica: domestic production, imports and exports of maize and beans, 1966-80 (in metric tons)

Year	Maize			Beans		
	Domestic production[a]	Imports	Exports[c]	Domestic production[a]	Imports	Exports[c]
1966	62.274	2 955	85	12.935	4 691	94
1967	67.672	3 152	735	7.071	7 414	50
1968	71.408	11 007	1 879	4.240	14 129	13
1969	62.586	16 663	47	5.990	8 425	62
1970	61.361	31 763	445	3.947	16 121	1
1971	61.525	26 231	407	8.669	16 602	1
1972	64.696	19 843	328	10.308	11 178	26
1973	64.508	43 164	1 536	5.230	5 774	106
1974	87.037	34 680	b	4.792	33 089	1
1975	42.061	13 098	2 880	13.902	4 745	b
1976	91.770	3 958	b	16.212	17	4 044
1977	88.907	3 315	4 582	14.059	188	80
1978	77.524	5 763	1 248	14.010	377	b
1979	75.272	3 965	b	11.321	5 114	58
1980	65.102	61 005	b	11.504	12 528	8

a. Includes production during on August-July crop year.

b. Insignificant amounts exported.

c. Exports were made in order to capture gains due to higher prices being offered in other countries.

Sources: Dirección General de Estadística y Censos; Banco Central de Costa Rica; Consejo Nacional de Producción.

TABLE 7. Interest rates established by the Costa Rica National Banking System (selected years)

Sector	1952	1964	1966	1974	1978	1979
Industry	-	7 y 8%	8 y 9%	7 a 10%	8 a 12%	18.2%
Livestock	6 y 8%	7 y 8%	8 y 9%	8 a 10%	8 a 12%	18.2%
Agriculture	5 y 6%	7 y 8%	8 y 9%	8 a 12%	8 a 10%	18.2%
Basic Grains:						
Small producers	6%	7%	8%	8%[a]	8%	8%
Other producers	6%	7%	8%	10%	a	18.2%

a. Three points above the basic interest rate set by the Central Bank.

Source: Banco Central de Costa Rica, Crédito y Cuentas Monetarias. Series 1950-1980.

B. The Regional Socioeconomic Context: Limitations to the Appropriation of the Economic Surplus

This section of the paper describes the economic relations between small farmers and those agents and institutions representing the commercial (merchants, coffee processors) and financial (banks and coffee processors) sectors. The purpose of this brief analysis is to identify the impact of these relations on the process of technical change within the area of the study. The description will be confined to those relations which significantly affect what happens to peasant surplus production, and which are subject to modification through changes in public policies, such as subsidized prices, market regulations, and the like.

1. Coffee production and the coffee processors

The economic relationships most affecting the production of coffee in Pejibaye have been those established between the coffee planters and the processors in the area. The processors buy the coffee and, at the same time, finance most producers who require loans.

The process of coffee marketing begins as soon as the crop is picked, whereupon it is taken to receiving stations located in various sites in the area. When the coffee growers deliver their harvest, they receive a receipt for the amount delivered. This is used to claim payment when the processor has sold the coffee and the Coffee Board has determined the final payment. The producer can request an "advance" payment for the coffee (usually 500 colones for each fanega delivered) which is discounted from the final payment, 5-7 months after the coffee has been delivered to the plant. This delay is caused by the fact that the final price is not known until the coffee has been sold on the international and domestic markets.

A verification survey taken of 70 coffee producers in the area showed that 54 percent took loans to finance production-related expenses. Of this 54 percent, 88 percent received loans from the local processing plant. No grower was financed by the National Banking System (SBN)[1/]. Coffee growers

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1/ In line with the government policy of not encouraging coffee production in areas thought to be ecologically marginal for coffee.

can request loans from the plants for up to 60 percent of the estimated value of the crop (estimated on the basis of average amounts harvested in previous years). This loan is guaranteed by the coffee which the grower is to deliver to the plant at harvest-time, and is dicounted from the final payment. But the coffee grower must pay interest on the loan from the date of its inception up to the following 31 March.

The National Banking System has traditionally offered subsidized loans (real negative interest rates) for coffee and for small farmers. Funding for coffee is standard nation-wide and is not officially linked to a specific area or group. Nonetheless, the funds available tend to be distributed among producers in the Central Plateau area. In 1980, for example, there were funds available at subsidized interest rates (8 percent p.a.) for coffee plantation renewal, planting improved varieties and the replacement of unproductive plants. According to the SBN representative in Pejibaye, no coffee grower in the area received a loan from this fund as resources were exhausted soon after having been put in circulation. Almost the entire fund was loaned to growers located in the Central Plateau area.

2. Maize and bean production, local merchants, and the National Production Council

Most maize and bean producers in Pejibaye grow these crops for home consumption[1/]. Once the family's needs have been covered, they sell the rest to local merchants and to the National Production Council (CNP). In many instances, the local merchants buy the bulk of the surplus, with the CNP participating mainly to regulate prices. The CNP price is set in accordance with the prevailing government policy and becomes the floor (minimun) price.

When a farmer wants to sell his crop to the CNP, he takes it to the outlet[2/], where it is weighed and checked for moisture content and

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1/ There is a sub-zone where maize and bean production for sale predominates. The area is less suitable, ecologically, for coffee, and was settled fairly recently.

2/ The CNP maintained a purchase outlet in Pejibaye until 1972, when it was closed for budgetary reasons. But the CNP commonly shows up in the area with the greatest production (El Aguila) at harvest-time, offering the maize and bean growers a real alternative for selling their product.

impurities. Should these exceed the fixed ceiling, a penalty is imposed which consists of lowering the threshold price. If, under these conditions, the price is still higher than the one offered by local merchants, then the farmers prefer to sell to the CNP. Farmers reported that while the nominal CNP price is higher than the merchants', the application of the penalty equalized prices. For this reason, merchants buy most of the crop when the government is not granting subsidies. The reserve occurs when, as in 1981, the price paid to producers is higher than the consumer price, and the CNP purchased virtually the entire crop.

Farmers sometimes prefer to sell to local merchants because extra advantages are offered. Often the merchants supply sacks and transport from farm to warehouse. Some also grant credit for consumer items, backed by the product which the farmer will later deliver and which covers the value of the items sold on credit. The farmers, however, retains the option to repay debts in cash.

The use of institutional credit to finance the maize and bean crop is uncommon among small farmers in the area. The aforementioned survey showed that a mere 6-15 percent of these farmers obtained loans for this purpose. This is also partly due to the fact that the farm labour involved is supplied mainly by the family, and because purchased input use is low. In this sense, farmers are self-financing, paying for production costs with income from other activities such as day-hire or growing coffee.

The major source of credit for those farmers who do use it is the National Banking System, which operates through the Agency of the National Bank of Costa Rica. The SBN maintains special funds for loans to small farmers, but these funds are commonly tied to specific crops. At the present time, there is an AID-subsidized line of credit which is administered by the SBN and intended specifically for small farmers producing basic grains. The fact that these funds are tied to activities which are less profitable than coffee prevents producers from investing the funds in activities with the highest potential payoff.

3. Small farmer participation in income distribution

Theoretically speaking, the possibility exists for a small number of commodity buyers and credit suppliers to use their powers of negotiation to appropriate a good part of the income derived from agricultural production.

The economic position of the numerically large group of small farmers, with respect to this group of buyers and suppliers is precarious because: a) they are not in a position to store their crops while awaiting more favourable prices; b) they cannot finance a crop demanding significant amounts of purchased inputs; and c) the fact that they are scattered and unorganized decreases their chances of being politically effective in getting their needs recognized in the market-place.

One might expect, under the above-described conditions, that the distribution of income from production and marketing, and the trade and financial relations established, would favour those sectors with greater economic power and political influence. Table 8 shows the percentages received by producers of maize, beans and coffee. Maize and bean figures are estimated on the basis of consumer prices and coffee on the basis of the sale price. In all cases, producers received a major share of the income generated, which would imply that there is not much surplus appropriation by other agents with greater potential bargaining power, such as merchants and processors. This is due to the fact that the government establishes the distribution of coffee-generated income by means of laws and regulatory agencies like the Coffee Board and regulates maize and bean prices through actions of the CNP.

However, there is another way to capture an increased income-share via the establishment of usurious interest rates on loans advanced to finance production costs. This did not occur with maize and bean production, as most farmers in Pejibaye do not use credit, and also because a line of credit specifically established for small farmers with subsidized interest rates, which are negative many times over in real terms, does exist.

TABLE 8. Costa Rica: producers' percentage share of total income derived from maize, bean and coffee production (selected years)

Farm year	White maize (PP/CP)	Bean (PP/CP)	Coffee (PP/SP)
1964-65			70.7
1965-66	82.7	76.7	68.6
1966-67	81.0	55.3	73.9
1967-68	80.1	68.9	76.0
1968-69	84.9	81.5	76.0
1969-70	58.6	62.9	
1970-71	69.9	83.5	
1971-72	66.8	75.1	
1972-73	84.6	75.1	
1973-74	50.8	43.2	
1974-75	61.2	78.4	69.6
1975-76	83.5	85.1	
1976-77	78.0	85.1	73.2
1977-78	71.6	85.1	
1978-79	74.3	85.1	71.9
1979-80	72.1	75.9	
1980-81	145.7	165.9	

PP = Producer price.

CP = Consumer price.

SP = Sale price which is the weighted average of the portion earmarked for export and the price of the portion earmarked for domestic consumption, according to quotas set for each harvest.

Source: Table prepared based on Tables 1 and 4.

In the case of coffee, the situation is not the same. The major source of financing, the coffee processors, is private[1/]. And as it is not state-regulated, loan terms and interest rates can be very flexible. Theoretically, additional income might be captured in this way, using the credit system offered by the coffee processing plants. In 1981, for example, the nominal interest rate on loans granted by these plants was 24 percent p.a., comparable to the prevailing rate for unsubsidized loans. The terms of the loans specified that interest ran from the day the loan was granted (usually at the time of the harvest in September-October) to the following 31 March. By that date the plants have usually sold the coffee and the grower has been paid his share, minus the value of the loan. Interest, however, is charged for the entire period, even in the event that the debt is repaid before 31 March[2/]. This means that the interest rate varies in accordance with the date the loan is repaid and usually exceed 24 percent.

Other potential means for capturing surplus exist through the establishment of high prices for consumption goods and production inputs that farmers must purchase. Although a detailed analysis was not undertaken of this aspect, present government policies affecting the establishment of prices for consumer goods indicate that significant farm income reduction due to unfavorable terms of trade is very improbable. Farm implements and basic consumer goods are sold directly to farmers through the state-controlled CNP outlets in rural areas. Inputs such as fertilizers, etc. are imported duty-free, thus allowing the establishment of lower prices. Furthermore, with the exception of coffee producers, small farmers acquire minimum amounts of purchased inputs.

The description of these regional relationships suggests that, contrary to expectations, small farmers in Pejibaye do receive the greater part of the value of their products, and there is no significant appropriation of

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1/ A common practice in the area is for exporters to provide funds for the plants, which in turn loan to the growers. The exporters secure funding from foreign import firms or from the international finance market.

2/ Plant owners point out that the reason for this type of contract is that they themselves need loans to finance the growers, but only receive payment for the coffee months after the sale. If so, the plants would only be covering their own expenses and there would be no surplus appropriation.

the surpluses they generate by other groups with more power to negotiate. This can be traced mainly to state intervention in the form of income distribution, marketing and financing regulatory mechanisms (financing for maize and beans). Consequently, any constraints on the small farmer vis-a-vis technological change do not have their origin in a transfer of income to other Costa Rican social groups through terms of exchange unfavourable to the farmer.

C. Production Trends in Pejibaye and Technological Change at the Farm Level

With the arrival of the first settlers in Pejibaye forty years ago, forest clearing and the cultivation of certain products such as maize and beans for home consumption began. Soil fertility and suitable climate enabled the farmers to get very good maize and bean yields even in the absence of soil conservation practices. Small plots of coffee were also planted during this same period. Oxcart trails were built, making it possible to transport the coffee produced and to sell it to coffee processing plants in San Isidro del General, capital of the canton of Pérez Zeledón. Prior to 1950, marketing for the commodities of these farmers was in the embryonic stages, and most of the grain crop was consumed by the farmer and his family.

