5-1972

Relative Rates of Return to Controlled Irrigation Among Classes of Summer Paddy in the Guayas Basin, Ecuador

Percy G. Aitken

RELATIVE RATES OF RETURN TO CONTROLLED IRRIGATION AMONG CLASSES OF SUMMER PADDY IN THE GUAYAS BASIN, ECUADOR

by

Percy G. Aitken

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Agricultural Economics

UTAH STATE UNIVERSITY
Logan, Utah

1972

ACKNOWLEDGMENTS

I wish to express sincere appreciation to Dr. Allen LeBaron, my thesis director, and to the other members of my graduate committee for their advice and counsel throughout my graduate program. Special appreciation is due to Dr. Clark Ballard, Dr. N. Keith Roberts, Dr. E. Boyd Wennergren and Dr. Allen LeBaron for arranging financial assistance. This study was specifically supported by Contract #AID csd/2167 between Utah State University and the United States Agency for International Development: On-Farm Water Management in Sub-Humid Areas of Less Developed Countries (Project Director: A. A. Bishop/H. B. Peterson), however, the conclusions and opinions are the writer's and do not reflect official or unofficial positions of USAID or the host country.

Appreciation is also extended to the USAID Mission in Ecuador, to Engineer Bolivar Lupera of the National Rice Commission of Ecuador and to the many others who helped in conducting field research in Ecuador during the Summer of 1971. Ruby Johnson edited and typed this thesis.

To my wife Clara, I owe special thanks for her patience and encouragement.

Percy G. Aitken

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

ABSTRACT

Relative Rates of Return to Controlled Irrigation Among Classes of Summer Paddy in the Guayas Basin, Ecuador

by

Percy G. Aitken, Master of Science

Utah State University, 1972

Thesis Director: Dr. Allen LeBaron
Department: Economics

The primary objective of this study was to examine rice production methods with special emphasis on farm and water irrigation management practices in the different rice farm types of the Guayas Basin of Ecuador. To do this, farmers were divided into eight categories on the basis of farm practices, seasonal farming, irrigation facilities and level of mechanization. Profits per hectare ranged from 4,807 to 762.10 sucres per hectare. Mechanization varied from totally mechanized to total absence of machinery. Year round farming varied to seasonal farming. Average production varied from 110 quintals of hulled rice to 20 quintals per hectare.

The preparation of farm budgets for the different types, presented some problems, due to the lack of available records by the small farmers and reluctance to provide data by the large mechanized units.

The cost/benefit ratios of changing from one type of farming to another were calculated as well as the labor absorption possibilities for the different types of farming. These could provide a criteria for planification of rice production policies in Ecuador.

(98 pages)

INTRODUCTION

Objectives

One of the principal objectives of this study is to examine the rice cultivation in Ecuador with special emphasis in the traditional farm practices. The study is limited to the summer rice cultivation but data on winter rice is important for comparative purposes and is included. Most of the summer rice farming operations utilize traditional farming practices that have to be well understood before they can be the object of planned change. For example, a unique characteristic is that the rice paddies are really closed depressions that are converted into shallow lakes during the rainy season.

Another objective is creation of benefit/cost ratios for summer cultivation practices based on preparation of average annual farm budgets for each type of farming practice. A third objective is to observe the returns to water management practices as they are shown in the different types of farming practices.

Labor absorption due to possible policy presentations and an estimate of the social impact on the different levels of rice production are also considered.

The purpose and formal objectives of this study are:

1) Examination of traditional rice cultivation in Ecuador;
2) Estimate benefit/cost ratios for summer rice cultivation practices;
3) Rates of return to improved water management practices;
4) Labor absorption and estimate social impact for different levels of rice production.

CHAPTER I

GENERAL CHARACTERISTICS OF RICE CULTIVATION IN THE GUAYAS BASIN

Ecuador is potentially a very rich country. Huge oil deposits have been found recently in the Amazonic or Eastern area of the country which are thought to be as important or more important than the Venezuelan oil fields. Also, some important aluminum bauxite areas have been found close to Guayaquil. But still Ecuador is basically an agricultural country with the problem of not producing enough food for its own people and trying to increase its production to meet the increases in food demand created by the population growth. One of the main staples of the Ecuadorian diet is rice, 88.1 percent of which is produced in the Guayas Basin as reported by the National Rice Commission[1,3] (see Table I).

In the year 1969, the geographical distribution of the rice production in the country was as follows:

Table I. Geographical Distribution of Rice Production, Winter 1969.

Province	Winter		%	Summer		%
Province of Guayas	66,944.15	Hectares	62.3%	17,751	Hectares	68.1%
Province of Los Rios	27,754.78	"	88.1% 25.8%	4,703	"	17.0%
Province of Cañar	1,442.25	"	1.4%	——		
Others	11,277.39	"	10.5%	3,600	"	14.9%
TOTAL	107,418.58	Hectares	100.0%	26,054	Hectares	100.0%

Source: Comisión Nacional del Arroz, Ecuador.

The above table shows the area of rice production for the whole year. But it is necessary to keep in mind that in Ecuador, two rice crops can be obtained per year, one in summer and one in winter.

By 1969, it was calculated that of the total area of rice cultivation reported as mechanized, only 2,000 hectares were worked totally in a mechanized way, of which 1,000 hectares belonged to the "plan pilots" of the Banco Nacional de Fomento, which worked in cooperation with the National Rice Institute. The other 1,000 belonged to various private farms.

Rice planting is made in three different ways: (1) by hand or "Espeque", (2) by transplanting from nurseries and (3) by machinery. The first two types use 75 to 100 pounds of seed per hectare and the mechanized planting uses 200 to 250 pounds of seed per hectare. It was calculated by the National Rice Commission, that for year 1969, 65.35 percent of the total rice planted was done by hand, 9.30 percent was done by transplanting from nurseries and 25.35 percent was machine planted.[1,37]

Importance of Rice at National Level

Rice production in Ecuador is the fourth largest crop by area and covers approximately 110,000 hectares per year.

The value of the rice crop per year is calculated to be 385 million sucres ($) (U.S.$1,540,000) per year which is equivalent to 5.1 percent of the gross national product of Ecuador.

Between 1940-1950, rice exports made up approximately 25 percent on the total value of Ecuadorian exports.[5,6]

The plans for the expansion of rice production in the country are now in the hands of the "Programa Nacional del Arroz, Maíz y Control de Piladoras y Molinos". This institution was created in 1948 as the

"Comisión Nacional del Arroz", and became the present institution in 1971 by law, which also increased the powers of the institution in regards to all the aspects of rice production.

The Guayas Basin has an important part of the development plans of Ecuador. In July 1962 and July 1963, two different commissions of the Pan American Union made a study of the potential development of the Guayas Basin indicating the importance of this area for the Ecuadorian economy.(3,2)

Guayaquil, the most important city of Ecuador and the principal port for imports and exports, is in the Guayas Basin facing the Pacific Ocean. The principal center of production of Ecuadorian agricultural exports such as banana, cacao and rice, is in the Guayas Basin.

The Guayas Basin itself is a 33,640 km^2 of area with a north-south watershed trend.(3,27) It has a very humid tropical climate. Its principal natural resource is its fertile soil and its abundant ground and surface water.

The area of the Guayas Basin is the best suited for rice cultivation in Ecuador, where the farmer has traditionally been cultivating rice for hundreds of years.

Rice Production and Area

In the following table, we have to make the following considerations. The total crop of hulled rice is given in units of quintals of 100 pounds (Spanish quintal). The yields per hectare are given in quintals of 100 kilos (metric quintals), almost double. The rice mills calculate a normal yield of 57 percent from nonhulled rice to hulled rice as can be calculated from metric tons in nonhulled rice to metric tons in hulled rice.

Table II. Area and Rice Production.

	AREA	PRODUCTION			YIELD
		Nonhulled Rice	Hulled Rice		Per Ha.
Year	Hectares	Metric Tons	Metric Tons	qq. of 100 lbs.	qq. of 100 kg.
1954	51,300	146,157	83,518	1,839,600	28.49
1955	78,500	198,443	113,396	2,497,700	25.28
1956	92,920	206,292	117,881	2,596,500	22.20
1957	104,200	248,488	141,993	3,127,600	23.84
1958	108,800	258,947	147,600	3,253,104	23.80
1959	115,800	262,266	159,492	3,515,204	22.65
1960	91,100	307,128	175,063	3,858,388	33.71
1961	94,600	296,754	169,150	3,728,066	31.37
1962	111,700	300,780	171,445	3,771,790	26.92
1963	113,059	304,490	173,559	3,818,298	26.92
1964	105,282	236,416	135,094	2,972,068	22.45
1965	99,729	260,397	148,798	3,272,556	26.11
1966	101,166	275,684	157,533	3,465,726	27.25
1967	110,561	249,639	142,650	3,138,300	22.57
1968	112,376	144,552	82,601	1,817,222	12.86
1969	107,419	288,016	164,580	3,620,760	26.81

Sources: Banco Central del Ecuador.
Banco Nacional de Fomento.
Ital-Consult.
Comisión Nacional del Arroz, 1964-1969.

The demand for labor and capital inputs has steadily increased in recent years, high prices obtained for rice, increasing, therefore, input price; but the total rice production has not kept pace with the demand because most of the farmers still maintain traditional methods of farming and cannot afford the high cost of the modern factors of production levels. The increase of demand has come from two sources:

1) the population increase in Ecuador, and 2) failure of rice crops in neighboring countries which has increased the demand of those countries for legal and illegal imports of rice.

Markets for Rice

The best market for Ecuadorian rice is Ecuador itself. The immediate alternatives markets are Peru and Colombia (see Appendix IV). But these markets are limited by red tape regulations and subject to strong seasonal price variations. The world market quotes, at present, a low price with a tendency to drop at lower levels while world production increases constantly.

The small farmers which conform the majority of the rice farmers of Ecuador, market their rice either through intermediaries or to local mills where they are advanced cash on their future crops.