The first all-weather roads were opened in the early fifties, linking the zone with the southern part of the Panamerican Highway. This was a boost to the marketing of basic grains. Production, especially of maize and beans, became much more vigourous. New inmigrants, many from the coffee-growing areas of the Central Plateau, arrived in the fifties. These farmers acquired land and planted crops they had past experience with, especially coffee. The development of coffee-growing in the area was more in answer to the set of economic circumstances (the experience and traditions of the new arrivals backed by the existing infrastructure for processing and distribution) than to any special effort of the government. During the period the zone was being settled, there was no expressed government policy as to what ought to be done in the area. The area was considered to be a basic grains basket due to

TABLE 9. Pejibaye: changes in area planted to coffee, beans and maize (ha) 1950-1973

Region	Area cropped: Coffee			Area cropped: Maize			Area cropped: Beans		
	1950[a]	1963	1973	1950[a]	1963	1973	1950[a]	1963	1973
Costa Rica	48 800	82 527	83 406	54 947	53 281	51 888	27 564	43 800	26 681
Pérez Zeledón	678	4 946	8 719	n.d.	4 180	5 032	n.d.	5 186	3 188
Pejibaye	n.d.	n.d.	996	n.d.	n.d.	1 326	n.d.	n.d.	1 191

a. Farms larger than one block (0.7 ha)

Source: Dirección General de Estadística y Censos, Censos de Población, 1950, 1963 y 1973.

the predominace of maize and beans. Moreover, when the international price for coffee fell in the late fifties, and quotas for coffee production were set for grower countries in 1963 (International Coffee Agreement), the state adopted policies tending to discourage coffee production in the area by depriving it of technical and credit assistance[1/].

This government policy was not very influential, however, because the coffee growers in the area got loans and credit from the coffee processors, without there apparently existing any type of discrimination by the state to discourage this. It is possible that the absence of state technical assistance was a negative stimulus to technological change, especially with reference to the acceptance of new varieties, which proceeded at a slower tempo than in other coffee-growing areas in the country.

It is evident that, despite certain weak state actions designed to restrict coffee production in marginal areas, that the broader state policy toward coffee production has favored expansion (Table 9). This is reflected in two factors: a) economic conditions heavily favoured coffee over maize and beans (Appendix A); and b) there were better facilities for procuring credit and for marketing coffee. Pérez Zeledón is now the canton with the highest production in the country, though yields (per unit area) are among the lowest.

Maize and bean production trends are not comparable to those of coffee (Table 9). A slight increase in the area cropped was noted for maize, and a major decrease in the area planted to beans. Generally speaking, this is in response to two factors: a) a state policy during most of the period under study which attempted to supply staple commodities cheaply to urban

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1/ This policy was applied throughout the southern Pacific area of the country, which includes the cantons of Buenos Aires, Osa, Golfito and Coto Brus, in addition to Pérez Zeledón. The area, in which 13 718 ha are now under coffee, is presently served by one coffee expert from the Ministry of Agriculture.

consumers (implying low prices to farmers); and b) a lack of appropriate technologies to make possible substantial boosts in the productivity of these grains[1/].

The following is a general description of technological changes in Pejibaye since the area has been settled. The description is followed by an examination of the most significant technologies adopted on the different types of farms present in the area.

1. Technological change in coffee production

a. Adoption of varieties

The oldest variety in the country, known as "Típica" or "Criolla", comes from an arabica variety brought to Costa Rica at the end of the 18th century when coffee was first planted here. The "Salvadoreña" variety was adopted in 1920, and was crossed in the forties to obtain the "Tico" hybrid. During the fifties three short-stature, high-yield varieties called Caturra, Mundo Novo and Geisha were brought from Brazil.

In Pejibaye, the most common varieties are the "Criolla" and "Salvadoreña" used by over 70 percent of the producers interviewed in the area. The oldest coffee plantations were planted in "Criolla" about ten years ago, on the average, and are halfway through their productive life[2/]. There is very little chance that a producer would be willing to renew a coffee plantation before productivity declined substantially, and then wait 4-5 years until the new plants begin to produce.

What usually happens is that new varieties are adopted in the form of additional new plantings, or by interplanting (retupición). Land is scarce, and so the dominant practice on small peasant farms is interplanting, which consists of planting new plants among the existing ones, thereby increasing plant density. Sixty-two percent of the Pejibaye coffee farmers

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1/ It would be unfair to assign blame for this problem to the government alone, since maize and bean technology is also much less developed internationally than for example rice and wheat technology.

2/ The productive life of a coffee plantation is estimated to run about twenty years.

have adopted this practice, mostly using traditional varieties ("Criolla" and "Salvadoreña"), although the modern variety "Caturra" is common also. This practice has been adopted quite recently, as evidenced by the fact that 70 percent of all interplanting has taken place within the last five years.

One aspect affecting the adoption of varieties is the availability or ease of obtention of seeds. Fifty percent of the coffee growers have their own home nurseries (after six months to one year, the young plant is planted in the plantation). Of this fifty percent, 87% use seeds from their own farm exclusively, while the remaining 13 percent also buy the seed from a friend or neighboring planter. Only one grower reported that he had bought seed from the Coffee Board. Half the growers buy young plants produced in the nurseries of other farmers.

Obviously, home production of seeds and purchase from other growers predominates. In selecting seeds, growers are guided by such criteria as the appearance of the bean (colour and size) and its ripening season (early or late). When the grower buys seed from the Coffee Board he can look at the bean, but has no way of knowing its ripening time[1/]. This is an important element, as the grower can, to some extent, spread out harvest labour requirements over a longer period during harvest-time. The only way he can know what time the beans ripen is to use his own seed or that of a trusted neighbor. This is a constraint on the acceptance of new varieties[2/].

b. Fertilization

The use of chemical fertilizers is relatively recent (about 6 years). In the Pejibaye area, 45 percent of the farmers use chemical fertilizer regularly; 13 percent in sporadic fashion; and 42 percent not at all.

1/ In selecting and recommending specific seed, coffee culture experts do not take ripening season into consideration.

2/ This point is given special attention in the following document on technological policy considerations.

The traditional method of fertilizing coffee was developed in the Central Plateau area. The practice, called "pitting" ("tanqueo" o "gaveteo"), was brought to Pejibaye by coffee workers settling there. It consists of digging pits 10 cm deep and 50 cm wide and long on the upper side of the slope, maintaining 1 m of distance from each plant. The pits are then filled with mulch which eventually forms compost which fertilizes the roots. The pits also prevent soil erosion as the hillsides under coffee become contoured.

The introduction of chemical fertilizers has substantially curtailed the use of this method. Some farmers maintain the pits as a form of erosion control and apply the fertilizers on the pits. But interplanting is gradually replacing pitting, as new plants are planted in the space formerly occupied by the pits.

Sixty percent of the coffee growers using chemical fertilizers apply the full amount in one application and 38 percent divide the amount into two applications. The three most commonly-used types of fertilizers are the full-formula (N-P-K- plus trace elements) and two which basically provide nitrogen (urea and nutrán). Fertilizers are usually applied in May (the full formula) and in November-December (nitrogen formulae). Forty-four percent of the farmers applying fertilizers indicated that in recent years there have been no substantial variations as to rate/ha applications -- 20 percent of the farmers applied more and 31 percent less, the latter due to the 1981-82 jump in fertilizer prices.

c. Use of pesticides, insecticides and herbicides

Pesticides and insecticides are rarely used. Farmers feel that American leaf spot and common leaf spot, the most common diseases, attack the leaves but do not affect yields to any significant extent. Chemical weed control is somewhat common, however, though more recently adopted and less common than fertilization. Thirty-five percent of the farmers normally use herbicides, while 94 percent weed manually with spade or machete (some grower use both techniques, hence the overlap). Of the farmers using herbicides, 81

percent have adopted the practice during the last five years. The most popular herbicides are Gramoxone and Radex. Half the farmers have continued to apply the same rates/ha, whereas 33 percent of the farmers have cut back the amounts used, mostly because the high cost of the input is not offset by the advantages it offers (principally lower labor costs).

2. Technological stagnation in maize and beans

a. Adoption of varieties in maize culture

Maize is usually planted twice yearly: "winter maize" in winter and "summer maize" in the summer or dry season. Cross pollination of maize makes variety identification difficult as it causes genetic deterioration. That is, when varieties are mixed in the same field the new ones soon lose their identity through crossings with local varieties. There are innumerable local varieties, some of which produce high-yields. Growers almost always identify the maize they grow by such generic names as "maicena", "white maize", and "yellow maize", and most use seed collected during the previous harvest. Only 10 percent buy improved seed from the National Production Council, which would appear to indicate that there is little adoption of new varieties.

b. Maize fertilization

Fertilizer application is a very recent practice which began about 4 years ago, being adopted by 45 percent of the winter maize and 59 percent of the summer maize growers.

The traditional form of fertilizing consisted of making piles from the trash left after weeding by hand. The piles were arranged in rows between which maize was sown with a planting stick. One month later the rows were ridged, i.e., the decomposed plant matter from the piles was forked around the roots of the plants; to maintain soil fertility, the position of the piles was changed every year, leaving part of the plot fallow. At that time, only one crop was planted a year, which was also a soil conservation aid.

This was virgin land during the colonization period; the soil was highly fertile and did not need fertilizer inputs. But heavy farming in the last decade has considerably diminished soil fertility, and this has led to the use of chemical fertilizers in order to maintain reasonable yields levels.

c. Use of herbicides, pesticides and fungicides for maize

A prominent preventive technique used with corn is to dip the seeds, usually with Aldrin, to prevent ant attacks. Growers in the area adopted this practice many years ago, and so it is not a recent technological change. There is a higher percentage of adoption as compared to other insecticides -- 75 percent vs. 25 percent. A slight tendency to adopt herbicides during the same period that chemical fertilizers began to be adopted was also noted. But they are infrequently used, indicating that manual weeding continues to be dominant weed control technique.

d. Adoption of varieties in bean culture

Like maize, beans are planted manually twice a year. It should be pointed out in this case that different techniques are used for the different seasons. The beans are sown in winter and in the summer no tillage bean growing, or "frijol tapado", is the dominant technique.

In contrast to maize, most farmers identified the varieties they used. Table 10 lists those varieties mentioned, divided into traditional ("Criolla"), modern, and unclassified[1/]. The latter were identified generically ("red bean", "black bean", "CNP") and might well belong to any one of the varieties classified.

Table 10 reveals a certain continuity in the supply and acceptance of bean varieties during the period under study. Generally speaking, the traditional varieties and those developed by the University of

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1/ There may be fewer varieties than listed, as those with names like Chimbolo and Chimbolón are probably the same variety.

TABLE 10. Pejibaye: varieties of beans planted

Traditional	Modern(by decade of introduction)			Unclassified
	1950	1960	1980	
Black Chimbolón	San Fernando	Turrialba 1	Talamanca	Black Bean
Red Chimbolón	Mexico 80	Turrialba 2	Jamapa	Red bean
Chimbolón	Mexico 29	Turrialba 3		CNP
Black Chimbolo	Mexico 27	Turrialba 4		Purple bean
Red Chimbolo	Mexico 20	Turrialba 5		White bean
Chimbolo	Black Mexican	Turrialba Indian		Cuban
Pinto	Mexican			Little Cuban
Quiubra				
Red Quiubra				
Cañita				
Cañero				
Sierra				
Little Sierra				
Rico				

Source: Verification survey, 1982

Costa Rica during the fifties still predominate today. However, there has been considerable adoption of varieties launched by the National Production Council in 1980 and developed under the guidance of CIAT. They are hardier and better adapted to the ecological conditions prevailing in bean-growing areas in Costa Rica.

e. Use of agricultural chemicals in bean culture

There is very little use of chemical inputs for bean plant protection, fertilization and upkeep. Most farmers experimented with fertilizer at some time, but no major increase in yields was detected. Some growers felt that the high incidence of pests (especially slugs) cut heavily into the chances for a good crop, and so they avoided incurring expenses for fertilizer. Here, the risk factor appears as a constraint to the adoption of fertilizers. Only 14 percent of the growers use herbicides and even fewer use insecticides (6 percent). For herbicides, this is mainly due to the possibility of having recourse to manual techniques, the high-risk nature of the crop, and the low product price which does not favor heavy investment.

3. Effects of technological change on the organization of peasant production

The adoption of new technologies, although unequal in intensity for the three commodites under study, had certain effects on the local production systems. The following paragraphs examine the effects of these changes on each crop, considering four variables: soil fertility, employment, the use of industrial inputs, and productivity (Table 11).

a. Coffee

Table 11 reveals that the only factors affecting soil fertility have been interplanting and the use of chemical fertilizers; the first had a negative and the second an ambiguous impact. Interplanting increased seed densities considerably (by 50 to 100 percent), but it did much to deplete the soil. This in turn necessitated increased use of chemical

TABLE 11. Pejibaye: effects of technological change on the production unit

Commodity	Fertility	Labour/ha		Industrial Inputs	Productivity	
		FL	HL		Land (kg/ha)	Labour (kg/hr)
1. COFFEE						
a. Modern variety	0	+	+	+	+	+–
b. Interplanting	-	+	+	+	+	+–
c. Chemical fertilizers	+–	-	0	+	+	+
d. Herbicides	0	-	0	+	+	+
2. MAIZE						
a. Chemical fertilizers	+	-	-	+	+	+
b. Herbicides	+	-	-	+	?	+
3. BEANS						
a. Modern Varieties	0	0	0	0	+	+

+ = Positive effect
- = Negative effect
FL = Family labour
0 = Neutral
+– = Undetermined
HL = Hired labour
? = Unknown

fertilizers to offset soil degradation. But the use of chemical fertilizers replaced the compost pit system, which nourished the plant and also prevented soil erosion. The adoption of fertilizers and the technique of interplanting (which eliminated the compost pits) increased soil erosion.