Formerly, the small farmers use to rent their land from large landowners and pay their rent in a percentage of the crop. Today, the large landholdings are being split in smaller units due to land reform measures. As a consequence, the large landowner has ceased to be the source of credit for rice production and the intermediary for its marketing.

The actual marketing system involves a great risk for the small rice farmer who never feels secure of the price he may receive, there are no constant relations between the market price of rice and the price obtained by the farmer. The small farmer generally receives an "advance" payment on his crop. This advance carries two conditions: (1) a rate of interest, and (2) settlement of the debt at harvest time "according to market price of the day". Price insecurity, the land tenure system, the lack of good soft credits and total lack of intensive extension work, discourages the small farmer from increasing his investment and production. The area of

summer rice farming has increased slightly since 1968, year in which the "Banco Nacional de Fomento" started to grant softer credits to summer rice farmers for irrigation equipment (pumps and others) through direct imports.

It is interesting to point out that the most progressive "entrepreneurial" poza farmers are able to secure pumps and credits from the "Banco de Fomento", decreasing their cost in interest rates, and decreasing their yield uncertainty due to lack of water.

It has been reported that rice mills will commonly advance money on future harvests as loans with interest as high as 20 percent for every six months, plus the obligation to deliver the harvest to the mill. These loans are generally made to small farmers and vary from US$100 (2,500 sucres) to US$2,000 (50,000 sucres) as reported by the farmers interviewed.

Rice Varieties and Marketing

The varieties of rice under cultivation at present in Ecuador, by grain size, are as follows:

Table III. Rice Varieties by Grain Size.

Extra long	Long	Medium	Small
SML	Blue Bonnet 50	Brasilero	Chileno
Nilo 3	Rexoro	Canilla	Piedra
Tapuripa	Fortuna	Comino	No hay Taco
	Dawn	Criollo	3-15
	Puyon	Corriente	Chato
	Lira	Cañario	Ayora
	Hawayano	Canelo	Gringo Pobre
	Texas Patna	Morado	IR - 8
	Zenith	Perlillon	
	Colorado	Estrella	

Source: Comisión Nacional del Arroz.

The rice mills pay prices based only on two classifications--long and short--and consideration of 13 percent moisture content. Long includes the extra long and long. Short includes medium and short. The prices expected this year by the farmers are 150 sucres per bag of 195 pounds (unhulled) for the long varieties and 140 sucres for the bag of 195 pounds (unhulled) for the short varieties. A bag of 195 pounds of unhulled rice yields 100 pounds of hulled rice if a yield of 51 percent is considered.

The rice mills officially report yields of only 57 percent from unhulled to hulled rice; but in private conversation with the writer, they had accepted up to 65 percent yields, which allows them to play and vary the prices in accordance to the client. The international average for yields in rice milling is 71.7 percent as reported by Fatjo.(2,2)

It is the common opinion that rice hulling is the "best business in the Ecuadorian seacoast".

Of the total production of hulled rice by the rice mills, the National Rice Commission reported that the production by size of grain is divided as follows:

Extra large grain	23.41%
Large grain	48.06%
Medium grain	19.95%
Small grain	8.56%
	99.98%(1,13)

As we can see, the tendency is to produce rice of large and extra large size, especially the latter which has a demand in the international markets of Colombia and Peru.

The small farmers and the local merchants make a slightly different classification which is more simple. They divide the size of grain in large and small. The extra large and large as large, and medium and small as small.

Rice Classification by Grain Size

Comisión Nacional del Arroz		Small Farmers and Millers
Extra large grain Large grain	=	Large grain
Medium grain Small grain	=	Small grain

There are more than fifty varieties of rice cultivated in the Guayas Basin, thirty of them being the most common.

Every year in Ecuador, the State sets the official price of rice (nonhulled) in order to stimulate the rice farmers. But the official price is seldom taken in consideration in the market operations. The observations showed that the same price was paid for a bag of 195 pounds of unhulled rice, with premiums allowed for grain size. Protein content and hulling percentages were not taken in consideration for small farmers.

Generally the system of marketing is as follows:

The rice mills advance money as loans to the small farmers with the compromise of receiving their harvests. The rice mills will try to secure the volume needed to work at full capacity. When a farmer receives a loan from a mill, he also receives the guaranty that his whole crop will be sold; and he diminishes his possibilities of not taking the advantage of price fluctuations that may benefit him. The rice mills will hull the rice and supply it to the national market for consumption, paying the farmers the free market price for nonhulled rice.

By advancing money, the rice mills receive the benefit of collecting high interests on the loans and securing the necessary rice volumes for their operations.

There is another group which is called "fomentadores" or gatherers who will advance money and set fixed prices for the rice.

These rice gatherers sell their product to the mills. In many cases, the whole crop of a small rice producer is already sold before harvest. So, the benefits of the rice price fluctuations will never or seldom benefit the producer.

The people receiving the rice from the producer, be it the rice mills or the gatherers, will make discounts on their appreciations of the type of grain, its percentage in broken grains, moisture, waste, dust, etc., and have a final price for the farmer after discounts.

"FENACOPARR", the national federation of rice producers' cooperatives, recognizes as the most urgent problem the fact that the rice producers are under the control of the gatherers and the rice mills and is trying to obtain enough money to finance low interest loans for rice production to its members, in order to obtain, in this way, an increase of the income of its members.

The National Rice Commission has been studying the possibility of building silos where rice could be purchased and accumulated.

In the international market, the rice situation is bleak. The United States is the biggest rice exporter. Japan, which was traditionally a rice importer is now a great rice producer and exporter and is now trying to reduce the areas dedicated to rice production. Besides, by increasing their standard of living, the Japanese are now consuming less rice than before.

In Europe, Italy is supplying the European Common Market and still has surpluses to increase the supply of the international market. So, the general tendency in the international market is to decrease the price of rice. This has been possible due to the adoption of modern

mechanized methods of rice production and the adoption of rice varieties with greater yields.

The Rice Institute of Ecuador

The "Comisión Nacional del Arroz", created in 1968, as an independent state corporation, has now been enlarged; and greater responsibilities have been added to it, such as the control of all rice mills, the corn production on the coastal area and the control of the flour mills. The new institution is now called "Programa Nacional del Arroz, Maíz y Control de Piladoras y Molinos". This new institution came into being in 1971 by law.

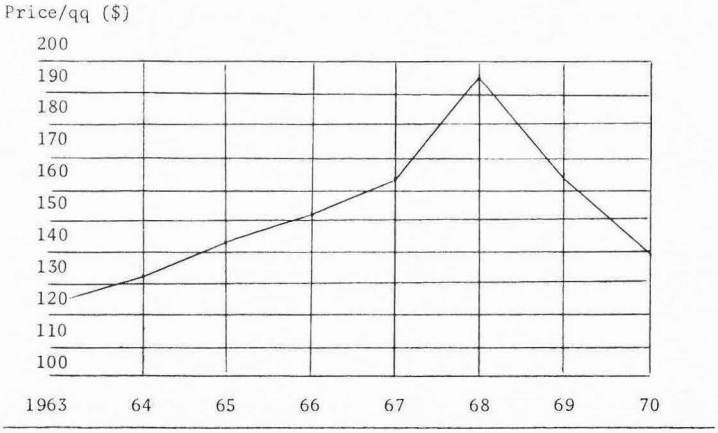
Price of rice has varied a great deal in Ecuador in a period of eight years from 1963 to 1970. The price per quintal of hulled rice has gone up from 126 per quintal (100 pounds)* to 197 per quintal in 1968 to decrease again to 140 per quintal, the year of the study.

Table IV. Variations of Rice Price Per Quintal (100 pounds).

Year	Price per Quintal in Sucres
1963	$126
1964	132
1965	144
1966	141
1967	152
1968	197
1969	161
1970	140

Source: Comisión Nacional del Arroz (Legal Department)

*"quintal" (qq) is a Spanish weight measure equal to 100 lbs. The "metric quintal" is more modern and equals 100 kilos.



Source: Comisión Nacional del Arroz (Legal Department).

Figure 1. Price Fluctuation for Rice Per Quintal Year 1963-1970 (in sucres).

These fluctuations in rice prices make it difficult to calculate accurately, rates of return and predictions in the farmer's income.

Typical Tenure and Cultivation Arrangements in the Guayas Basin

The land tenure system in the Guayas Basin is still based on the large landholdings which had their origin in the Spanish Colonial distribution of the land and later distributions and sales made during the Republic. The small farmer or "Campesino" generally rented some land from the large landowners and paid them rent in kind through a percentage of the crop being delivered to the landowner, and certain prearranged number of days work free on the landowners holding. This type of arrangement has lasted since the Spanish Colonial times to our days.

Since 1970, there has been an effort to provide ownership of the land to the small farmer. As a consequence, the number of small proprietors in the Guayas Basin has increased rapidly. This has permitted the creation of the "Rice Production Cooperatives", which at the time of the study covered over 16,000 hectares (see Appendix III).

The majority of the small farmers are "poza farmers"; that is, they share the ownership of shallow lakes where water is accumulated during the winter months so that during the summer, rice can be planted in the banks and at lower levels as water levels decrease.

Many of these "pozas" or shallow lakes have been enlarged and improved in their water holding capacity by hand labor and machine.

Labor is plentiful in the rice production area of the Guayas Basin, in fact, an excess of labor can be noticed which forces the prices of wages down. The excess of labor in rice is due in part to the fact that this type of farming is preferred to others such as cacao or banana which are more linked to large export corporations and which present a larger quality risk.

Land Tenure.--Land tenure in the Guayas Basin is still largely based in the landholdings which were first distributed by the Spanish Crown and later by the Republic.

In 1969, of 4,035 rice farmers counted in the Guayas Province, 903 were proprietors of the land they farmed which is equal to 22.3 percent of the total farmers, while 3,132, equal to 77.7 percent, were renting the land.[1,38] No similar count was made for Los Rios Province, although the opinion was that a smaller percentage of the proprietors could be possible for that province. We can see by the Tables V and VI, that farms less than 35 hectares for the Provinces of Los Rios and Guayas total

94 percent of the farmers' farm units, the majority of which are probably rented from the large landowners.

The data has not been updated since, but percentage of ownership of land is supposed to have increased, due to the agrarian reform laws. For the Provinces of Guayas and Los Rios, rice production was carried on in farms that could be grouped by size in five categories with the following results.

Table V. Number of Farmers by Size of Farm, Guayas Province, 1969.

Size of Farm	Number of Farmers	%	Less than 35 hectares
Up to 3 has.	1,728	43.5	
From 3 to 14 has.	1,461	36.3	
From 14 to 35 has.	509	12.5	92.3%
From 35 to 70 has.	193	4.3	
From 70 has. or more	144	3.4	
Total	4,035	100.0	

Source: Comisión Nacional del Arroz.

Table VI. Number of Farmers by Size of Farm, Los Rios Province, 1969.

Size of Farm	Number of Farmers	%	Less than 35 hectares
Up to 3 has.	2,205	60.0	
From 3 to 14 has.	1,185	29.5	
From 14 to 35 has.	265	7.1	96.6%
From 35 to 70 has.	92	2.4	
From 70 has. or more	41	1.0	
Total	3,788	100.0	

Source: Comisión Nacional del Arroz.

Farmers (6353) with less than 35 hectares farmed 94 percent of the total number of farms in the Guayas Basin. This would tend to confirm that

Ecuadorian rice farming is mostly made by small farmers. If we assumed that the modern factors of production (machinery, fertilizer, etc.) are beyond the economic possibilities of the small farmer, the future increases in agricultural production, which can be expected by the mechanization of agricultural practices, which could provide better yields, will be very slow. The large farmers cultivating 6 percent of the farms produce 23 percent of the summer rice harvest. Similar conditions are present in the year round production as will be discussed later.

Land Reform.--The agrarian reform with due payment of the land taken for distribution is a very slow process and so, the Ecuadorian Government has enacted a special law called "Law #1001" or the "Ley de Precaristas", which forbids any land rental and takes over the land which is rented for the benefit of the people that rent it, giving them the possibility to buy it at declared values for tax purposes which is generally only 10 percent of its real market value of the land.

Due to the "Ley de Precaristas" or Law #1001, the number of small rice producers requesting technical and extension service has increased greatly; and the cooperative movement has grown steadily.

Rice Production Cooperatives

In 1969, the number of cooperative rice producer organizations was 19.[1,28] At the time of the visit to the National Federation of Cooperatives of Rice Producers, "FENACOPARR", in August 1971, this number had increased to 32 cooperatives with more than 16,000 hectares of land under cooperative organization (Appendix III). This has been possible mainly due to the Law #1001 or "Ley de Precaristas".

The list of rice cooperatives served by FENACOPARR in August 1971, is as follows:

Cooperative	Zone
	I
Los Rios	Babahoyo
Las Mercedes	"
Marcos Bonnetazu	"
El Agosto Bonnetazu	"
	II
La Unión	Daule
Narciso de Jesus	"
San Felipe	"
Nueva Esperanza	"
Progreso	"
Las Pampas	"
	III
La Boldaca	Milagro
Jujan	"
Yaquachi	"
Huancauilca	"
La Isla	"
Río Ruidoso	"
Nueva Fortuna	"
Los Angeles	"
La Carmela	"
Villa Mercedes	"
	IV
Margarita	Sambo Rondón
Nueva Narcisa	"
31 Octubre	"
San Luis	"
Los Juncos	"
	V
Legua de los Indios	Baba
Santa Isabel	"
Tinoco	"
	VI
22 Octubre	Vinces
El Roblento	"
San Juan	"
Buena Fe	"

Source: FENACOPARR (Clusa)

The cooperatives actually have started to market their product and obtain some of their inputs such as fertilizer. But they do not work the land as a cooperative farm. So, these are marketing and consumption cooperatives and not production cooperatives as they have been thought to be.

No cooperative works the land in a mechanized way. The only one that has plans to do so but has not started even with one hectare so far is the "Cooperativa de Jujan", whose land has to be cleared, leveled, etc. Some members of the cooperatives will rent tractors or water pumps to work small plots, but it would be safe, at present, to state that most of the agricultural work in the cooperatives is done by hand and on an individual basis.

The non-farm job opportunities in the Guayas Basin are very few. Most of them are concentrated in the urban center of Guayaquil. In the rural area, non-farm job opportunities are limited to the banana packing plants, river boat navigation and commerce in small scale along the river towns of the basin. The salaries are too low, the profits too meager and people either migrate to the urban Guayaquil or stay at the farm.

Rural population explosion is more apparent in the Guayas Basin than in any other area of Ecuador.

The Nacional Rice Commission has made good in-roads in helping the farmers of the Guayas Basin to improve their farming techniques and their yields, improving, therefore, their income and standard of living. Some other organizations have started to develop different types of assistance for the small farmers, but these organizations limit their scope of work to their membership.

Pests.--The greatest portion of insect pests that the rice crops in Ecuador suffer from is a type of sucking insect which perforates the leaves in the nurseries, damages them and exposes them to the possibility of greater attack by the fungus "Pirricularis Orizae Cavara" which attacks the leaves with rustlike spots and dries the leaves causing the plants to weaken and die, reducing, therefore, the production. Another great problem is the one produced by the accumulation of an aquatic plant which is a wide-leaved tuber with beautiful blue flowers commonly called "lechuga", or "Jacinto de agua" or "camalote", but which is actually a type of Hyacinthus S.P. (Echornia).[4,88-92]

Seeds.--The seeds used by the Ecuadorian rice farmers exceed 50 varieties but can be classified in extra long, long, medium and short by size of grain. This is of great importance since the rice mills pay preferential prices for deliveries of extra large and large grains. Most of the improved varieties do not produce large grains. But due to present common water management practices in the Guayas Basin, improved varieties cannot be planted by most farmers. The improved varieties are high yield small size plants and are planted in 20 centimeters of water level. Most of the shallow lake (poza) farmers plant the native varieties in 40 centimeters of water level. With this level of water the small improved plant variety would drown. Improved varieties can be planted, with advantage, in the winter.

For the winter (the latest figure), 1969, the distribution of seed was as follows:

Table VII. Quality of Seed Use by Provinces, Winter 1969.

Provinces	Improved Seed Varieties		Native Varieties	
	Hectares	%	Hectares	%
National Total	63,103.30	58.75	44,315.30	41.25
Guayas	35,836.70	33.36	31,107.40	28.96
Los Rios	19,372.90	18.04	8,381.90	7.80
Cañar	1,268.70	1.18	173.60	0.16
Others	6,625.00	6.17	4,652.40	4.33

Source: Comisión Nacional del Arroz. 107,418.60 = 100%

The type and quality of seed is of greatest importance since it can show us the extent to which the extension services have been effective and also can explain to us some of the costs of bird watching and yields, which are important in the budgets.

The improved varieties, which have to be planted in low water levels (controlled irrigation), are seldom used by the small farmer who loses some of the advantages of the ingrown defenses of this variety. The improved varieties have some big, rough, sharp leaves at the top of the plant and over the heads of grain. These leaves, due to their width and length, are always on the move because of the wind and scare away the birds, allowing, therefore, a greater number of grains to ripen in each head, increasing the yields. In the native varieties, this self-defense of the plant does not exist and the heads stick out. When these are bent by the weight of the ripening rice, they serve as an excellent foothold from where the birds can reach the seeds more easily. Therefore, the plots with native varieties will suffer the greatest attack

by the birds which will have the effect of diminishing the yields quite considerably. This reason, more than any other, has favored the acceptance of the improved seed varieties in Ecuador, on farms where water management practices permit it. This is the reason for the high cost of bird-watching in the two low management levels described by White and this is one reason why this cost was not found to be so high in management levels #1 and #2.[8,51-81] Although no explanation was given at the time, the native varieties are tall and the improved varieties, such as the IR - 8, are small. Since the farmers on the shallow lake plantings cannot control the water, they transplant when the water has a height of 40 centimeters (4,000 m^3 p/ha). If the poza farmer would wait until he has a 20 centimeters level of water on the shallow lakes, that would allow him to plant the small improved varieties, but he would run out of water because most of the small farmers do not have control over the water and cannot add it to their initial available amount. Also the uneven level of the land creates some problems.

This is one reason why most small farmers have not been able to adopt the improved seed varieties in their farm practices.

Fertilizers.--The use of fertilizers is still very small in Ecuador; and according to the yearly report of the National Rice Commission, in the Guayas Basin, only 11 percent of the farmers used fertilizers in 1969. In the Province of Los Rios, this percentage increased to 13 percent.[1,6] One of the reasons is the high cost of chemical fertilizers in the free market. As an example, we have what was related to the writer by the rice farmers at the beginning of the year 1970, the cost

of 100 pounds of "Urea" (Nitrogen) was quoted in the market of Guayaquil at 125 sucres. At the end of January, the government expressed that a direct importation would be carried on by the Banco de Fomento and a small amount was imported. As soon as the news was let out, the fertilizer importers lowered their prices to $.90 (90 sucres) per 100 pounds. Most of the fertilizer in the market was sold due to low prices; and due to this success, the Banco de Fomento did not repeat the importation of fertilizer. At the time of the present study, (August 1971), the price of "Urea" had gone back and up to $130 (130 sucres) per 100 pounds and there were no amounts to be found in the market. These price fluctuations of the modern factors of production plus the almost permanent high cost of the same, withheld the small farmers from investing in these factors of production. To the criteria of the writer there was no continuity in the governmental policy with regards to fertilizer imports, which created general insecurity and high prices.

Irrigation.--Rice farming is carried on in the summer, with or without irrigation, depending on the state of technology and water management of the farm. Irrigation is provided by pumping on lands leveled and prepared for rice culture. Irrigation can also be obtained by capturing water from the river by gravity or due to the increase in river water level caused by tides. But in short, we can state that there are two types of summer rice farming, one in which irrigation can be provided and controlled, and one in which rice is planted in temporary shallow lakes created by the winter rains in natural depressions which occur from December to May. Rice farming in these natural shallow lakes is called "poza".