However, the introduction of new varieties and the interplanting technique did have a positive effect on employment, but this was not true of the adoption of agricultural chemicals (Table 11). High yielding varieties demand more workers at harvest-time, and interplanting demands more workers for pruning, thinning, removal of excess shoots, and the like. The adoption of agrochemicals (fertilizers and herbicides) replaced the traditional techniques (which were more labour-intensive) of organic fertilizing, clearing and weeding. Fertilizers replaced the compost pit system, and herbicides manual weeding, although it is true that both latter techniques are often combined.

It is important to make a distinction between family labour (FL) and hired labour (HL), because this varies considerably from one unit to the next, in accordance with the number and ages of family members and the area cropped. Usually, the crop management work is done by the farmer himself, while the harvest is often undertaken by both family and short-term hired workers. For this reason, the techniques which have to do with cropping practices (interplanting, fertilizers, herbicides)have greater impact on how family labour is used, whereas harvest practices (modern varieties, interplanting) affect both family and hired labour.

In addition to this, the adoption of modern varieties and interplanting demand greater use of industrial inputs, mainly chemical fertilizers. The new varieties need nutrients if they are to achieve their potential productivity. The need for additional nutrients is intesified by interplanting, as a larger number of plants are growing in the same unit of area (Table 11).

Productivity was examined by examing the effects of technological changes on both land and labour productivity. The vast majority of coffee growers in the Pejibaye area plant both traditional and

modern varieties in the same fields, using the interplanting technique. Yields statistics do not distinguish between the productivity of different varieties planted together in the same field (Table 12). However, experimental data do seem to demonstrate the superior productivity of the modern varieties (Aguilar, Barboza and León, 1982).

Table 12 attempts to quantify the impact of interplanting and the adoption of herbicides and chemical fertilizers on land productiviy. This is done by comparing the average yields of different producers according to the frequency of adoption.

The absence of significant differences in the case of interplanting (Table 12), is due to the fact that this technique has been newly incorporated, which means that many of the new plants have not yet reached the age of productivity. Therefore the effect of the technique on yields is not yet apparent. The same Table shows that the adoption of chemical fertilizers and herbicides has had substantial impact on yields. As there is no data from controlled experiments, there is no way of knowing the effect of each separate technique because all the farmers who use fertilizers also use herbicides. It is quite possible, however, that the major impact on productivity can be traced to the adoption of chemical fertilizers, given the fact that the farmers have no other way to maintain soil fertility than by applying fertilizers, whereas there is an alternative to herbicides; those farmers not utilizing herbicides can control weeds by utilizing manual labour.

Concerning labour productivity, measured in terms of how much is produced per man hour or man day, the trends are ambivalent for the adoption of modern varieties and the impact of interplanting. On the one hand, both techniques increase yields per unit of area, which would imply a boost in labour productivity, ceteris paribus. But on the other hand, the increased yields create a greater demand for labour, especially at harvest-time, which has a negative impact on the figure for labour productivity. The net impact of these two contrasting factors is unknown and should be subjected to controlled experimentation.

TABLE 12. Coffee: impact of interplanting, chemical fertilizers and herbicides on land productivity*

Techniques / Frecuency of adoption	Interplanting		Chemical fertilizers		Herbicides	
	Farms (%)	Yield	Farms (%)	Yield	Farms (%)	Yield
Always	64	5 528	45	6 851	8	8 162
Sometimes			14	5 220	28	5 929
Never	32	5 316	41	3 992	64	4 957

* Average kg/ha yield (coffee berries)

Source: Verification survey, 1982

The effect of chemical fertilizer and herbicides on labour productivity is unmistakably positive, given the per hectare boost in yields and the reduced demand for labour, which implies a greater product per unit of labour invested.

b. Maize

Two major technological changes involving industrial inputs were observed for maize: the use of chemical fertilizers and herbicides. However, neither of these innovations were adopted in full by the farmers. Chemical fertilizers maintain or increase soil fertility in soils depleted by repeated maize crops. The farmers reported that the first maize harvests on new land produce good yields, but that with time yields fall steadily, requiring the application of chemical fertilizer to maintain soil fertility and ensure acceptable yield levels. The use of herbicides helps to conserve soil fertility, whereas manual weeding promotes erosion and the loss of nutrients and soil moisture caused by turning the soil.

As for labour, both techniques are labour-saving, though to different degrees and in different ways. Chemical fertilizers replaced organic fertilization, which was a highly labour-intensive technique. Herbicides directly replaced labour, and which was the intention of the farmers using them.

Table 13 compares maize yields in terms of the frequency of adoption of agrochemical technologies in maize. The use of chemical fertilizers produced a slight increase in yields. But the relationship does not appear clear in the case of herbicides. Average yields for winter maize were higher with this technique but the reverse was true of summer maize. As was true for coffee, the adoption of agrochemical techniques had the effect of reducing the demand for labour, often increasing the productivity of the land, and so the net effect is an upward trend in labour productivity.

c. Beans

Bean production underwent the fewest technological changes, the most significant of which was the gradual (partial) adoption of new

varieties. Since cropping methods were unchanged, the most notable impact on the production unit was on land productivity, and to a lesser extent, labour productivity.

Table 14 breaks down yields by varieties. Though the 1950 varieties predominate, more recently launched varieties, for both regularly sown winter beans and the summer "no tillage beans", appear to be superior in terms of productivity. Since the amount of labour needed to plant and harvest beans did not change, an increase in yields necessarily implies an increase in labour productivity.

IV. TECHNOLOGICAL CHANGE AND SOCIAL DIFFERENTIATION

One basic assumption of the theoretical framework (PROTAAL, 1980) is that the potential for technological change varies in accordance with the economic level of the production unit. In other words, technological acceptance is greater on those farms which can afford to incur the expenses and assume the risks inherent in agricultural production. This capability is generated over time through the accumulation of surpluses, once production and reproduction costs for the family unit have been met.

Surpluses make possible the capitalization of the production unit, mainly through the purchase of additional land. The capacity to generate surpluses is reflected in the productive level of the farm. This in turn is determined by the relative quantities of each commodity produced, and by their market value as well. This implies that a farm's capacity to generate surpluses depends in part on the area cropped and the yields obtained. Of greater importance is total production measured in terms of monetary value, as there is not necessarily a direct connection between acreage and productive value.

In an attempt to determine the differences in terms of resource endowment, the adoption of technology and therefore the potential for farm capitalization, a representative sample (numbering 108) of Pejibaye production units was divided

TABLE 13. Maize: the effect of chemical fertilizers and herbicides on land productivity

Techniques / Adoption	Chemical fertilizers		Herbicides	
	Farms (%)	Yields (kg/ha)	Farms (%)	Yields (kg/ha)
Winter maize				
- Yes	48	1 409	20	1 519
- No	52	1 236	80	1 267
Summer maize				
- Yes	60	1 190	31	904
- No	40	852	59	1 074

Source: Verification survey, 1982

TABLE 14. Beans: Yields from traditional and modern varieties (average kg/ha)

Planting method / varieties	Modern by decade of introduction			Traditional and unidentified
	1950	1960	1980	
Regular sowing	451	516	501	421
No tillage "or tapado"	275	525	435	319

Source: Verification survey, 1982

into three categories reflecting the various relative positions in terms of the monetary value of the production[1/]; the relative importance of each productive activity, and the composition and use of labour (family or hired)[2/].

The categories as defined were:

i) Semilandless (19 in number). This category included landless units and/or those who hire out most of the family labour.

ii) Peasant farmers (68 in number). This category was subdivided in terms of the monetary value of the production into lower, middle and upper peasants. It contains those production units devoting most of the family labour and other productive resources to growing coffee, maize and beans. These units may or may not hire temporary help, but in no case hire permanent workers. The bulk of their income derives from the above three commodities, and in most cases, the farmers own part of the area cropped, and are sharecroppers on the remaining portion.

iii) Semicapitalists (11 in number). This category includes units which hire salaried workers and/or derive most of their income from such activities as livestock or commerce. They generally own a large part of the land they work and utilize mainly hired labour.

A. Characteristics of the Production Units and their Impact on the Acceptance of Technologies

The following is an analysis of the general features of different farm situations in accordance with the above categories as found in Pejibaye. The analysis stresses the differences observed in terms of the levels of technological adoption, which can affect social differentiation trends in the area.

1/ To determine the monetary value of production in each category, commodities were assesed at their market price, disregarding whether they were intended for sale or home consumption.

2/ Ten of the interviews did not provide sufficient data on the utilization of family labour or origin of income so these could not be pinpointed and were therefore excluded from the study.

Table 15 illustrates the major production activities prevalent in Pejibaye. Coffee, maize and beans are first in all categories, save the semicapitalist, where livestock-raising predominates. In the three peasant subcategories, there are considerable differences in the importance of coffee, on the one hand, and maize and beans on the other. Coffee predominates on farms with a high production value, declining in importance on those of lesser production value. The reverse is true for maize and beans, which predominate on low production value farms, and diminish in importance on the high production units. The column "day hire" includes units in which most of the family labour is hired out, and is important only in the semilandless category. However, only 42 percent of these acknowledged day hire as their major activity, which implies semilandless still consider agriculture to be their main activity, despite the importance of their off-farm work.

Table 16 shows the average total area of farms in each category, the area planted to the three commodities included in this study and the ammount of grazing-land. Total farm size follows an ascending order which goes from semilandless to semicapitalists. The exception is the upper peasant, who generally owns less land, on the average, than the middle peasant. The absence of substantial differences among the categories is noteworthy in the case of area planted to maize and beans. The real difference is the amount of coffee and of grazing-land. Grazing-lands are the outstanding feature of the semicapitalist category: most of these reported livestock to be their major activity.

Among the peasants and semilandless, the striking difference is the amount of land under coffee. The upper peasant subcategory has an average area under coffee 2.5 times greater than the middle peasant, and about 5 times more land under coffee than the lower peasants and semilandless. The differences in coffee areas pretty well explain the differences in total value of production among the three peasant farmer subcategories.

Table 17 shows the distribution of the commodities in this study by intended use: home consumption, sale or payment for land use (sharecropping). All but insignificant amounts of the coffee produced are sold to the processing plants. The situation is different for maize and beans and varies

TABLE 15. Pejibaye: Major activities of producers by categories (%)*

Categories	Coffee	Maize and/or beans	Day hire	Livestock	Commerce
Semilandless	53	68	42	0	0
Peasants (all)	(69)	(59)	(3)	(7)	(0)
--Lower	50	81	0	0	0
--Middle	71	57	10	10	0
--Upper	90	38	0	14	0
Semicapitalists	27	9	0	73	27

* In all cases, the percentages add up to more than 100 as many producers reported more than one activity.

Source: Verification survey, 1982

LE 16. Pejibaye: Distribution of total and cropped area (ha) by categories

Categories	Total	Grazing	Coffee	Maize		Beans	
				Winter	Summer	Winter	Summer
Semilandless	1.5	0.6	0.7	0.3	0.8	1.2	0.4
Peasants (all)	(11.2)	(4.2)	(1.6)	(0.5)	(0.8)	(0.9)	(0.6)
--Lower	6.9	2.0	0.6	0.5	0.5	0.7	0.5
--Middle	15.4	5.0	1.2	0.5	1.4	1.2	0.6
--Upper	12.7	6.2	3.1	0.6	0.7	0.8	0.7
Semicapitalists	50.5	31.7	1.4	0.7	1.2	2.1	2.2

Source: Verification survey, 1982

TABLE 17. Pejibaye: Distribution of maize and bean production by categories (percentage of total production)

Product / Categories	Maize						Beans					
	Winter			Summer			Winter			Summer		
	HC	SH	S	HC	SH	S	HC	SH	S	HC	SH	S
Semilandless	56	21	23	34	25	41	34	29	37	36	25	39
Peasants (all)	(60)	(8)	(32)	(65)	(3)	(32)	(56)	(8)	(36)	(61)	(7)	(32)
--Lower	75	9	16	92	0	8	73	9	18	73	8	19
--Middle	56	8	36	56	4	40	38	7	55	58	4	38
--Upper	38	4	58	47	4	49	31	8	61	49	8	43
Semicapitalists	73	0	27	64	0	36	36	8	56	37	5	58

HC= Home consumption SH= Share to owner S= Sold

Source: Verification survey, 1982

considerably among the different categories. A salient feature of the semilandless is the proportion of the harvest delivered as payment for the land sharecropped (25 percent), which, added to the part earmarked for home consumption and sale, explains why they have to plant more land in order to obtain the same net income as those who do not have to rent land.

The percentages of these commodities intended for home consumption and sale differ greatly among the different categories. Lower peasants consume 73-92 percent of the maize and beans produced, and the amount sold is minimal (8-19 percent of the total production). In the middle peasant subcategory, home consumption slightly exceeds sales, while the upper peasant family sells more of their product than is consumed.

To close this brief analysis, and before looking at the adoption of technology by categories, Table 18 presents a breakdown of coffee, bean and maize yields by category. The differences between maize and beans are neither great nor constant. This is not true of coffee, however. The upper peasant subcategory got the highest yields, about 150 percent higher than the middle category, and 200 percent higher than the lower peasants and semiproletariats. If we assume a close relationship between productivity and level of technological adoption, the indicators of technological adoption by categories should vary in a comparable way to yields.