CHAPTER II

DATA AND METHOD

Survey Procedure

Any study of rice is important for Ecuador due to its economic share in the gross national product and due to its social impact, since 80,000 families, representing almost 500,000 people, which makes 8.4 percent of the total population of Ecuador, live off rice farming or related activities.[5,7]

In order to study rice farming in Ecuador, it is important first to obtain the farm budgets and the necessary general knowledge of the conditions and types of rice farming in the country.

Location of the Survey.--The survey was made in the Provinces of Los Rios and Guayas, where 88 percent of the national rice production comes from (Table VIII). The Guayas Basin includes the Provinces of Pichincha, Manabi, Cotopaxi, Los Rios, Guayas, Bolivar, Cañar, Chimborazo, and Tunguragua. The most important among them due to the topographic conditions, existence of rivers and water irrigation potential, communications and rice production, are the Provinces of Guayas and Los Rios. The Guayas Basin is near the seaport of Guayaquil on the Pacific Ocean.

Table VIII. Geographical Distribution of Winter Rice Production, 1964.

Province of Guayas	62.3%	88.1%	66,944.15 Hectares
Province of Los Rios	25.8%		27,754.78 Hectares
Province of Cañar	1.4%		1,442.25 Hectares
Others	10.5%		11,277.39 Hectares
Total	100.0%		107,418.58 Hectares

Source: Comisión Nacional del Arroz, Ecuador.

The overall study was made in three stages. First, a general visit was made of the rice farming area, and 106 questionnaires were presented to rice farmers. Second, a study of the questionnaires revealed the necessary data for the construction of the farm budgets on the different types of rice farming in Ecuador. Third, interviews with millers, farmers, merchants and government people were made to complement the necessary data.

Number of Farmers in the Area.--The total number of farmers in the area is 7,823, of which 4,035 are in the Province of Guayas and 3,788 are in the Province of Los Rios. This number of farmers is reported by the National Rice Commission for the year 1969 (see Tables V and VI).

Rice Area Covered by the Study.--The area covered in the study was limited to the Provinces of Guayas and Los Rios, which accounted for 88.1 percent of the rice production of Ecuador. The number of farmers interviewed was only 1.3 percent of the total number of farmers, due to the time limitations, and were chosen at random from the six extension areas served by the National Rice Commission.

Map references are found in Appendices II-1 and II-2, which cover the areas of the Guayas Basin. These two areas have been divided by the National Rice Commission in six extension areas and the questionnaires were taken in these six areas (see Appendix II-1).

Date of Survey.--The survey was taken in the month of August 1971. This was carried out by seven enumerators, the six area extension agents of the Comisión Nacional del Arroz and the writer as coordinatro for the six areas. Each extension agent worked in one area according to the following assignment.

	District	Agent Assigned to the District	Province
1.	Babahoyo	Ing. Bolivar Lupera	Los Rios
2.	Daule	Ing. Edgar Pinto	Guayas
3.	Milagro-Triunfo	Ing. Jacinto Bruke	Guayas
4.	Sambo Rondón	Ing. Jorge Livingstone	Guayas
5.	Baba, Urbina, Jado	Ing. Jacinto Varas	Los Rios, Guayas
6.	Vinces	Ing. Manuel Vintimilla	Los Rios

The survey emphasized the following objectives:

1. To obtain farm budgets for management levels numbers 1, 2, 3, and 4 as described by White[8,54-76] with emphasis of separate detail possible for both fixed and variable costs.
2. To obtain data of volume of water used by the different management levels.
3. To obtain general information of the agricultural practices of rice, and the intensity of labor use.

The questionnaire was presented to the farmers directly and great tact had to be used in order to obtain correct answers, since most farmers did not have any records or feared to risk their answers.

Characteristics of the Six Districts in Study Area

District I - Babahoyo.--This is the largest planted area in the winter. In this area, all winter rice farming follows the system of direct farming,

while during the summer they follow the system of transplanting. The soils are clayish but not extremely heavy.

District II - Daule.--This area is made up of strongly clayish soils. Most rice farmers own pumps, and rice planting goes on during all year. This the best area for rice. The system used for farming is transplant.

Most of the area of Daule is flat and most of it is semimechanized (at least one pump). Most of the farmers will have pumping facilities.

The rice yields are the highest for the country.

District III - Milagro.--This area is divided into three subareas:

Milagro
Yaguachi
El Triunfo

A lot of winter rice planting is found in Milagro and El Triunfo, while the subarea of Yaguachi plants summer shallow lakes (poza).

The problem in this area is recognized to be the salinity of the water due to the mixing of river and ocean water due to the tides.

District IV - Sambo Rondón.--This the most important area for the summer planting. Some of the most important mechanized farms have been developed in this area.

District V - Baba, Urbina, Jado.--This is a new section in the extension services of the "Programa Nacional del Arroz". The area is difficult to reach due to a lack of good roads.

This the least mechanized area and the one in which agriculture is most backward.

This area specializes in summer rice planting in shallow lakes (poza).

District VI - Vinces.--This new area is for the extension services. It is distinguished by the important winter dry rice planting. This area

was famous for its cacao plantations which were replaced for banana but their transportation costs were too high and they have been switching to rice in the last few years.

This is one of the least mechanized areas.

The six area agents provided by the "Comisión Nacional del Arroz", are graduate agricultural engineers, who have either received the title or were to receive it in the future months. They were highly trained people with excellent knowledge of the area and with confidence and personal knowledge of the farmers.

Two training sessions were made with the enumerators in order to have a clear understanding of the terms used in the questionnaire and to clear up any misunderstanding that could arise during the work. Every six days, all the enumerators met in Guayaquil to have a progress report. This system permitted the coordinator to be of help when needed and to clear up any problem that may come along.

Subjects Covered by the Questionnaire

The objectives of the questionnaire were:

1. To obtain farm budgets for management levels numbers 1, 2, 3, and 4 as described by White[8,51-80] with emphasis of separate detail possible for both fixed and variable costs.
2. To obtain data of amount of water used by the different management levels.
3. To obtain general information of the cultivation of rice which could influence its production and water consumption.

The questionnaire was presented to the farmers directly and great tact had to be used in order to obtain the correct answers, since most

farmers did not have any records or feared to answer the questions. The questions covered in the questionnaire were:

The first ten questions were identification questions which not only identified all interviewed farmers with a locality and area, but also identified him in his producing capacity, area farmed, land tenure, etc.

The next nine questions were information questions that covered credit, systems of irrigation used, costs of irrigation, costs of structures, volumes of water used, sources of water, and systems of farming. Especially important, was question 19, where detailed costs of agricultural practices were obtained, from preparation of the land and planting to harvest and yields.

Questions 20 and 21 were opinion questions in regard to market cost of land developed, as well as underdeveloped.

The last question, number 22, dealt with lists of machinery, cost and amortization. This question was useless in the majority of the interviews since the few farms that used machinery calculated a rental price.

Evaluation of Collected Data

20 questionnaires were distributed per area, some questionnaires were invalidated due to contradictory information or faulty information; some others because the interviews were cut short by the interviewed farmer due to the fact that they considered themselves threatened by the questionnaire; and some others were lost because some farmers wanted to keep the questionnaires overnight to study them and later they refused to either provide the information or return the questionnaire. The

greatest resistance was encountered by the enumerator that tried to interview some of the largest mechanized operations and the semi-mechanized operations.

A total of 106 questionnaires were collected from the six districts according to the following table (11.6 percent of the questionnaires were invalidated).

Table IX. Number of Questionnaires Used by Areas

District I = 13	District IV = 18
District II = 19	District V = 19
District III = 19	District VI = 18

Total 106 questionnaires

The questionnaires were divided in accordance with the management levels described by White as shown in the following table.

Table X. Questionnaires by Management Levels (White).[8,51-80]

Districts	I_{TM}	II_{SM}	III_{PX}	IV_{P}	Total
I	—	6	—	7	13
II	—	6	11	2	19
III	—	1	2	16	19
IV	—	1	9	8	18
V	—	—	—	19	19
VI	—	—	2	16	18
Total	—	14	24	68	= 106

White divided the management levels for rice farming into the following categories:

Type I - Totally mechanized;

Type II - Semimechanized;

Type III - Poza farming with additional water either from the river by pumping or provided by the tides that soaked up the river water;

Type IV - Poza farming with no additional water.

The first management level is represented by the large farmers who have had all their operations mechanized and who work land which has been previously leveled to zero slope. Only one farm fulfilled the conditions described, but none of the mentioned area (500 has.).(6,54)

The second management level is represented by middle size farmers with semimechanized operations. Most of these farmers had some type of machinery and they cultivated farms consisting of 35 hectares or more. Type I and II represent no more than 6 percent of the farmers (see Tables V and VI). Most of the farmers on this type do not reach the area described.(6,64)

The third and fourth management level includes all the farmers with less than 35 hectares and they represented 94 percent of the number of farmers. They generally cultivate rice in natural depressions to which water is provided by rainfall or the high tide.(6,71-81)

White did not take in consideration: dry farming operations, mechanized and nonmechanized. In the irrigated semimechanized farming, as presented by White in the second management level, there should be another differentiation due to costs of planting or transplant planting which, according to the local farmers, made a noticeable difference.

To the third and fourth management levels presented by White, another management level was added (water provided by pumping to the natural depressions used to cultivate rice) in order to determine better the water costs and needs.

Of the data that was collected from the small farmers, 86.7 percent were within management levels #3 and #4 of White's classification. The remaining portion of the data (13.3 percent) was collected from management level #2, but it also included dry mechanized and nonmechanized farming. The farmers were selected at random and there were no biased selections.

One personal visit was made to "La Angelica", which is the only farm with the characteristics of management level #1 (totally mechanized).