1. Technological adoption and coffee culture

As pointed out previously, the major technological changes in coffee took place in three areas: a) acceptance of new varieties; b) increased seed density through interplanting coffee plants; and c) use of herbicides and chemical fertilizers. Table 19 illustrates the percentage of growers adopting modern technologies by category. Excepting the semilandless, the extent of adoption corresponds closely with yields (Table 18). The most widely-accepted technique has been interplanting, followed by the utilization of chemical fertilizers. Among upper peasants and semicapitalists, the use of chemical fertilizers has topped the acceptance list, followed by interplanting among upper peasants and the adoption of Caturra coffee by semicapitalists.

TABLE 18. Pejibaye: Average coffee, maize and bean yields by category (t/ha)

Category	Coffee (berry)	Maize		Beans	
		Winter	Summer	Winter	Summer
Semilandless	4.0	1.0	0.7	0.4	0.3
Peasants (all)	(5.7)	(1.3)	(1.0)	(0.4)	(0.3)
--Lower	3.3	1.1	0.7	0.3	0.3
--Middle	5.8	1.2	1.2	0.5	0.3
--Upper	7.5	1.6	1.1	0.4	0.3
Semicapitalists	6.6	1.8	0.8	0.8	0.4

Source: Verification survey, 1982

TABLE 19. Pajibaye: percentage of growers adopting modern coffee technology. By categories

Category	Modern variety[a]	Interplanting	Herbicides	Chemical fertilizer
Semilandless	45	82	27	55
Peasants (all)	(25)	(61)	(36)	(54)
-Lower	17	44	17	28
-Middle	17	67	28	39
-Upper	40	70	60	90
Semicapitalists	57	43	43	71

a. Caturra

Source: Verification survey, 1982.

TABLE 20. Pejibaye: average time span for adoption of modern coffee culture technology. By categories

Category	Modern variety[a]	Interplanting	Herbicides	Chemical fertilizer
Semilandless	2.3	3.0	1.7	6.2
Peasants (all)	(5.2)	(4.4)	(3.1)	(5.8)
-Lower	6.0	4.1	2.0	2.6
-Middle	3.0	4.0	3.0	5.2
-Upper	5.7	4.8	3.4	7.1
Semicapitalists	2.0	3.3	8.0	6.7

a. Caturra

Source: Verification survey, 1982.

The semilandless achieved relatively high technological levels, nearly equalling or exceeding those achieved bv lower and middle peasants for all technologies examined. Yields, however, were only slightly higher than those of lower peasants and much beneath those of middle peasants. One possible explanation for this discrepancy may lie in the average time span for adoption of the new techniques (Table 20). Considering that a coffee plant begins to produce 4-5 years after planting, and that semilandless only began to interplant coffee about three years ago, the effect of interplanting on yields has not yet materialized.

2. Technological adoption in maize culture

Table 21 shows the percentage of Pejibaye farmers adopting the most important techniques available for maize. The use of chemical fertilizers unusually exceeds that of herbicides for all categories, excepting semicapitalists, for whom herbicides are a way of reducing the requirement for day-hire labour for manual weeding.

Among the peasant categories, there is a tendency for the degree of adoption of fertilizers to vary in accordance with the yields obtained. But despite the fact that there is a greater percentage of farmers applying fertilizers among middle peasants than among upper peasants (75 percent as opposed to 50 percent), upper peasant maize yields are slightly higher, which might indicate either more efficient application, better farm land or a combination of both.

3. Adoption of technology in bean culture

Table 22 provides information on the only variable for which significant change was observed: the use of improved varieties. The data show that the predominant trend in the area is for farmers to continue to plant the traditional varieties. The highest rates of adoption are found among the semilandless and semicapitalists. This is explained by the direct link between these two groups due to their sharecropping arrangements. It is the semicapitalists who often decide which varieties shall be used in sharecropped plots.

The foregoing analysis clearly shows the differences among Pejibaye farms concerning the access to productive resources and the adoption of technology. Generally speaking, the adoption of technology tends to be concentrated among those groups in which coffee is the main activity. These are also upper categories, economically speaking. For coffee, there is a particularly significant correlation between yield and technology, and this further increases the differences in the value of production among the categories.

The following paragraphs examine the impact of these factors on the income of the production unit, which in turn affects future social differentiation trends.

B. Land Access and Income Levels: Prime Indicators of Rural Differentiation

Rural differentiation is defined as the process whereby the organization of peasant production becomes modified, either by incorporating capital and wage labour into the productive process (upward), or through the deterioration of productive capacity and the ensuing proletarization of the family labour force (downwards). Differentiation is a reflection of changes which have taken place in the production units, and can be traced to the web of relationships between peasant farmers and other social sectors.

Ever since the initial settlement of the region, no significant changes have taken place among small farmers with respect to the incorporation of wage labour or durable capital into the productive process. What is evident, however, is the continuous increase observed in land purchase spread out over the last four decades. Table 23 illustrates the fact that 61 percent of the farmers interviewed arrived in the area as temporary day-hire workers. A bare 10 percent were able to obtain their own land at the very outset. This shows that the general trend since the area was settled has been towards "upward" differentiation. Most of these farmers arrived virtually without resources, worked for a time, and acquired land gradually through purchase, the commonest

TABLE 21. Pejibaye: percentage of farmers adopting modern technology in maize culture. By categories

Category	Winter Maize		Summer Maize	
	Chemical fertilizers	Herbicides	Chemical fertilizers	Herbicides
Semilandless	43	13	50	50
Peasants (all)	(54)	(15)	(58)	(27)
-Lower	41	19	45	9
-Middle	75	13	55	46
-Upper	60	10	78	22
Semicapitalists	17	67	33	67

Source: Verification survey, 1982.

TABLE 22. Pejibaye: percentage* of farmers adopting modern technology in bean culture. By categories

Category	Winter Bean				No Tillage Bean			
	Modern varieties			Traditional and not identified	Modern varieties			Traditional and not identified
	1950	1960	1980		1950	1960	1980	
Semilandless	46	23	15	46	71	14	14	43
Peasants (all)	(22)	(15)	(17)	(66)	(7)	(0)	(11)	(96)
-Lower	18	14	14	68	9	0	18	73
-Middle	18	27	27	64	0	0	11	100
-Upper	38	0	13	63	13	0	0	100
Semicapitalists	38	0	50	38	33	0	33	33

* The percentages total up to more than 100 because some growers use two or more varieties.

TABLE 23. Pejibaye: status of farmers upon arrival in Pejibaye

Farmers / Status	Number	%
Day-hire labourer	66	61
Son of landowner	19	18
Landowner	11	10
Other	12	11

Source: Verification survey, 1982.

TABLE 24. Pejibaye: land acquisition methods

Farmers / Method	Number	%
Inheritance	11	12
Purchase	66	71
Gift	3	3
Other	13	14

Source: Verification survey, 1982.

form of acquisition (Table 24). The land was bought from the earliest settlers, who were occupying a greater area than they were able to farm, and/or absentee landlords to whom the government had granted land in the area in exchange for land they had owned in the Central Plateau but which had been occupied by squatters.

Table 25 shows that there has been a pretty constant flow of immigrants over time, 80 perecent of which came from the coffee-growing areas of the Central Plateau. On the average they have been in the Pejibaye area for somewhat over 21 years, and most have held title to their land for about the last ten. This means that more than 11 years ago by before a farmer is able to obtain his own land.

Only 15 farmers (14 percent of the sample) sold land during their stay in the area. The main reasons were to boost or maintain consumption levels, and to expand production in other areas or crops. In the first instance, the fact is taken to indicate a process of "downward" differentiation in which the productive base is becoming weakened.

In general, the data seem to indicate that upward differentiation has taken place. At the beginning most families owned no land and with time were able to buy some. This was mainly made possible by the initial availability of land for sale, and by the fact that the labour of the day-hire worker provided a small surplus with which to gradually acquire land. The impact of technological change on this process was minor. Nonetheless, as we shall see, technological innovations having to do with specific crops, particularly coffee, contributed to internal differentiation within the Pejibaye area[1/]. This phenomenon is explained when we look at the surpluses generated by the prevailing processes of production and circulation within the area under study.

1/ Internal differentiation refers to the division of a population into social strata. In this instance it happens because of the unequal access to productive resources and the ensuing variations in family incomes.

TABLE 25. Pejibaye: length of residence in area and land tenure (years)

Farmers / Years	In area		On farm[1/]	
	No.of families	%	No.of families	%
0 - 5 years	15	14	32	36
6 - 10 years	4	4	24	27
11- 15 years	13	12	14	16
16- 20 years	18	17	10	11
21- 25 years	19	17	5	6
Over 25 years	39	36	4	4
	average:	21.4 years	average:	10 years

1/ Fifteen families (14 percent of the total sample) did not have land in Pejibaye.

Source: Verification survey, 1982.

a. Surpluses and net income

Technological change can stimulate differentiation processes when the adoption of new techniques increases the surplus generated from production (income minus expenditure), which then acts as a fund for the future capitalization of the farm[1/]. If the surplus is small or negative, the possibilities of expansion are constrained and the more likely outcome is a process of decapitalization with the eventual proletarization of the family labour force.

If one were to make in order to obtain an in-depth understanding of the process of differentiation in the area, one would have to have the records over a period of time of farmer incomes and expenditures, and how the surpluses were distributed among on-farm investments, consumption and other expenditures. This data base is impossible to obtain from field work because the great majority of the farmers keep no written farm records. In addition, this kind of information is sensitive and hard to get, as many farmers fear it will later be transmitted to the government authorities and use to impose taxes.

Despite this, it is possible to estimate the surpluses derived from the production of coffee, maize and beans. This, together with the data on income from off-farm family wage labour (steady and temporary), makes it possible to estimate the net income of each family interviewed. Given below is the formula used to calculate surplus and net income, the findings for each category, and a brief examination of the meaning of these figures.

In order to estimate the surplus (S) derived from the major productive activities of each unit (coffee, maize and beans), the following formula was used:

$$S = \sum_{i=1}^{3} P_i (Q_i - HC_i - SH_i) - MCF_{bm} - MCP_{mp}$$

where:

P_i = Price to grower for sale of commodity i.
Q_i = Total quantity of commodity i produced.
HC_i = Amount of commodity earmarked for home consumption.

1/ For a discussion of this topic, see: PROTAAL, 1980.

SH_i = Amount of commodity i delivered to owner (sharecropping).
MCF_{bm} = Monetary family reproduction costs (consumption costs).
MCP_{mp} = Cost of means of production (amortizations, inputs, wages, rents, and the like).

Data supplied by the 108 farmers interviewed during the verification survey provided the breakdown on amounts produced, home consumption, and share to landowner. Individual commodity prices were estimated for each commodity using the prices reported by farmers for the period of sale immediately following the harvest. The monetary family reproduction cost was calculated on the basis of data collected from a system of records kept for 10 peasant families in the area. An average annual per capita cost was calculated from the detailed records kept on consumption expenditure over a six-month period. Production costs, mainly temporary day-hire, and agrochemical inputs were estimated from data in the verification survey.

Table 26 presents average production surpluses generated by the semilandless and the three peasant subcategories. Semi-capitalists were excluded as they derive the bulk of their income from other activities such as livestock or trade. Crops, especially coffee, maize and beans, are the dominant activity in the other categories.

Though the historical trajectory of each category is not indicated by the figures, they do provide an idea as to what the future possibilities are of capitalization and the adoption of technology. Table 26 features the clear division of economic surpluses among the socioeconomic categories examined. The semilandless and lower peasants obtain a negative average surplus, with a very high percentage of farmers whose surpluses are also negative.

Contrasting with this, the middle and upper peasant subcategories exhibit positive surpluses, on the average, and there is a low percentage of units with negative surpluses.

TABLE 26. Surplus and net income for each category of production unit[1/]

Category	Surplus		off-farm income	Net income	
	Average	% Negative		Average	% Negative
Semilandless	-9 594	63	18 499	8 905	44
Peasant (all)	22 398	37	542	22 940	37
-Lower	-14 607	95	200	-14 407	95
-Middle	9 263	15	1 200	10 463	15
-Upper	75 177	0	210	75 387	0

1/ Prevailing colon rates 1981/82. The rate of exchange ranged from 8.54 to 63 colones per US$1.00.

Source: Verification survey and field records, 1982.

The resultant calculated surpluses reflect only the difference between production and reproduction costs and the income generated from the sale of farm produce. In order to obtain a more accurate estimate of the total funds potentially available for farm investment, a net income figure was calculated in the following manner[1/]:

$$NI = S + W$$

where:

W= income from off-farm activities, mainly wages earned from temporary work on neighboring farms or non-agricultural work.

With the exception of the semilandless category, all others maintain near-equal income and surplus levels[2/]. By contrast, the semilandless category differs dramatically: the average net income is 8 905 colones contrasting with a negative surplus of 9 594 colones. Nonetheless, over 40 percent of the family units included in this category exhibit negative incomes, which would seem to indicate a lack of sufficient productive power or economically active family labour to generate the minimum family income needs.