On the date of this study, it was found that in accordance to the management levels defined by White, there was only one farmer within management level #1 who almost reached an extension of 500 hectares of planting per season. During the course of the study, various attempts were made to calculate the percentage of the area under rice cultivation which was mechanized. Different figures were obtained, but these figures always varied according to the definition of mechanization. Mechanization could be defined as total mechanization, partial mechanization or even incipient mechanization. But any standard would need to be defined before applying it to the ownership of one pump when that is all that is needed, or 2 tractors when 20 are necessary, for one operation. So, a figure for percentage of mechanization was not obtained. Degree of mechanization will be shown in the budgets of the different types of farm practices, according to the mechanized agricultural practices used.

The data collected had many weaknesses. The principal weakness being the small number of the sample for such a large area and population. This was due principally to the time limitations.

Another great weakness of the data was that since 86.7 percent of the data had been collected from small farmers. We found the problems of distrust, illiteracy, lack of winter data, fear of taxes and other consequences that could affect the rights of the farmers in the new land tenure measure that the government was starting to enforce, such as the "Law #1001" or Agrarian Reform Law, when forced with the questionnaire.

So we can say that the quantity and quality of the data collected, presented weaknesses. Nonetheless, the collected data permitted to calculate realistic farm budgets for the different types of farms visited.

Elements of Representative Farm Budgets

The crop production cost estimates are calculated on a per hectare rather than a per farm basis. This was considered to be a more useful approach considering the facts of restricted data on farm production, organization, and size of sample. Cost estimates, developed on a per hectare basis, disregard the issue of economies of scale or farm size which may be important as mechanization occurs in the Guayas Basin area. However, no data is available on economies of scale. Custom work rates are used in all cases where mechanized farm practices are involved. This procedure eliminates the need to deal with individual farm machinery costs, and amortization of capital costs, which are the primary sources of economies of scale. As long as custom rates are the same per hectare for all size areas, economies of farm size are not relevant. It should be kept in mind, however, that this type of costing procedure likely overstates the

costs for large efficient farms and may understate them for small inefficient farms. However, in the absence of sufficient survey data to accurately analyze the situation in the Guayas Basin area with respect to the influence of farm size and scale economies, it was felt that the most realistic approach to the cost problem was to utilize custom rental rates.

A representative farm in the present study will be a farm that complies with the characteristics of farm management which are laid down according to the characteristics of agricultural and irrigation practices that will follow. This has nothing to do with size, and land ownership, which are not essential characteristics for this stage of the study, but which may be important at a later date.

The four management levels designed by White have been complemented and subdivided to make 8 types of farms or farming practices as follows:

Management Level I. Totally mechanized. Leveled land, water control, planting by plane. Two crops per year.

Management Level 2. Dry farming. A. Mechanized.
B. Nonmechanized.

Management Level 3. Irrigated farming. Semimechanized. A. Direct planting.
B. Transplant planting.

Management Level 3. Poza farming. A. No water control.
B. Additional water by pumping.
C. Additional water by tides.

These eight types of farming show different farm budgets and costs and also show different production alternatives varying, therefore, their break even point. So, farm budgets will be calculated for all eight types divided as follows:

1. Totally mechanized, planting by plane - land leveled to zero slope (gradient). Irrigation, water control.

2. Dry farming, mechanized - planting by machine.
3. Dry farming, nonmechanized - planting by hand.
4. Irrigated farming - semimechanized, transplant planting.
5. Irrigated farming - semimechanized, direct planting.
6. Poza (shallow lake or natural depression) - farming with no water control.
7. Poza (shallow lake or natural depression) - farming with additional irrigation provided by pump.
8. Poza (shallow lake or natural depression) - farming with additional irrigation provided by river water which is provided by gravity or by backing of the river due to the tides.

The specific characteristics of each type will be described ahead of each farm budget.

This division allows us to have an overall look at costs and returns in Ecuadorian rice farming since it considers winter and summer farming. The typical winter rice farming is the dry farming practice which uses rain water, and no other type of irrigation during the winter months.

The budgets, as explained before, were prepared in a per hectare, per year basis. The rental cost of some inputs allows us to consider all costs as variable costs. The returns will vary in accordance to the different production alternatives of the type of farm since the market price of 140 sucres per quintal (qq) was assumed for all.

The break even point, which is the point at which costs and returns are equal, will be easily calculated from the information in the budgets.

The internal rate of return, which is the rate of interest, which makes the present value of costs and returns equal, could be calculated

for investments in water or other inputs as they yield an increase in gross returns lasting a number of years. This also could be calculated without difficulty from the information provided in the budgets.

The labor absorption possibilities are also presented showing the amount of labor used per year per hectare in the different types of farms. The amount of labor increased or saved when passing from one type of farming to another. The difficulty found in calculating the amount of labor used was twofold. First, all calculations were made by the small farmers on the basis of "Cuadras" (Ecuadorian area standard), which, when converted to hectares, gave decimals in some instances. The second, was the lack of total uniformity in salary per man days since some variation was found in different areas, and also because child labor was also used at lower rates. Nonetheless, the information obtained can allow us to determine tendencies in labor absorption not known before for Ecuador rice farming operations.

CHAPTER III

CLASSIFICATION OF TYPES OF RICE FARMS

Water Needs Estimated for Rice for the 8 Types of Rice Farming

Rainfall in the coastal area of Ecuador, and therefore, in the rice area, falls from the middle of December until the middle of May. That is a period of around 150 days. The average rainfall per year can be stated as 2,000 millimeters per year.

The rainy season, which is the warmest season of the year, is called winter in Ecuador which is the opposite of the whole world. But in reality, there are no seasonal changes in Ecuador, with the exception of the rains. So, we can state that we have a rainy season, so called "winter" and a dry season, so called "summer".

The water needs in rice crops in winter are less than in summer, due to the rainfall. The calculations given below are based on information obtained in the field and they do not claim to be exact. In the calculations, we assume 2,000 millimeters of rainfall equals 2,000 mt^3 per hectare of rainfall in the winter.

Table XI. Seasonal Water Needs for the 8 Types of Rice Farming.

Type	Summer/ha	Winter	Volume Drained for Harvest
Type 1 Totally mechanized, 2 lt/ sec/ha during 56 days	10,000M^3	8,000M^3	2,000M^3
Type 2 Dry farming, mechanized	No crop	--	--
Type 3 Dry farming, nonmechanized	No crop	--	--
Type 4 Irrigated farming, mechanized, transplant planting	10,000M^3	8,000M^3	2,000M^3
Type 5 Irrigated farming, mechanized, direct planting	10,000M^3	8,000M^3	2,000M^3
Type 6 Poza, additional water for nursery needs	4,000M^3	No crop	--
Type 7 Poza, additional water by pump	6,232M^3	No crop	--
Type 8 Poza, additional water by Estero (tide)	6,800M^3	No crop	--

Pump Capacity.--Pumps servicing the irrigation needs varied from 1" to 6". The following calculated averages were obtained for the most common characteristics of pumps.

1) 20 feed lift

2) 5 hp. motor

Pump Capacities

1"	40 gallons/minute
2"	100 gallons/minute
3"	450 gallons/minute
4"	-- gallons/minute
5"	900 gallons/minute
6"	2,000 gallons/minute

Tides.--A one hour "tide irrigation" or water obtained from the tides, will raise the water level 5 centimeters in one hectare, this being equal to 500,000 liters per hour or 500M^3 per hour.

Cultivation and Irrigation Practices of the 8 Types of Rice Farming

Type 1 - Totally Mechanized, Planting by Plane.--According to the National Rice Commission, there is only one farm in Ecuador which is farming 500 hectares of rice. This farm does all of its operations in a modern and mechanized form.

The farm is "Cultivos Tecnificados" C.R., which was formerly the old "Hacienda Angelica". The technical manager and one of the important shareholders was a former FAO rice technician to Ecuador.

The "Hacienda" is located one hour by boat from Guayaquil up the Babahoyo River. The Hacienda has a piece of land with soil elevation differences at as much as 2 meters. The ground was leveled to 0-5 centimeters according to the contours, then divided in plots of 1-2 hectares in area.

The irrigation facilities are provided by pumps which deposit the water in main water boxes from which it is carried to primary and secondary irrigation canals. The tertiary canals are plot interconnecting canals and a main drainage canal from which the water can be recovered for re-use. Water in the plots is let out after the ground has been plowed. The "fangueadores", which are big basketlike wheels attached to the rear wheels of the tractors, are used in the fields to "beat" the clods of earth and to break them. The land is drained and the pregerminated seed is dropped by plane in the plots. Once the seed has taken hold, the land is flooded to no more than 15 centimeters and irrigation will start according to the needs of the crop. By the irrigation practices, the water level is raised slowly to a maximum height of 20 centimeters. The

water is kept moving from plot to plot in order to meteorize it (process of oxygenation). Before the harvest, the water is drained and the plant is allowed to ripen.

The volume of water needed for this operation is calculated to be two liters per second per hectare during 56 days out of the 120 days that the crop is in vegatative period (2 x 60 x 60 x 24 x 56). This makes a total of 9,600,000 liters or 9,600M^3 (9,600 cubic meters) per hectare needed per season. During the summer, all the water is provided by the pumps. During the winter operation, almost 2,000,000 liters (2,000M^3) are provided by the rainfall which is the average rainfall for the winter months (December-May). When the fields are drained to allow the ripening of the crop, there is an average of 20 centimeters of water in the field.

The planting is made with pregerminated seed and the seed is dropped by plane. The fertilizing, as well as the pest and herb control, is made by plane.

Once the fields are dried, the harvest is done by combines and the rice packed in sacks with a weight of 195 pounds per bag which is equivalent to 100 pounds of hulled rice as calculated by the rice mills.

The production alternatives for this plantation vary between 90-100-110-120 qq per ha. (100 pound bags) of hulled rice.

This plantation is at the moment thinking of constructing its own rice mill and plans to sell hulled rice in the future.

The plantation has 3,000 hectares of which they plan to dedicate 1,000 hectares to rice and sell the rest, terminating, therefore, their actual livestock operation.