Lower peasants are the subcategory which are worst off and the ones with the fewest chances of capitalization and hence upward differentiation, or mobility. On the other hand, the economic possibilities of the middle and upper peasants for achieving minimum living standards plus growth are on the positive side. These people are in a position to adopt new technologies, especially ones requiring inputs of capital goods.

1/ For a more exact estimate of net income, other relevant factors such as taxes and money received from family working outside the unit ought also to be taken into consideration. No questions were asked on these items due to the sensitive nature of the data and the reticence of the informants to answer such questions.

2/ This is because these units are almost wholly engaged in farming, with no major off-farm source of income.

In reviewing this analysis, one noteworthy feature is the high correlation between the level of technological adoption and the particular socioeconomic category. Generally speaking, the lower peasant subcategory has the lowest rate of technology adoption, followed by semilandless and the middle and upper peasants (Tables 19, 21 and 24). To a certain extent this fact confirms the direct relationship between the chance for and direction of differentiation or mobility, and technological change. Those units which generated enough resources adopted technologies which, all other things being equal, then allowed them to subsequently add to these resources. The reverse was true among those units not generating sufficient resources even to cover consumption needs. They were unable to adopt the available technology, which usually comes incorporated in industrial inputs. If this process continues, it might lead to the eventual breakup of these units, and the ensuing proletarization of the family labour force.

V. SUMMARY AND CONCLUSIONS

During the sixties and seventies, the adoption of new technologies in coffee, maize and bean culture in the district of Pejibaye was, in general, both slow and partial. There are major differences, however, among the production trends for coffee, on the one hand, and maize and beans on the other. The acceptance of new technologies into the peasant production systems tended to be concentrated in coffee, whereas the techniques used in maize and bean culture (except the adoption of fertilizers for maize) did not vary significantly.

This can be explained by the interaction of various conditions prevailing in the general socioeconomic context affecting peasant production, especially the influence of government policies governing the relations established by the different social sectors at regional and local levels. These conditions, combined with the prevailing economic situation and ecological conditions prevalent in each family production unit, act to determine the income derived from each productive activity. This, in turn, has its effect on the activity pattern chosen by the farmers and on technological changes taking place in the area.

A. Technological Change in Coffee Production

As coffee is an export crop with high cash value, it ranks high in importance to the economy of Costa Rica. A key factor in the striking increase in coffee production was the series of government policies established in the thirties in response to controversies between coffee growers, processors and exporters which arose over the unequal distribution of coffee-generated income. The coffee processors were few in number and thus able to bargain effectively and appropriate the lion's share of coffee-generated income by setting prices allowing them to maximize their rate of earnings. This hurt the coffee growers, and so they organized and began to exert pressure on the government to regulate grower/processor relations. The state first intervened in 1933 and has continued to promulgate laws fixing the distribution of income from the sale of coffee. The distribution established was clearly favourable to growers[1/]. This was made possible by the political power exercised by the coffee barons, most of whom were highly-placed government officials or relatives of such officials[2/].

In addition to this, by establishing a distribution of coffee-generated income favourable to growers, these policies spurred production. This in turn allowed the state to tax this activity for the maintenance and growth of the state apparatus.

Other major aspects of government action were credit policies to finance more coffee-growing and support to technological development of coffee culture. This last item can be seen in the importation of technologies of foreign origin and the establishment of coffee research programmes and institutions.

Heavily encouraged by the state, coffee production spread from the Central Plateau to others areas ecologically less suited to the crop. But coffee was still able to compete with other crops, livestock, and nonagricultural

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1/ A description of the method adopted to determine this distribution can be found in Chapman et al.,1983.

2/ It should also be mentioned that some of the big growers were also the owners of processing plants, so they benefited no matter how the conflict was resolved.

activities, despite low yields, and this stimulated the growth rate of production as more and more land was planted to coffee.

As production expanded, the coffee processors built new plants in the new coffee areas, thus adding even greater incentives to produce by making it possible for producers far from the urban centres to market their coffee. Most of these new producers were small farmers.

In the late fifties worldwide overproduction of coffee severely affected coffee prices. Producer countries founded the International Coffee Organization, the purpose of which was to curtail world supplies as a way of maintaining prices at a stable, profitable level. Quotas were set for each member country, including Costa Rica. The upshot was that the state took certain steps to limit the expansion of coffee production. The most important of these was to exclude the new "marginal" areas, as they were called, from subsidies and technical assistance.

This had little impact, however, because other conditions promoted production in these areas. These were: good returns to growers (through the regulation of income distribution) comparison to those of other productive activities, and an adequate transportation and marketing apparatus. Private enterprise, in the form of the processing plants, undertook to provide the needed financing.

We said before that the adoption of technology in the area under study had been rather slow. It is therefore legitimate to wonder why, if the context was so favourable, the adoption of technology did not proceed at a faster rate. The answer has to do with the following three factors: the fact that coffee is a permanent crop; the precarious economic conditions of the peasant production unit; and the way growers select the coffee they plan to plant.

Coffee is a perennial crop. Once the plant reaches a given age, it produces every year. It does not need to be replanted. This is a constraint to the adoption of new technologies, especially the substitution of traditional varieties by newer, more productive varieties. Unlike what

happens with annual crops such as maize and beans, where it is relatively easy to introduce new varieties, variety substitution in coffee implies heavy costs because the existing plants have to be eliminated. Many growers cover their living expenses with the income derived from coffee, and so a waiting period of four years before the new plants produce would be excessive.

This is why new varieties are adopted mainly through: a) increasing plant densities (interplanting) while maintaining existing plants; b) the use of modern varieties in new plantings; c) the renewal of coffee plantations in which productive capacity has declined due to the age of the coffee plants.

The second constraint is the precarious economic conditions under which most small farmers operate. For one thing, the small landowner cannot plant only coffee, because he needs the annual crops to survive while waiting for the coffee to begin to produce. For another, the only way the farmer is going to be in a position of invest in inputs such as agrochemical products is if the other crops generate an income in excess of that needed to maintain the family.

The third aspect has to do with the way growers select their seed, which is related to constraints imposed by the scarcity of manual labour (family and day-hire) during the harvest period. The acute labour demand during this period limits the amount of coffee a grower and his family can pick using the manual labour available. In-depth interviews revealed that Pejibaye coffee producers have devised a strategy to partially cope with this situation. They classify each coffee plant on their farm as "quick" or "slow" (early or late ripening), in an attempt to lengthen the harvest period and thereby achieve a better distribution of the manual labour and increase the amount of coffee planted. This is why they prefer to use their own seed or seed purchased from a neighbor, for which the ripening date is known, rather than seed supplied by the Coffee Board, as they cannot know its characteristics beforehand. This retards the adoption of new varieties[1/].

1/ Further discussion of this point focusing on its implications for technology generation activities is contained in the following document on technological policy.

Despite these farm-level constraints, there has been significant adoption of coffee technology in the Pejibaye district. This has mostly to do with the government tendency to ensure that the grower derives most of the production value, and the provision of proper financing and marketing channels by the private sector. The outcome of both factors is a rather good profit, compared to the usual productive activities of small farmers. Without the obstacles inherent in the production unit and in the crop itself, production might well have developed even more intensively than has been the case.

B. Technological Stagnation in Maize and Beans

Maize and beans are the other two main commodities produced by small farmers in Pejibaye. Though these crops are annuals, a feature facilitating the incorporation of new technologies, technological changes within the area under study were observed to be rather insignificant. There are various reasons for this.

For one thing, state-fostered policies have tended to hold consumer prices for these grains at levels in line with minimum wages of workers in the urban industrial sector. The CNP was established for the purpose of achieving self-sufficiency in basic grains. This is the agency responsible for fixing producer and consumer prices, and which intervenes directly in the marketing of basic grain. Without subsidies, however, a low consumer price also means a low price to the grower. Even though the grower gets the better part of the monetary value of his commodity, with such scant reward for capital investment and family labour, there is little incentive to incorporate new technologies, especially technologies heavily dependant on inputs which have to be bought.

At the same time, efforts undertaken by the government to generate and extend appropriate technologies for the socioeconomic and ecological conditions under which small farmers operate have been relatively recent and have yet to produce significant results. In general, the technology which has been made available is confined to technologies developed for commercial production, incorporated primarily in industrial inputs such as agrochemicals.

Furthermore, small farmers have to cope with a series of situations which limit the acceptance of new technology. Three prominent factors are: a) rather unfavourable ecological conditions; b) high risk; c) more profitable alternative commodities.

In the first instance, much of the maize and beans is planted on slopes or hillsides where there is heavy erosion, problems with maintaining soil moisture, and the low soil fertility which naturally follows. Risk is another important factor, especially in bean culture, as beans are highly susceptible to pests and diseases. The consequence of this is low yields, and in extreme cases, the loss of the entire crop. But perhaps the most important aspect is the possibility which some farmers have to devote their efforts to growing coffee. As we have seen, various economic and social factors converge to create a climate where coffee-growing is an economically-favoured activity, specifically in terms of prices (profitability) and the supply of available technology.

The obstacles inherent in the production unit not only limited the adoption of technology, they also explain why the small farmers did not make use of the subsidized credit offered, first by the CNP and later by the SBN.

While it is certainly true that the government has deployed efforts to regulate the marketing and financing of maize and beans, the limitations of the production unit itself, combined with the advantages offered by coffee, have had their effect on the technological stagnation observed for these two crops.

C. The Major Determinants of Social Differentiation

Certain socioeconomic conditions within the regional context maintained and reinforced state protectionist policies, which had the effect of fostering the upward mobility of a large number of Pejibaye farmers. This is reflected in the increased allocation of land destined primarily for growing coffee, and the introduction of new coffee culture techniques which increased the productivity of the resources invested.

It was evident from the analysis, however, that the changes which took place did not affect the whole population equally. Those who benefited most were the farmers who arrived at the time the district was being settled and who acquired land in areas which were ecologically suited to coffee-growing. Those who were able to obtain access to the basic productive resources -- land and family labour -- were gradually able to invest their labour and money in coffee production. This made possible the generation and attainment of surpluses so that production could be expanded, through the adoption of advanced technology and by the acquisition of more land. By contrast, those farmers who arrived in the area later benefited much less, as they had less access to buying land and had to settle in areas which were less well-suited ecologically to coffee-growing.

This inequality of conditions in turn contributes to internal social differentiation taking place within the region. This is a process in which the production units progress or regress at different rates, giving rise to social and economic differences in terms of productive capacity and living standards. The likely outcome of this process in the future is discussed and analyzed in the following document.

APPENDIX A

ANALYSIS OF GROSS MARGIN

Using the information gathered in the verification survey, the gross margin per hectare of the three crops studied was calculated on the basis of the following formula:

$$GM_i = P_i (Q_i - SH_i) - MC_i \div A_i$$

in which:

P_i = Average price of commodity$_i$.

Q_i = Quantity of commodity$_i$ produced.

SH_i = Share delivered to land owner (portion of commodity$_i$ owed by sharecropper).

MC_i = Monetary production costs of commodity$_i$, in special inputs and hired labour.

A_i = Area (ha) under commodity$_i$.

Table (1) gives the figures for average gross margin by producer category. The most salient fact is the economic superiority of coffee over maize and beans in all producer categories.

TABLE A.1. Pejibaye: gross margin (colones/ha)[1/] for coffee, maize and beans by categories (1982).

Category	Coffee	Maize		Beans	
		Winter	Summer	Winter	No tillage
Semilandless	16 015	3 824	2 196	3 041	3 480
Peasants (all)	(22 073)	(5 643)	(5 534)	(3 520)	(4 513)
-Lower	11 945	4 930	4 047	3 250	4 198
-Middle	23 506	5 340	6 497	4 062	4 789
-Upper	29 900	7 283	5 796	3 449	4 552
Semicapitalists	21 460	12 606	4 760	6 947	4 681

1/ At the going 1981 rate for colones.

Source: Verification survey, 1982.

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B. Ideas on Technological Policy Emerging from a Case Study

IDEAS ON TECHNOLOGICAL POLICY EMERGING FROM A CASE STUDY

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María Cuvi

I. INTRODUCTION

This document presents a series of reflections on possible strategies that the state could adopt to promote the development of the small farm sector through technological change. Also discussed are aspects related to the process of social differentiation which has occurred partly due to technological change when the initial distribution of resources is unequal. The ideas presented are based on a case study in which production systems were analyzed together with the socio-economic and ecological conditions which prevail among the small peasant farmer producers of the district of Pejibaye, Costa Rica.

The report is divided into four sections which follow this introduction. The second section presents a brief description of the relevant characteristics of the small producers on a national level and in the region of Pejibaye. The third section describes public policies with regard to coffee, maize and beans and their consequent impact on the small farm production in Pejibaye. The fourth section analyzes certain strategies related to promotion of increased production and support of the small producer sector. Finally, the fifth section presents some empirical evidence derived from the case study mentioned above, which may contribute to explain special aspects of the situation of the Latin American peasant.