They have no problems with the Agrarian Reform Law or "Law #1001", and they employ 50 men permanently at the farm.

All the walls around the rice plots are made out of clayish mud which has been stacked by bulldozers. The only works that are built on cement and brick are the water boxes for pumping and the canal water lines which can divert the water by means of wooden planks slid into the structures.

This plantation has an office in Guayaquil and it is stated that they pay 16 to 18 percent interest (commercial rate) per annum on bank loans for their operations.

Their cost on bird watching is minimal because they use improved varieties which have ingrown bird defenses.

Some large rice producing farms have terminated rice operations and have dedicated themselves to other products. Among them we can quote:

1) "Plantation Tropicales", which formerly used to have over 1,000 hectares on rice, they now have reduced this area to 150 hectares of rice, dedicating their land now to banana plantations.
2) "Jugerine San Carlos", which used to have 500 hectares on rice, now has around 100 hectares of rice and dedicates the rest of its land to sugar cane and citrus fruits.

The firm of "Cultivos Tecnificados", formerly "Hacienda la Angelica", which represents the only firm within Type 1, after kindly showing all of its operations during one day, and after keeping our questionnaire for 5 days, declined to provide data because it formed part of their "restricted information" as expressed personally by their manager. Although the data could not be obtained directly for this operation, its costs have been calculated based on research in the School of

Agriculture of Guayaquil where some theses are available, also the machinery firms of Guayaquil were consulted. Some data, such as amount of seed per hectare, etc., were provided by kindness of personnel of the firm.

We have, therefore, arrived at the costs as shown in the budget for this type of operation.

Average production calculation for this type of farm is 110 qq per hectare of hulled rice.

Each qq of 100 pounds of hulled rice is equivalent to 195 pounds of unhulled harvested rice with a moisture content of ±13 percent.

Break even point for this type of operation has been calculated at 75 qq (see Graph 2).

Type 2 - Dry Farming, Mechanized.--This type of farming is carried on by farmers who have no irrigating facilities or who are too far from the water sources or whose land is too high, increasing, therefore, the cost of pumping.

This is a winter type of farming and the present study was made during the summer, so no plantings of this type were personally visited but interviews were held with farmers, and also data was obtained from the National Rice Commission.

The use of machinery is limited to the planting and harvesting in many cases but the use and distribution of fertilizers, herbicides and insecticides is done by hand, as well as the complementary weeding.

The planting of rice is done by machine and not by plane. The amount of seed used is larger in this type than in Type 1. This could be due to waste, inefficiency or quality of seed, but the data was consistent in the use of 200 pounds per hectare.

The yields for this type of farming range from 40-60 qq (units of hulled 100 pounds) per hectare.

The bird watching cost is reduced because birds are distributed in a larger area (winter planting) and by the use of firecrackers. Break even point has been calculated at ±44 qq (see Figure 3). Average production has been estimated at 50 qq per hectare. Price of product has been calculated at $.140.

Type 3 - Dry Farming, Nonmechanized.--This type of work is quite traditional with the only improvement due to the use of fertilizers and insecticides, when used.

No machinery and no irrigation is used. The low cost of bird watching is due to the fact that birds are disseminated in a larger area in the winter.

The "Socola" is the land clearing of brush and trees. It is carried on by hand, by machete and other hand tools. The resulting wood and brush is burned and the ashes spread. The planting is made after the first rain and is direct planting by the system of "claveteado" which is making holes 1 inch deep with a stick where 15 to 20 grains are deposited. The harvest is made by contract and they pay $.10 sucres per bag of 195 pounds which is considered to yield 100 pounds of hulled rice or the equivalent of 51.5 percent of yield in hulling.

The production alternatives have been given at levels of 20-30 or 40 qq per hectare and the yield depends on the rain obtained during the winter season. Average production is calculated to be 30 qq per hectare.

The break even point has been calculated at 24 qq per hectare (see Figure 4).

The rent for the land is paid in rice at the rate of 10 percent for every hectare, although this amount varies in each individual case. This is an average.

Type 4 - Irrigated, Mechanized, Transplant.--The variation of this type with Type 5 is that the planting is done by transplant due to the topography of the terrain which is uneven and not as flat as Type 5. Also, the farm sizes are smaller.

The system of transplanting actually includes a double transplant which is made in the following way.

The rice nursery is created; when the seedlings are old enough, they are transplanted into a second larger nursery where the plants are kept until they reach a given height at which moment they are definitely transplanted into land which has already been put under water. The first transplant is called "claveteo" because the holes in the ground where the rice will be placed are made by use of a stick.

Bird watching in both Types 4 and 5 is carried on by firecrackers and by men. The total cost for birdwatching was available but no separate costs could be obtained. Most farmers of this type own the land.

Alternatives of production for this crop have been calculated to be between 70-80-90 qq per hectare. The average yield per hectare has been calculated at 80 qq per hectare.

The break even point for this type has been calculated to be 63.5 qq (see Figure 6).

Type 5 - Irrigated, Mechanized, Direct Planting.--This type of farming is different from Type 1, due to various reasons.

1) Type 5 does not plant by plane.

2) Type 5 does not fertilize by plane.

3) Type 5 does not spray insecticides by plane.

4) Type 5 does not cultivate 500 hectares, but less.

5) Most farms within this type are partially mechanized and must rent machinery.

In general, farms of this type have land which is more level than the farms which use the system of transplanting (Type 4). This is the reason why the value of the land has been calculated at $.10,000 per hectare for this type while for Type 4, a value of $.5,000 per hectare has been set. Most farmers of this type own the land.

Production alternatives for this type of farm have been calculated to be 60 qq, 70 qq, 80 qq and 90 qq per hectare.

The break even point has been calculated at 65 qq per hectare (see Figure 5). Average production is calculated to be 80 qq per hectare.

Type 6 - Poza Farming with no Additional Water.--Most of the farmers of this type use to rent the land and now they are supposed to be proprietors, according to Law #1001, or the Agrarian Reform Law.

This type of farming is done in shallow lakes formed by the winter rains. Some of these shallow lakes will be as large as 350 hectares and crisscrossed by walls separating individual plots. The bottom of the "poza" has a conical tendency but it is fairly flat with some small areas which are deeper.

Most of the work, if hired, is done on "tarea" or contract (piece work). Seldom are fertilizers and insecticides used, and they are only employed when there is a danger of losing the crop, never as a preventive measure.

Most of these farmers do not obtain credits from the banks but from private "fomentadores" (gatherers) who charge 20 percent interest per crop

(six months) or 40 percent per year. The farmers on this type, harvest once a year. After the harvest they run out of available water.

Their cost for bird watching is high, due to the fact that they use native varieties of rice and not improved varieties which have ingrown defenses. Also, since summer rice planting covers smaller areas, there is a greater bird concentration on the crop.

Ninety percent of the farmers visited fell in this category or within Types 6, 7 or 8.

Production alternatives for this type are 20 qq, 30 qq, 40 qq per hectare. The average production per hectare for this type has been calculated to be 30 qq, although most farmers recognized that two of every three average crops were over 35 qq.

The break even point for this type has been calculated to be 23 qq (see Figure 7).

These farmers work only in the summer.

Type 7 - Poza Farming with Additional Water by Pump.--Same as Type 6 except for the difference that these farmers can obtain additional irrigation water in their land, and therefore, obtain better crops.

Production alternatives for this type are 30 qq, 40 qq, or 50 qq per hectare. Average production is calculated to be 40 qq per hectare. The break even point has been calculated to be 25 qq (see Figure 8).

In this cost, some allowance for administration should be made since many farmers are entrepreneurs who, if they have the money to buy a pump, carry the pump on rental and hire occasional overseers while they are about the pump business.

Many of these farmers who are "progressive" and have bought a pump can also secure loans from the "Banco de Fomento" at 9 percent per year

which is less than 25 percent of the rate of interest paid by Type 6, who remain working with rates of interest as high as 40 percent per year. These farmers could work summer and winter.

Type 8 - Poza Farming with Additional Water by Tides.--Same as Types 6 and 7 except for the difference that these farmers will take additional water from the river when the river is banked by the tides and overflows a canal previously built.

Production alternatives for this type are the same as for Type 7. The average production is calculated to be 40 qq per hectare due to the fact that additional water for his crops can be obtained, and therefore, obtain better yields.

The main difference between Type 7 and Type 8 is that Type 8 saves the costs of the pump but pays higher interest rate (40 percent per year) since the farmer secures loans from the "fomentadores" (gatherers) and not from the bank.

Production alternatives for this type are 20 qq - 30 qq - 40 qq. The break even point has been calculated to be 26 qq (see Figure 9). These farmers can work summer and winter.

Two Crops Per Year

The farm types that potentially could produce two crops per year are farmers within: Type 1. Totally mechanized, irrigated;

Type 4. Irrigated, mechanized, transplant planting;

Type 5. Irrigated, mechanized, direct planting;

Type 7. Poza farming, additional water by pump;

Type 8. Poza farming, additional water by tides.

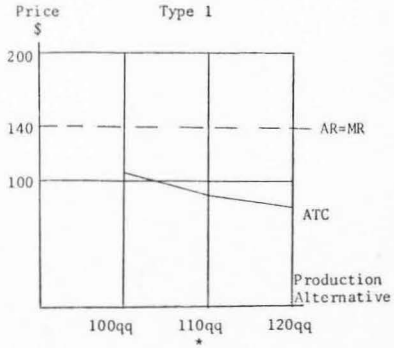
The possibility of two crops per year was not asked in the questionnaire, and in some cases, the farmer voluntarily provided the information. But the information was not consistently obtained.

The nonmechanized dry farm operation depicted in Type 3 is the least expensive from a break even standpoint, but the basic poza operation is nearly equivalent (Type 6). Profits actually depend on the relation of average yields to the break even point. In Type 1, for example, these points are widely separated. The remaining profit factor is the number of quintals per hectare. Thus, it is possible for one type to be more profitable on a per quintal basis, whereas on a per hectare basis, this could not be true. The relations among 7, 8, and 1 illustrate this point.