II. EVOLUTION OF SMALL-SCALE PEASANT FARMER PRODUCTION OF COFFEE, MAIZE AND BEANS IN THE COSTA RICAN CONTEXT AND WITHIN THE AREA STUDIED

A. Characteristics of Small Farms in Costa Rica

In Costa Rica the process of colonization had characteristic features very different from those of the majority of other countries of the continent[1/]. Lacking the two principal factors which gave an impetus to the conquest of America - precious metals and an indigenous population which could be used as labour - Costa Rica was obliged to make due with its initial population of conquistadors and smallholders.

Practically isolated, though in an environment favourable to human life and agriculture, the Hispanic population had to procure its own livelihood. This was an important factor in the process of social equalization and gave origin to the early appearance of a peasant farmer population which settled in the fertile lands of the Central Plateau, and whose production was destined to self sustenance with a gradual incorporation into the market.

The first settlement period lasted from the conquest until approximately 1850 and was restricted to the Central Plateau, the second period began as of that date with the expansion of coffee production which incited colonization from the Central Plateau towards the rest of the country.

The contemporary settlement process has followed a typical historical trend: from the centre outwards. As those areas which have been occupied become too crowded and income generation possibilities diminish, surplus population migrates to new areas. This situation seems to have continued until the end of the sixties at which time the agricultural frontier could be extended no further.

During this process of population, the small producer sector suffered certain structural changes which are reflected both in the elimination of the smaller units and in the reorientation of productive activities. When we compare the agricultural census of 1963 with that of 1973, for example, we see a

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1/ For a more detailed description of the colonization process, see Chapman *et al.* 1983.

drastic decrease in the number of farms of less than 5 hectares (about 50%) and a relative permanence of farms of from 5-50 hectares, which only decreased by 4%. In addition, during this same period, modifications occurred in land use: the area under production increased in relation to the total area of the farms which reflects greater land use, and there was a general tendency to devote larger areas to pasture. The latter phenomenon corresponds to the opening of the United States market to meat from Central America in the sixties.

Small producers settled throughout the country; however, there are some geographical zones in which small farm production predominates over other types of production units. A characteristic common to those zones is the dedication of the land to the cultivation of maize and beans destined mainly for home consumption and, to a lesser extent, for the market. Other subsistence crops are also produced, although on a smaller scale, and domestic animals are raised. However, the substantive factor which establishes the differences between producers from different zones is the possibility of producing a high income-generating crop, and this is determined by ecological conditions, availability of resources (mainly land), and access to markets. Thus, small producers who have settled in zones which meet these conditions devote themselves to the cultivation of products such as coffee and tobacco. The relatively high profitability of these products facilitates the generation of surpluses which are subsequently used to increase this production through the incorporation of technology and the extension of the area under cultivation. Small producers who are excluded from the production of coffee and other high income-generating products have had to migrate to the cities or become agricultural labourers.

The principal purpose of this study of small producers undertaken by PROTAAL is to understand the behaviour of this type of farm with regard to the adoption of technology, and the relation between this process and other processes of permanence or decomposition in the peasant sector. Therefore, the subjects for analysis were small farms in which the technological variant contributed to explain the "upward" differentiation processes which would occur in those farms devoted mainly to the production of coffee.

Within this framework it is important to emphasize the modifications observed in the use of land during the inter-census period (1963-1973). On the one hand, the greater intensity of use is due to a process of the adoption of technology in high income-generating products. On the other hand, the increase in the area devoted to pasture is due to the expansion of extensive cattle raising. In the first case, the intensive use of land increased the income received by the small farms in which the productivity of family labour was also increased. In the second case, the expansion of extensive cattle raising occurred on land which was inadequate for the production of coffee and this, in fact, slowly strengthened the large estates.

An important element which allows us to understand historical permanence and the evolution of small producers associated with the production of coffee is the scarcity of labour which has existed in Costa Rica since the beginning of colonization. Contrary to other Central American countries (Guatemala and El Salvador), Fernández and Alvarado (1982) maintain that the unsurmountable obstacle to the formation of large coffee estates during the nineteenth century was the scarcity of labour due to the small volume of population and to the generalized system of small holdings. Faced with this situation, the dominant social sectors, in the case of coffee the processors and exporters, were forced to establish relationships and conditions of exchange which permitted the productive development of the small farms. The State had to participate decisively in the regulation of this activity in order to achieve a balance in the relations between the groups involved in the coffee-growing activity. This brought about a strengthening of the small farm production related to coffee, which have slowly incorporated new technologies.

B. The Small Producers of the District of Pejibaye

The district of Pejibaye is located in the extreme south of the canton of Pérez Zeledón, which in turn belongs to the province of San José. The climate is tropical rainy with a short dry season during the months of January, February and March. The soils in the district may be classified in three groups

according to the type of cultivation for which they are apt: a) soils apt for annual cultivation; b) soils apt for permanent cultivation, pasture and woods (especially for topographical reasons); and c) soils apt for permanent cultivation, pasture and woods, but which present problems of fertility and erosion (the majority of the soils in the zone under consideration are of this type). The topographical profile of the district shows altimetrical variations which range from 1 100 to 400 meters above sea level[1/].

The basic production strategy of Pejibaye small farmers evolved from the production of basic grains and vegetables for home consumption at the time of the first settlement (in the decade of the 1930s), to production oriented ever increasingly towards national and international markets. The majority of the peasant families in the zone originated from the Central Plateau from where they migrated in search of land.

Today, the producers may be characterized as small market-oriented family farms using basically family labour and owned or sharecropped land. However, they still maintain certain traditional features inasmuch as, with the exception of coffee, they assign an important part of their production to family consumption.

In general, within the zone studied, producers of coffee, maize and beans predominate, combining these crops on their land in different proportions. Together with these products can be found others such as sugar cane, banana, plantain, different tubers and roots which are produced almost exclusively to home consumption. Poultry farming is also common, and in recent years, pig raising for sale has acquired certain importance. In addition, certain farmers who would no longer be considered in the category of small producers, and who own sufficient land, are raising beef cattle. Except for these larger farms, coffee is the main product and that which provides the greater part of the

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1/ These differences allow us to understand the possibilities the farmers have of being involved in the production of coffee. Those farmers located in the highest zones could cultivate coffee as this requires a minimum altitude of 600 meters above sea level.

family income. Maize and beans occupy a secondary place and play a multiple role: they may be sold or consumed internally or both at the same time. The relative importance of one or the other function depends on access to productive resources and on the relative importance of coffee in the farm enterprise mix. The latter factor is reflected in: a) the dedication of areas previously cultivated with grains to the production of coffee; b) the distribution of family labour and the organization of work being established according to the requirements of the coffee crop[1/]; and c) the widespread adoption of new technology in coffee production.

The evolution of coffee production has been greatly affected by the participation of the private sector, which has installed processing plants and a large number of coffee berry reception centres in the Pejibaye area. These facilities, along with the regulation of coffee-growing activities by the Oficina del Café (Coffee Bureau), enable producers to receive a substantial part of the total income derived from this activity. Maize and beans offer fewer economic advantages. The prices of these products have been substantially less than those of coffee and they are crops which entail large risks (excess or lack of rain, and incidence of disease), factors which have acted as elements inhibiting the expansion and development of these crops.

1/ The attention given to the grains depends on the calendar of activities required by the coffee plantations.

III. PUBLIC POLICIES AND TECHNOLOGICAL CHANGE IN THE PRODUCTION OF COFFEE, MAIZE AND BEANS

A. Relevant Public Policies

In the previous section we suggested the presence of certain processes of transformation of small farms according to the basic economic relations established for each type of product. In this section, interest is focussed on the analysis of the principal public policies relating to the production of coffee, maize and beans, which have affected small producers in general.

The public policies developed by the Costa Rican state have had an important positive effect on coffee production, as well as a somewhat negative effect on maize and bean production. State participation in the regulation of the coffee-growing activity began in 1933 with the enactment of laws which gave origin to the Instituto de Defensa del Cafe (Institute for the Defense of Coffee) - which would later become the Oficina del Cafe (Coffee Bureau) - and the definition of the relationships of the different agents who participate in this activity. From that date onward, a slow but gradual improvement of the judicial-legal framework has taken place; the most salient feature has been the intention to achieve a balance in the income participation of each agent: the state, the producers, the processors, and the exporters.

The state also encouraged a system of public financing which provided credit to every stage of coffee production, from cultivation to export. This favoured the incorporation of technologies which demanded capital investment. Since the early 1960s, however, state support, both economic and technological, has been limited to those zones which have historically presented optimum natural conditions for the cultivation of coffee[1/]. This restriction sought to ensure that the growth of national production would be achieved through increases in yields per unit area and not by expansion of the area

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1/ This state decision was taken as a result of Costa Rica's incorporation into the International Coffee Agreement (1962), and responded to the rules of the Agreement which imposes quotas on coffee exports.

cultivated. The first coffee research programmes were started in the 1940's and were in the hands of various international institutions; subsequently, some research was absorbed by national institutions. Only as of 1950 did the state destine stable financial resources to the activities of research and extension. In 1962 these activities were strengthened with the creation of a joint programme of the Ministry of Agriculture and the Oficina del Café which has been maintained without interruption up to the present day. An important characteristic of this research has been that a large part is carried out on the coffee growers' farms, and this has favoured the adoption of new technologies and an understanding of the specific needs of the producers.

Public policies related to the production of maize and beans have very different characteristics from those related to coffee. In the first place, they have not been specifically formulated for these products but rather for basic grains in general which also include rice and sorghum. In the second place, the maize and bean producers have had minimum possibilities of expressing their technological and economic demands through their own organizations[1/]. In the third place, public policies have been oriented towards certain economic aspects (prices and subsidies) and have had a cyclic and therefore unstable character. They have thus had little positive effect on the structure of production and the generation and diffusion of technology.

The institutions in charge of executing economic policies relating to the production of corn and beans are the Consejo Nacional de Producción (CNP) (National Production Council) and the National Banking System. The CNP was created in 1949 with the intention of regulating prices of basic grains, thereby endeavouring to eliminate price fluctuations and stabilize producers' income. This institution maintains purchasing agents (in those areas where they are

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1/ Rice presents a different situation: producers of this grain have constituted an interest group and, through the Cámara Nacional de Granos Básicos (Costa Rican Chamber of Basic Grains), further their own interests. Maize and bean producers are not represented in this Chamber, and their lack of organization prevents them from exercising much influence on the policies which affect their interests.

justified by the production volume) as a mechanism of applying a fixed minimum price. However, its participation as a buyer normally has little significance, as the majority of the production is acquired by the private sector. However, when high subsidies are established for the production and consumption of basic grains, the CNP becomes the main buyer. In addition, officials of this institution have granted certain technical assistance to the producers and in the last five years they have promoted the use of improved seed. The National Banking System, composed of the commercial banks, maintains an extensive network of agencies in which they have offered lines of credit for the production of maize and beans with subsidized rates of interest.

Research activities on basic grains have focussed on the production of high yielding varieties. The bulk of the resources, however, has been devoted to rice, with detriment to maize and beans. Despite the fact that small producers are responsible for more than 50% of the national production of these grains, the actions of the CNP and of the extension systems have been designed so that grain producers must incorporate technological packages which include seeds and methods developed for the commercial sector. Only in recent years has an effort been made to improve the traditional systems of small producers.

In parallel form, the Banco Nacional de Costa Rica, which belongs to the National Banking System, is the institution which has worked most closely with the small producer sector. This bank has an extensive network of rural credit agencies which provide financing at subsidized rates of interest, specially directed at small producers. Previously the CNP acted as guarantor when credits were granted to those producers who did not have title to their land. However, this programme was suspended because many large producers of rice who rented land resorted to the system.

In general it may be said that in the case of coffee, unlike that of maize and beans, specific conditions such as high, stable prices and adequate available technologies facilitated an attractive income level and acted as incentives for the small producers to cultivate this product.

B. Technological Change and the Impact of Public Policies on the Small Farms of Pejibaye

From the case study it may be inferred that the adoption of technology in the agricultural production of the district of Pejibaye to be concentrated in the cultivation of coffee. The small producers benefited indirectly from state actions oriented to protect and promote national production of coffee. This, together with certain socio-economic conditions and ecological factors peculiar to the zone and typical of the small farms, favoured the production of coffee in relation to other crops.

In effect, the special nature of the product (an export commodity) and the judicial-legal framework within which the production of coffee is set in Costa Rica,allowed even Pejibaye - a zone considered "marginal" because of its ecological conditions - to benefit from general public policies. Despite the absence of state backing with regard to financing and technical assistance, and despite the low yields obtained, the canton of Perez Zeledon to which Pejibaye belongs, generally obtains the highest national production figures for coffee. Thanks to the relatively high income-producing capacity that it has maintained over the years, this crop has partially displaced other traditional crops such as maize and beans from the zone. The lack of state support in the Pejibaye area was compensated by the credit, transport and marketing facilities provided by the processing plants installed in the region.

Although a process of technological change in the cultivation of coffee was observed in Pejibaye, this was less intense and complete than that which occurred in other regions of the country. The reasons explaining this are related to: a) ecological conditions; b) situations characteristic of the internal organization of small farms; c) features typical of the crop; and d) the absence of state assistance, both technical and financial.

As indicated previously, Pejibaye is a zone of relatively recent colonization. The producers who arrived first and settled on lands located in higher altitudes more suitable for the cultivation of coffee - invested heavily in this activity. As the result of a continual process of expansion of this crop, these producers managed to generate surpluses which allowed

them to increase production even more, either by the adoption of new technologies and/or by increasing the area planted. On the contrary, the producers who arrived in the region during the two most recent decades were obliged to settle in areas of lower elevation, which placed them in an unfavourable situation compared to the first settlers.

The internal organization of small farms and the characteristic features of coffee cultivation are two aspects which are closely related and which had the most direct influence on the adoption of technologies consisting mainly of the incorporation of different varieties and the use of agrochemicals (fertilizers and herbicides). New varieties have gradually been incorporated by planting new plants in coffee plantations between the rows of the traditional varieties ("interplanting"). The choice of this method for increasing plant density responds to the scarcity of land suitable for this crop and to the fact that the principal source of income for almost all small producers comes from coffee. Interplanting allows the producers to introduce improved varieties without the drastic elimination of the old coffee plantations, which in Pejibaye are midway through their productive life[1/].

In addition, not all producers can plant their total surface area with coffee, essentially because they do not have the necessary labour to fulfill the requirements that this extension would demand and, partly because they need to complement their income and cover internal consumption with annual crops such as maize and beans. In general, the small producers of Pejibaye use family labour for cultivation and harvesting of coffee, but labour requirements are intensified and concentrated in the harvest period. This fact, added to the scarcity of temporary workers in the area, obliges them to plant surface areas which can be harvested using mainly family labour. There is, however, a characteristic of the coffee plant which has allowed them to redistribute somewhat labour use during the peak demand period. Even though the ripening time of the coffee plant is fairly uniform (in this aspect

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1/ Complete replanting would mean that the producer would receive no income for a period of 4 or 5 years.

the different varieties present relatively homogeneous genetic characteristics), the producers have developed a system of seed classification by which they can extend the harvest season and achieve a better distribution of available labour. However, as the technicians involved in the production of different varieties of coffee have not recorded this characteristic, the small producers prefer to use seed (their own or that of a neighbor, of which they know the ripening time.

The region of Pejibaye has not received the technical assistance from state institutions which has been given in other coffee-growing zones of the country. Only as of 1975 was certain technical and credit assistance offered to improve the productivity of the existing coffee plantations. However, this has had little relevance, partly due to the fact that the research was not carried out 'in situ' (a basic characteristic of coffee research in Costa Rica) and therefore did not take into account the needs and problems of production peculiar to the zone. This may also explain the limited use of seed produced by the Oficina del Café.

Maize and beans present a different situation. The principal function of these grains is to serve the needs of family consumption; only the surplus production is sold[1/]. For different reasons, these two crops occupy a secondary place in the system of small farm production. On the one hand, price and credit policies have not had the continuity, scope and importance of those for coffee; and on the other hand, the nature of these crops prevents them from competing with coffee which offers advantages with regard to prices, infrastructure and facilities of access to the available technology. In addition, both maize and beans are planted in poor soils (slopes and hillsides) subject to high erosion and lack of soil humidity, which affect the yields obtained and do not allow mechanization of these crops[2/].

1/ There is a sub-zone where production destined for sale predominates, but this is an area of very recent colonization where the ecological conditions are less suitable for the cultivation of coffee than in the rest of the region.

2/ Coffee planting is carried out in similar conditions, but because of its perennial nature and its excellent root system - coffee is a tree, not a plant - coffee is less harmful to soils than annual crops.

This series of factors has determined the limited importance noted in the adoption of new techniques. In the case of maize, fertilization was the only relevant practice, and, with regard to beans, the adoption of varieties put on the market by the CNP in 1980 was highlighted.

Of the state actions oriented to give an incentive to the production of basic grains, the one which had some impact in Pejibaye was the regulation of prices by the CNP. Although this regulation did not lead to substantial increases in the production of maize and beans in Pejibaye, the fact that the CNP sets a "base" price and intervenes in the purchase of these products obliges the private sector to pay similar or higher prices; and, moreover, to offer additional advantages (sacks and means of transport) when they are interested in buying the production.

In summary, public policies of credit, prices and marketing have not been able to overcome the restrictions due to the nature of small farm production and the advantages offered by coffee. The result has been the relative technological standstill observed in the cultivation of maize and beans. This situation also partly explains the limited response of small producers of basic grains to the financing offered by the National Banking System. In parallel form, state actions directed at the generation and transference of technology for these crops have been recent, of little significance, and of very limited scope.

The results obtained from the case study suggest that the state has not designed specific policies or created special mechanisms to give incentives to production in the Pejibaye area. Certain state activities over the past five years, such as the strengthening of the extension services, the sale of seed, and the design of projects directed at improvement of traditional cultural practices (beans) respond to a national and regional policy from which the area studied has benefited indirectly. This aspect is more relevant in the case of coffee. As we have seen, although Pejibaye did not receive some types of state support, it was able to benefit from general national policies affecting coffee production.

IV. TOWARDS A POLICY FOR THE DEVELOPMENT OF AGRICULTURAL PRODUCTION: THE VIABILITY OF THE "BACK TO THE LAND" PROGRAMME

In this section we will examine some potential agricultural policy strategies directly related to the promotion of production and support of the small farm sector. The policy considerations presented herein are based mainly on experience obtained in a specific context: peasant farmer production of coffee, maize and beans in Pejibaye, Pérez Zeledón. The analysis focusses on the small producer sector, its socio-economic conditions and possible ways of stimulating its development through specific public policies designed to increase agricultural productivity through technology adoption.

The reference point for this discussion is the objectives that orient Costa Rican agricultural policy for the 1982-1986 period, which may be summarized as follows: a) increase of food production; b) increase in the export of agricultural products which generate foreign exchange; c) development of agro-energy substitutes for petroleum; d) generation of employment; and e) increase in the emphasis given to small and medium farmers (Partido Liberación Nacional, 1981).

There are three positions which may be taken in regard to agricultural policy strategies destined to promote technological development of the agricultural sector and the strengthening of the peasant farmer sector. The first stresses the need to develop public policies which contribute to the modification of the socio-economic context in which peasant farmer production is set. Its intention would be to increase the income received by this sector, thereby allowing it to acquire the technology available in capital and consumer goods. The second stance centres its attention on the development of technologies suitable to a specific ecological and socio-economic context. In many cases, this implies the restriction of the scope of research to the search for technologies which minimize the use of limited resources (land and capital goods) and maximize the use of the abundant resources (family

labour). Between these two positions which represent extreme cases, there exists a third intermediate position which is a combination of the two previous ones. It puts forward both the need to modify the socio-economic context and that of developing suitable technologies for the new situation.

Using as a frame of reference the three positions mentioned above, the discussion which follows examines the public policies related to peasant farmer production from two angles: food production and rural development.

A. Strategies to Increase Food Production in Pejibaye

As may be inferred from the case study of Costa Rica, the socio-economic context favoured the production of maize and beans in Pejibaye, except in one crucial aspect: price. The basic infrastructure exists, and there is an adequate marketing system and public policies oriented towards assuring that the producer received a substantial share of the value generated by maize and bean production. However, there has been a standstill in the production of these grains, reflected by the limited adoption of technology and the reduction of the surface area under cultivation. There are three strategies directed at promoting production of these grains which could be adopted either together or separately. We will examine the viability of each one within the Costa Rican context. The first two strategies seek to adapt the socio-economic context, while the third analyzes the possibilities of developing appropriate technologies.

1. Increase in the prices of maize and beans

A mechanism to stimulate grain production would be to increase and stabilize prices (in real terms) which are paid to the producers, who could thus adopt intensive technologies in the use of inputs and/or increase the surface area planted. The costs of this policy could be passed on to the consumer or financed through increased taxes. In the former case, the increase of the price paid to the producer would signify an increase in the cost to the consumer. The second implies subsidizing the price to the producer while keeping the price to the consumer constant. The cost would

presumably be financed by an increase in taxes and this would be distributed among the taxpayers.

Policies of this kind present some problems. The increase in the price to the producer has to be sufficiently large to make the production of maize and beans competitive with other activities (in the case of Pejibaye, with coffee production). This means a substantial increase in the price paid to the producer, the cost of which would be difficult to pass on to urban consumers without risk of generating conflicts and protests. The more feasible option would be to pass on a major part of the cost to the taxpayers, accompanied by a slight increase in the price to the consumer. In this case, the most probable outcome would be that the price paid to the producer would be substantially more than that paid by the consumer; and this would generate a situation similar to that presented in 1981 causing beans to be repetitively resold. In that year, merchants bought grain in San José, transported it to the production areas and resold it to the CNP. In this way, an illusory boom in bean production was recorded, while the product was scarce in San José shops. The result was a high cost to the state and consumers; the latter were obliged to restrict their consumption of this product.

Another problem which arises from a price policy of this type is the competition established with producers in neighboring countries. This situation particularly affects small countries with relatively open frontiers: when high prices are offered to the producers it gives an incentive to import (perhaps illegally), and this results in a subsidy being paid to the production of neighboring countries and an excessive supply of the product.

2. Price subsidy of technological inputs

A state action that could stimulate the adoption of those technologies incorporated into inputs is the reduction of their cost, via the establishment of price subsidies. However, the possibility of undertaking an action of this type presents one unsurmountable obstacle, namely

that the majority of inputs used are not destined specifically for one crop or group of crops but can be used for a wide range of products, as is the case of fertilizers and herbicides, and to a lesser extent, insecticides. This means that the inputs may be used in activities distinct from those contemplated in the established subsidy policy. Under normal circumstances, the marginal value of the inputs applied in coffee-growing is greater than in maize and bean cultivation. In the absence of strict, individual control of use, an important part of the inputs bought at subsidized prices would be destined to coffee production and not to grains. The end result would likely be that a subsidy of the price of the inputs would become a subsidy of coffee production.

In addition, due to the lack of sufficient control of the Costa Rican frontiers, a lower price of inputs in Costa Rica than in the neighboring countries would be an incentive to export inputs, which would result in a partial subsidizing of the production of other countries.

3. Development of appropriate technologies for maize and beans

Due to the limitations of subsidy policies, whether these be for maize and bean prices of for the costs of inputs used in their production, a more viable alternative would be to develop appropriate technologies which take into account the following conditions: the relatively low prices of maize and beans, the adverse ecological conditions under which they are grown, the limited resources (money) available, and the lack of flexibility inherent in the complex systems of small farm production.

In the particular case of Pejibaye, production techniques would have to be developed which would facilitate: a) decreases in the risk involved, especially in the cultivation of beans; b) the increase in yields of crops sown on slopes with erosion and fertility problems; c) the use of low amounts of industrial inputs; and d) adaptation to the seasonal availability of labour, which is notably influenced by the requirements of the coffee crop.

The research programme implied is difficult. On the one hand, the generation of appropriate technology must be preceded by a rearrangement of research priorities. In addition, the highly specific field of a research based on production systems limits the number of users interested in its results[1/]. Likewise, it means a high percentage of the scientific personnel involved in the research must devote their time to the collection of information, to the analysis of different production systems, and also to the design and execution of experiments tending to resolve technologically the production problems detected. Exploratory research would have to be restricted, and this would reduce the possibilities of discovering technologies which might eventually have a larger impact on the production of these food crops.

Despite the difficulties, there are also a series of conditions which would justify this type of investigation, such as the relative homogeneity of the ecological and economic conditions of the small producer, which would allow the adaptation and transference of technologies developed for a specific situation to other regions with similar conditions. This, in turn, underlines the convenience of a rapprochement in the cooperation between countries which present similar conditions, not only in order to share research costs, but also facilitate an interchange of the new technologies which are developed.

At the present time, internationally there is great interest in promoting rural development through research focussed on the production systems of the small farmers. This interest is manifest both in national programmes and projects which are being developed and in the stipulations by the countries that finance international agricultural research centres that priority be given to this type of research. The fact that these undertakings exist implies that, before setting up a new research system, the technologies being developed in other countries and continents should be investigated. Another important aspect is the permanent interchange of

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1/ A technology developed specifically for Pejibaye might not be adaptable to the conditions of adjoining zones.

information with international organizations and with other countries in the region in order to take advantage of the results of work in research and transfer of technology which already exist[1/].

B. Strategies for Rural Development

Placing an emphasis on the welfare of the small producer may mean a similar strategy to that described for the production of the commodities which make up the "basic consumer basket"; commodities which, in many cases, are produced by the small farmer. Faced with complex production systems covering a series of crops, each one of which is produced with different intensity, it would be advisable to concentrate improvement activities on those products which are most important from the point of view of income-generation and which, consequently, help to increase the levels of production and the living standards of the small farm family.

In this context, coffee is the most important product for the small producers of Pejibaye. This crop generates the major part of their cash income and offers the highest rate of return on limited resources such as land and industrial inputs. In addition, coffee-growing has the backing of a marketing system and state policies that favour technological development, provide financing and, what is more important, allow the producers to receive a substantial part of the value of their production.