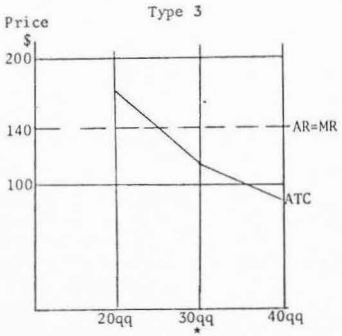
Estimated total cost budgets for the various summer rice farming alternatives were described earlier.

The range on production alternatives was considered according to the information provided by the questionnaires and by the expressed opinion of the interviewed farmers. This production is estimated to be common for the range of farms in each type. The budgets for the winter operations Types 2 and 3 were included here for comparative basis and to provide a more complete criteria of rice farming in the Guayas Basin of Ecuador.

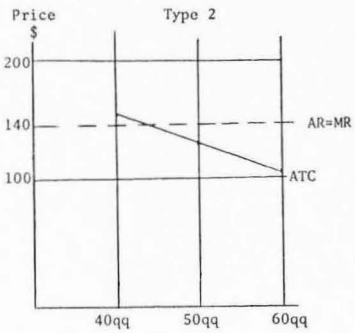
Graphs of Break Even Points for all 8 Types of Farming



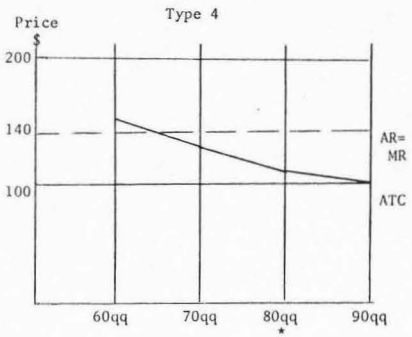
(Figure 2)



(Figure 4)

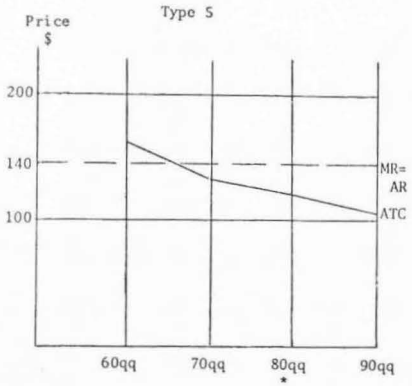


(Figure 3)

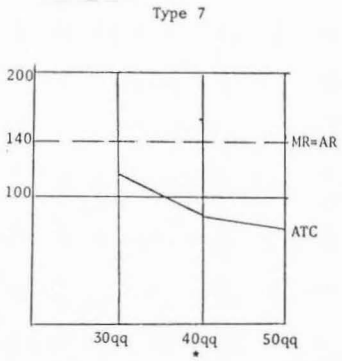


(Figure 5)

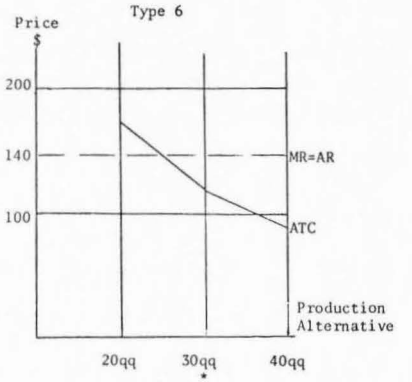
*Average production



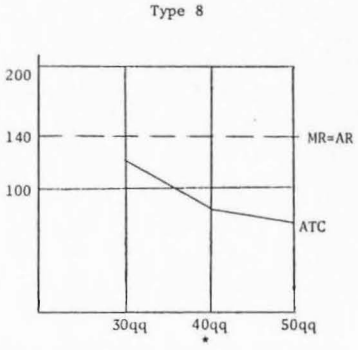
(Figure 6)



(Figure 8)



(Figure 7)



(Figure 9)

*Average production

Table XII. Budget for Farming Type #1.

Totally Mechanized, Direct Planting by Plane/ha.

	Labor Use Man Day/ha.	Cost Per Hectare in Sucres ($)
Land Preparation		$. 300
Plowing (once)		274
Sidewall Repair		167
Fangueo		384
Seed (150 pounds)		150
Fertilizer (N 900 lbs.)		900
(P 160 lbs.)		250
(K 120 lbs.)		120
Planting by Plane (0.80 lb.)		120
Fertilizing by Plane (0.60 lb.)		708
Irrigation (initial)		130
Irrigation (up to harvest)		527
Labor for Irrigation (7.5 man days at $40 per day)	7.5	300
Herbicides (9 ltrs.)		495
Plane Cost for Herbicides		20
Hand Weeding and Others (10.5 man days)	10.5	420
Insecticides (preventive & operational)		320
Plane for Insecticides		50
Harvest		1,000
Transport		240
Land Rent (5% of $.15,000/ha)		750
Administration		750
Total	18.0	$. 8,375
10% Unexpected		837
		$. 9,212
9% Interest Per Semester		1,381
		$.10,593

Production Alternatives

	100 qq	110 qq	120 qq
Cost per qq	105.90	96.30	88.27
Price per qq	140	140	140
Profit or Loss	34.10	43.70	51.73

Table XIII. Budget for Farming Type #2.

Dry Farming, Mechanized

	Labor Use Man Day/ha.	Cost Per Hectare in Sucres ($)
Machine Cleaning of the Land		$. 130.00
Plowing and Harrowing (twice)		390.00
Wall Fences		234.00
Planting & Fertilization		130.00
Seed (200 pounds)		400.00
Fertilizer (200 pounds) 10-30-10		293.38
Amonium Sulphate (200 pounds)		343.20
Labor for Fertilizer (2 man/day)	2	50.00
Chemical Herbicide (2 gallons)		660.00
Labor for Herbicide (2 man/days)	2	80.00
Weeding (14 days, 1 man)	14	350.00
Cleaning of the Wall Fences (2 days, 1 man)	2	50.00
Insecticides		158.00
Labor for Insecticide Application (4 days, 1 man)	4	160.00
Bird Watching (firecrackers)		117.00
Harvest		1,040.00
Administration		312.00
Watchmen	1	18.00
Transportation		260.00
Total	25	$.5,175.58
Unplanned Expenses (10%)		517.55
		$.5,693.13
1% per Month Interest to Investment (6 months)		341.59
		$.6,034.72
10% Annual Value of Land (50% of 3,000)		150.00
		$.6,184.72

Production Alternatives

	40 qq	50 qq	60 qq
Cost per qq	154.65	123.70	103.00
Price per qq	140	140	140
Profit or Loss	-14.65	16.30	37.00

Source: Programa Nacional del Arroz, Guayaquil.

Table XIV. Budget for Farming Type #3.

Dry Farming, Nonmechanized

	Labor Use Man Day/ha.	Cost Per Hectare in Sucres (ϕ)
Socola (land clearing) (10 man days)	10	$. 260.00
Burning (1 man day)	1	26.00
Wood Clearing (3 man days)	3	60.00
Planting by Stick (10 man days)	10	260.00
Seed (125 pounds)		250.00
Fertilizer, 200 pounds Amonium Sulphate		179.00
Labor for Fertilizer (2 days)	2	50.00
Weeding (3 times) (30 man days)	30	750.00
Insecticides (twice)		156.00
Labor for Insecticides (4 man days)	4	120.00
Bird Watch (12 teenager days)	6	120.00
Harvest ($.10 per bag)		300.00
Administration (8 man days)	8	160.00
Transportation ($.3 per bag)		90.00
Total	74	$.2,781.00
Interest to Capital 1% per Month		166.80
		$.2,947.80
Land Rent		420.00
		$.3,367.80

Production Alternatives

	20 qq	30 qq	40 qq
Cost per qq	168.37	112.26	84.19
Price per qq	140	140	140
Profit or Loss	-28.37	27.74	55.81

Source: Programa Nacional del Arroz, Guayaquil.

Table XV. Budget for Farming Type #4.

Irrigated Farming, Mechanized, Transplanting/ha.

	Labor Use Man Day/ha.	Cost Per Hectare in Sucres (ϕ)
Machine Cleaning of the Land		$. 130
Plowing		137
Sidewalls		236
Fangueo (breaking clods)		234
Log Harrowing		140
Fertilizing (N 800 pounds)		717
(P 200 pounds)		286
(K 100 pounds)		100
Labor of Fertilizing	5	104
Value of Seedling Plants/ha.		468
Labor for Transplanting ($25 per man)	39	975
Initial Irrigation (P)		130
Irrigation up to Harvest (P)		530
Labor for Irrigation	7	140
Weeding by Hand	13	260
Insecticides (twice)		160
Labor for Insecticides ($39/man)	4	156
Cleaning of Walls and Ditches		80
Bird Watching (firecrackers)		120
Harvest		1,560
Administration		156
Night Watch	1	15
Transportation		400
Total	69	$.7,234
Unplanned Expenses, 10%		723
		$.7,957
Interest on Capital, 1% per 6 months		454
		$.8,411
10% Annual Value on Land (5,000 ha.) (semester)		250
		$.8,661

Production Alternatives

	70 qq	80 qq	90 qq
Cost per qq	123.80	108.26	96.23
Price per qq	140	140	140
Profit or Loss	16.20	31.74	43.77

Source: Comité Nacional del Arroz.

Table XVI. Budget for Farming Type #5.

Irrigated Farming, Mechanized, Direct Planting/ha.