However, credit and technical assistance have been concentrated in areas which present optimum ecological conditions for coffee production. Pejibaye is one of the areas which has not received this type of support. Although it is not feasible to measure the precise impact this has had on production in marginal zones, there are clear indications that the absence

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1/ For example, the collaboration of Costa Rica with the Bean Programme of the International Centre of Tropical Agriculture (CIAT) since 1980, should be noted. One of the results of this collaboration is the introduction of new varieties of beans which resist some of the diseases which affect this crop. These varieties were brought from other Latin American countries by the Centre.

of support did not eliminate or deter the expansion of this crop. Coffee production in marginal zones has increased, above all through the expansion of the area cultivated and, to a lesser extent, through the incorporation of new technologies. Also, the vacuum created by the absence of state financing (National Banking System) was filled by private enterprise (processors) which granted credit to the producers in these areas.

If the cultivation of coffee benefits both the producer and the national economy (it generates foreign currency and contributes through taxes to the maintenance of the state bureaucracy), we should ask ourselves why state support was selective. The phenomenon is explained by the restrictions which were imposed on countries which are members of the International Coffee Organization by means of quotas allotted to each country regulating the export of the grain to other member countries. When the amounts produced are in excess of this quota, the grain must be sold on the non-traditional international market, on the national market, or be stored. Prices received for the sale of the surplus production vary and, in general, are very much lower than those received for coffee sold through the quota system. Thus, when coffee production is increased without the corresponding increase in the export quota, the proportion of coffee that must be sold for national consumption or to non-traditional international markets increases. This means a decrease in the price that producers receive for each unit produced.

On the other hand, the state's intention when it restricted support to coffee growing was to specialize the marginal zones in the production of foodstuffs, principally basic grains, destined to satisfy the national demand. This would allow the country to decrease grain imports, save foreigh currency and reduce its dependancy on the international market for basic national food requirements.

In the case of the small producers of Pejibaye, coffee offered them economic advantages far superior to the other productive activities available in the area. For this reason, the production of coffee experienced,

and will probably continue to experience, significant growth. As mentioned previously, one of the objectives of this Costa Rica's agricultural policy is to raise the living standards and welfare of small and medium producers. One way to achieve this would be to give decisive support to those activities - coffee growing in the case of Pejibaye - which constitute the basis of their production system.

1. Strategies to promote coffee production in Pejibaye

a. Adaptation of the socio-economic context

We have previously analyzed how actual socio-economic conditions favour the production of coffee. However, this production would be promoted even more with subsidized credit and increased technical assistance. To date, the processors have financed production with funds obtained from foreign import companies. As this type of financing is not subsidized, the interest rates charged to the producer are high. The state could finance small producers in the area using the funds available for subsidized loans to small producers which at present exclude coffee-growing activities. To this end, some of the restrictions regulating small farm loans would have to be eliminated.

Another important effort which could be made would be the provision of technical assistance to allow small producers to learn about and, inasfar as possible, adopt the new techniques which are available. Also, advice could be offered with regard to the type of agro-chemicals which should be used, and in what quantities, together with other aspects relating to improved cultural practices.

b. Adaptation of the technology

Once the socio-economic and ecological circumstances which regulate the production of coffee on small farms are known, it is possible to suggest certain technological innovations which would contribute to the progress of these units.

The results of the case study of Pejibaye indicate that the main "bottle-neck" is the high seasonal demand for labour required by coffee (for the harvest). This factor, more than any other, limits the quantity of coffee a producer can plant to the amount of family labour available[1/].

If it were possible to re-distribute labour requirements during harvest time, production could be increased (by expanding the area cultivated, intensifying cultivation, or a combination of both) and labour, both family and day-hire, could be reorganized. The "bottle-neck" which has been detected is the consequence of a characteristic common to the coffee varieties planted: all ripen at essentially the same time of year. Traditionally, the criteria used by researchers and technicians to select varieties has taken into account aspects such as the size of the plant, the colour of the berry, the precocity or age at which the plant first begins to produce and, more recently, the resistance to diseases such as coffee rust. The problem of the ripening time has interested the farmers who, from many years' experience, have come to determine sub-varieties which they call "fast" or "slow"[2/]. This allows the producer to prolong the harvest period and work with the labour available which, in many cases, is composed only of members of his family. Even though this mechanism has introduced a certain flexibility into the seasonal demand for labour, the latter continues to be an important obstacle to an increase in production. Due to the importance of this factor, it would be advisable for the institutions responsible for the generation and transference of technology to include it as a relevant criteria for seed selection and for an effort to be made to develop varieties with different ripening times.

Measures of this type would affect the activities which precede the harvest season, and could signify a decrease in the planting of

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1/ This relation is not direct, as there is the possibility of contracting seasonal labour, although this resource is limited.

2/ Of relatively early (fast) or late (slow) ripening.

other crops and the dedication to other activities. However, as labour requirements for other agricultural activities are not so critical, sufficient flexibility would exist for the benefits obtained by the increase in coffee production not to be counteracted by the decreases in other activities. The generation and adoption of such technology, ceteris paribus, would occasion an increase in employment and a net increase in income per farm[1/].

However, a technological change allowing increased coffee production could accelerate the deterioration of the economic conditions of rural workers who only have access to land through sharecropping arrangements, as their land would probably be recovered by the owner and planted with coffee. If this happened, some of these workers would lose their ties to the land and become temporary workers occupied in the coffee harvest and other similar tasks.

1/ This type of strategy would reduce the price paid to the producer per unit of coffee due to the increase in the percentage of the total production sold in non-traditional markets. The net effect of the change would, however, be positive because the volume of the production of Costa Rica has minimal influence on the movement of prices at the international level.

V. CONTRIBUTIONS OF THE COSTA RICAN CASE STUDY TO THE DEBATE ON THE STATUS OF THE LATIN AMERICAN PEASANT

A. Debate on the Status of the Latin American Peasant

Over the last two decades, the peasant problem has been the subject of abundant research carried out by social scientists, especially in Latin America. This has provoked a theoretical debate centered on the status of this sector within the capitalist system and its possibilities of survival or disappearance in the future.

In summary, the difficult positions that have emerged from the debate may be classified into two categories, campesinista and descampesinista. The former maintains that this sector, as such, contributes to the development of the national economy and, thus, it is necessary and possible to improve and strengthen its position through the generation of appropriate technologies and the implementation of integral rural development projects and programmes. The latter points out that this sector has been greatly penetrated by capitalism and transformed into a reserve of cheap labour for capital. For this position, the support strategies suggested are contradictory and more complex than for the former.

For both positions, the role played by technology constitutes one of the central points of the debate. In this regard, the different research projects carried out by PROTAAL have generated a series of interrogatives relating to the research process and the design of policies and projects directed at the development of the peasant sector.

The first interrogative is related to the institutional system for the generation of technology and the organization and cost of research. In this respect, we should ask ourselves what have been the successes and failures of technologies generated for the peasant sector. Can research institutions maintain political and financial support if they choose the peasant sector as their main beneficiaries?

The second points out the socio-economic and ecological conditions constraining small farm production and the possibilities for improving the techniques presently in use in this type of production system. Do past failures indicate a lack of knowledge of the dynamics of small farm production systems vis-a-vis the adoption of technology or, rather, are they directly related to the fact that existing technology is not appropriate?

The third refers to the high social costs implicit in a strategy which seeks the technological improvement of peasant farmer production. Do alternative methods exist which would allow us to achieve similar results at a lower cost?

The fourth relates to the possibilities of developing technologies which only benefit peasant farmer production. Is technology of necessity a mechanism of expulsion of peasants due to the competition with commercial producers or, to the contrary, can it become a mechanism which defends the permanence of this sector?

The fifth is related to the type of mechanism which might avoid the incidence of a process of internal differentiation induced by the adoption of technologies in a situation of inequality. Is it possible to prevent differentiation within the sector and at the same time maintain individual incentives?

Finally, the sixth refers to the creation of mechanisms which allow the benefits derived from technological change to be retained by small farmers. Do mechanisms exist whereby peasant farmers may transcend their economic situation, or will this remain invariable due to appropriation of the benefits by other social sectors ("treadmill effect")?

B. Evidence Contributed by the Costa Rican Case Study

One of the objectives of the case study of the small producers of Pejibaye was to collect empirical evidence which would contribute to the understanding of the dynamics of the peasant farmer sector.

The results obtained from the analysis suggest that the process observed presents tendencies which fit both the campesinista and descampesinista positions. Certain actions and mechanisms developed by the Costa Rican state indicate the intention to maintain and strengthen the socio-economic context in which peasant production takes place. This is reflected in the explicit objectives of the agricultural policies of the different governments, and in specific actions directed at ensuring that producers retain the greater part of the value of his production. It is also reflected in the establishment - under certain circumstances - of subsidized prices and credit. These actions have introduced modifications in the peasant production systems, reflected in changes in production techniques for certain crops and in the modification in the proportion of resources assigned to each productive activity.

Public policies have also had an influence on the differentiation process which has occurred within the small farm sector. Due to the unequal access to productive resources, from both a quantitative and a qualitative point of view, the degree of adoption of technologies varies and, consequently, so does the income obtained by each production unit. This, in turn, implies that the benefits of national policy and technological progress are distributed unevenly.

The absence of mechanisms which regulate this situation could accentuate these differences and lead to polarization and the disintegration of the sector into capitalist and proletariat producers. However, several factors indicate that this process will occur slowly: a) there are still socio-economic domains which have little attraction for commercial production; b) small producers make an important contribution to the production of coffee, which occupies a fundamental position in the Costa Rican economy, which means that small farmers are crucial to accumulation by other sectors; and c) due to the labour-saving nature of technological change experienced in industrial and commercial agricultural production which implies that excess labour will not be readily absorbed

by these sectors. It is probable that many small farmers will remain as such, rather than become either rural or urban wage-earners.

The foregoing considerations would seem to indicate that the Costa Rican socio-economic context contributes to the permanence of small producers in areas with conditions similar to those found in Pejibaye, for at least the forseeable future.

C. The Role of Technological Change in the Development of the Agricultural Sector

The case study of Pejibaye showed that socio-economic contexts still exist that fulfill the basic conditions for capitalization of the small farms. These conditions may be summarized as follows: a) high producer participation in the distribution of income derived from production; b) prices which allow a high rate of return on coffee-growing activities; c) availability of private credit; d) adequate marketing channels; and e) availability of technology appropriate to the conditions previously described.

This situation is, to a great extent, the result of the implementation of public policies designed and carried out with the intention of favouring the agricultural sector and, to a lesser degree, the small farmer. However, this fact is not a sufficient condition for the adoption of technologies to be able to have significant influence on the development of the small farm sector. The small farm unit presents its own special characteristics, intrinsic to its internal organization, which hinder, and in many cases prevent, the adoption of existing technologies: a) limited availability of productive resources, especially land; b) scarcity of seasonal labour; c) land with a low production potential; and d) absence of mechanisms which allow the peasant farmer to face the risks inherent in agricultural production. This situation might suggest the need to develop technologies "appropriate" to the precarious conditions under which this type of production is carried out. A strategy of this type

would demand the reorganization of research activities, would be very expensive, and would probably not result in a substantial increase in the productivity and welfare of small farmers.

In accordance with the foregoing, any intent to promote rural development through the provision of new technologies must take into consideration the following points.

1. The development of "appropriate" technologies demands a prior knowledge of the specific conditions of each peasant farmer situation and must be based on the achievements of the actual production systems.

2. The unequal quantity and quality of productive resources within the sector implies that each technological change - granted that technology is not neutral - affects the producers involved unequally.

3. The improvement of exchange conditions (prices) of commodities produced by small farmers constitutes a prerequisite to the adoption of technologies. Conditions must be such that the additional income derived from the technological change will be retained by this sector.

4. The technologies must be adapted to the capacity of farmers to face the risks involved and to the patterns of labour use, according to sex and age, at different times of the year.

In the light of the above mentioned points, it is evident that the development possibilities of small farm production depend both on decisive state support and on the generation of technologies specifically designed for particular situations. Although the combination of these two conditions would seem to significantly favour permanence and development of the small farm sector, it would not prevent, and may even stimulate, the occurrence of inequalities which accelerate the process of internal differentiation.

In the case of the coffee producers of Pejibaye, the development of new technologies would affect them unequally, according to the quality of their land, and the area available for coffee-growing in each farm.

While the regional economy would be strengthened, competition between the peasant farmers would increase; one part of them would differentiate "upwards" while others would slowly lose their peasant farmer characteristics, becoming semi-proletariat, landless workers, or migrating towards urban areas. A mechanism which would counteract this trend would be the promotion of actions directed at improving the situation of those peasant farmers whose lack of resources prevents them from benefitting from technological improvements in coffee production. Taking into account only the immediate problem of production, the establishment of associative forms of productions (communal farms) would permit a more equal distribution of the benefits derived from the incorporation of new technologies among producers. However, a measure of this type has other implications which go beyond the scope of the analysis presented here.

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