	Labor Use Man Day/ha.	Cost Per Hectare in Sucres ($)
Machine Cleaning of the Land		$. 130
Plowing & Harrowing (twice)		390
Sidewalls		236
Leveling (Fangueo)		480
Fertilizer on Planting (by machine)		130
Seed (200 pounds)		400
Fertilizer on Growing (N 800 pounds)		717
(P 286 pounds)		286
(K 100 pounds)		100
Initial Irrigation		130
Irrigation up to Harvest		527
Labor for Irrigation	12	244
Herbicides (2 gallons)		621
Labor for Herbicides	2	80
Hand Weeding	13	260
Insecticides		160
Labor for Insecticides	4	156
Cleaning of Walls and Ditches (by hand)		80
Bird Watching (firecrackers)		120
Harvest		1,560
Administration		156
Night Watch	1	15
Transportation		400
Total	32	$.7,384
Unplanned Expenses (10%)		740
		$.8,124
Interest on Capital, 1% for 6 months		486
		$.8,610
10% Annual Value on Land ($.10,000 ha.) (semester)		500
		$.9,110

Production Alternatives

	60 qq	70 qq	80 qq	90 qq
Cost per qq	151.50	130.14	113.80	101.22
Price per qq	140	140	140	140
Profit or Loss	-11.50	9.86	26.20	38.78

Source: Comité Nacional del Arroz.

Table XVII. Budget for Farming Type #6.

Poza (shallow lake) Farming/ha.	Labor Use Man Day/ha.	Cost Per Hectare in Sucres ($)
Cleaning (10 man days)	10	$. 200.00
Seed (100 pounds) ($.120 pounds)		120.00
Labor for Nursery (1 man day)	1	35.70
Nursery Transplant (claveteo)	10	214.30
Transplanting	14	571.40
Weeding	15	107.10
Bird Watching	28	571.40
Harvest & Other	40	600.00 (Based on $15 per bag, 40 bags)
Transport	10	120.00 (Based on $3 per bag, 40 bags)
Interest (20% on $.3,000/ha. 6 months)		600.00
Total	128	$.3,139.90
Interest on Capital (1% 6 months)		148.00
		$.3,287.90
10% Annual Value of Land ($.3,000) (semester)		150.00
		$.3,437.90

Production Alternatives

	20 qq	30 qq	40 qq
Cost per qq	171.89	114.59	85.94
Price per qq	140	140	140
Profit or Loss	-31.89	25.41	54.06

Table XVIII. Budget for Farming Type #7.

Poza Farming Plus Additional Irrigation by Pump/ha.

	Labor Use Man Day/ha.	Cost Per Hectare in Sucres ($)
Cleaning	10	$. 200.00
Seed (122 pounds)		126.00
Labor for Nursery	2	35.70
First Transplant (claveteo)	10	214.30
Second Transplant	29	571.40
Weeding	15	107.10
Bird Watching	28	571.40
Pump		
3 hours rent, 6" pump		300.00
Installation & other		100.00
Harvest	40	600.00
Transport	10	120.00
Total	144	$.2,945.90
Interest 9% on 3,000/ha. (semester)		270.00
		$.3,215.90
Interest on Capital 1% (semester)		200.00
		$.3,415.90
10% Annual Value on Land (semester) (3,000)		150.00
		$.3,565.90

Production Alternatives

	30 qq	40 qq	50 qq
Cost per qq	116.86	89.14	71.51
Price per qq	140	140	140
Profit or Loss	23.14	50.86	68.39

Table XIX. Budget for Farming Type #8.

Poza Farming Plus Additional Irrigation by Tides (Estero)/ha.

	Labor Use Man Day/ha.	Cost Per Hectare in Sucres ($)
Cleaning	10	$. 200.00
Seed		126.00
Labor for Nursery	2	37.70
First Transplant (claveteo)	10	214.30
Second Transplant	29	571.40
Weeding	15	107.10
Bird Watching	28	571.40
Ditch Cleaning	2	40.00
Water Watching	5	100.00
Harvest	40	600.00
Transport	10	120.00
Total	151	$.2,687.90
Interest 20% on $.3,000 (semester)		600.00
		$.3,287.90
Interest on Capital, 1% month (semester)		216.00
		$.3,503.90
10% Annual Value of Land (semester) (3,000 S/ha)		150.00
		$.3,653.90

Production Alternatives

	30 qq	40 qq	50 qq
Cost per qq	121.70	91.30	73.07
Price per qq	140	140	140
Profit or Loss	18.30	48.70	66.93

Table XX. Summary of Costs, Profits and Man Day Labor Use Per Hectare, Per Crop.

Type	Cost/ha.	Return/ha.	Profit/ha.	Labor Use/ha.
Type 1	$.10,593.00	$.15,400.00	$.4,807.00	18 days
Type 2	6,184.72	7,000.00	816.00	25 days
Type 3	3,367.80	4,200.00	832.20	74 days
Type 4	8,661.00	11,200.00	2,539.00	69 days
Type 5	9,110.00	11,200.00	2,090.00	32 days
Type 6	3,437.90	4,200.00	762.10	128 days
Type 7	3,565.90	5,600.00	2,034.10	144 days
Type 8	3,653.90	5,600.00	1,946.10	151 days

CHAPTER IV

SUMMER RICE

Analysis of Returns to Improved Water Management

Summer rice production represents approximately 20 percent of the total area under production in a given year.

Mechanized farming generally occurs in farms with areas of 35 or more hectares. This represents 6 percent of the number of farms while the small nonmechanized poza farming represents 94 percent of the number of farms (Tables V and VI).

Most of the summer rice production is currently obtained from pozas. These ponds (divided if necessary) form the small, nonmechanized farms having less than 35 hectares. These farms have been identified with Types 6, 7, and 8, in preceding sections. Only a limited amount of rice is obtained from mechanized operations. These mechanized operations have been identified as Types 1, 4, and 5 in preceding sections.

There is only a single example of a Type 1 rice operation in the Guayas Basin, which when combined with smaller, less developed units in categories 4 and 5, cover approximately 8 percent of the summer rice farming land area (approximately 1564 has.), and account for approximately 13 percent of the summer rice production. Small poza operations account for 94 percent of the summer rice (approximately 24,490 has.) land area and produce about 87 percent of the summer rice harvest. Thus, about

13 percent of the summer harvest comes from 6 percent of the land which is mechanized. There are fundamental technological differences between poza cultivation (Types 6, 7, 8) and the mechanized systems (Types 1, 4 5). The pozas are shallow natural depressions that can not be converted into flat land except at an expense greater than cleaning and leveling flatter places, that may not lie in advantageous positions to receive gravity water flows from rain or river channels. Once the flatter land is cleared and some controlled irrigation (auxiliary or supplemental pumps) is introduced, year round cropping becomes feasible.

The explanation why Types 4 and 5 do not return as much as Type 1 is found in original land preparation, annual land preparation, and some cultural practices. We, therefore, conclude that, in general, if poza farming is not possible the best overall returns come from a high degree of mechanization and good paddy preparation.

Since the higher returns in both poza (Types 6, 7, 8) and mechanized (Types 1, 4, 5) practices are associated with better water management, the returns to any necessary irrigation investment or rental spending are of particular interest.

Poza Farming.--The basic or simple poza arrangement is represented by Type 6 (Budget Table XVII). Supplemental water is controlled in amount and timing in Type 7 (Budget Table XVIII) because pumps are rented when additional water is necessary and additional labor is employed. In Type 8 (Budget Table XIX), the increased river and canal heads (due to tidal action) are led into pozas through small ditches that are rebuilt and maintained each year by means of hand labor over and above what is required in Type 6.

Therefore, on average, the only reason why Type 6 does not achieve the higher net returns per hectare of 7 and 8 is due to supplemental water availability. Some indication of the differences that supplemental water makes in profitability per hectare is shown in Table XXI.

Table XXI. Additional Costs that must be Incurred to Capture Supplemental Irrigation Benefits in Poza Rice Farming in the Guayas Basin.

Type	Added Costs				Net Benefits		Net Gain/ha	Benefit/Cost Ratio
	Pump	Labor		Total	Basic	Differential		
	$	days	$		$	$	$	
6	0	128	0	—	762.10	—		
7	400	144	320	720	2,034.10	1,272	522	1.77
8	0	151	460	460	1,946.10	1,184	724	2.57

Benefit/cost ratio is quite high for the tide induced supplemental water.

Of course, there are severe technological constraints on achieving Type 8 returns. Lands too near the sea would receive excess salt, lands too far up the river would either not experience alternative crests due to tides or would be outside the soil types suitable for summer rice farming. The poza has to lie below the river crest during times of high tide. The water heads have to be watched and controlled to prevent excess water which would flood the crop and drown the rice. The only reason why all lands demarcated by these criteria would not use Type 8 methods is if some constraint, functional or institutional, precluded annual construction of a long enough access ditch to the nearest river or canal (for example, the right of way might not be obtainable).

The same reasoning applies to movements from Type 6 to Type 7 (auxiliary pumping). Some financial or institutional constraint (or technical feature) must preclude the capture of the potential gains from better management.

Mechanized Farming.--The basic cultivation arrangement in mechanized farming is represented by Type 4 (Budget Table XV). Types 5 and 1 introduce some significant variations. Supplemental water is controlled in all three types because pumps are either rented or owned. However, water control is far more difficult in Type 4 due to natural topographic features of the terrain (see work description, page 42) which is far less flat than Type 5 (Budget XVI). For this reason, Type 4 uses a farming practice of transplant while in Type 5 planting is done by machine and in Type 1 (Budget Table XII), by plane. Also in Type 1, the degree of mechanization and land preparation is much greater than Type 4 (or 5).

On average, there is little difference in the net returns per hectare between Type 4 and Type 5. Apparently the relatively higher machinery and fertilizer cost necessary with less hand cultivation might put Type 5 at a slight disadvantage in the short run. However, over a longer time horizon the basically flatter lands and larger machinery base associated with Type 5 lent themselves to the transformation to Type 1 at a lower developmental cost than Type 4. This difference in potential must be borne in mind when contemplating the relationships shown in Table XXII. In this table, the comparison between Type 4 and Type 5 is not too important. The benefit cost ratio of the investment in water management to achieve level #1 is quite high. From Type 5 to 1 would be about 1.7.

There are severe constraints on achieving cultivation of Type #1. In addition to the high initial cost in land leveling and preparation, there is also a requirement for larger machinery to leap from Types 4 or 5 to 1 plus the technical and managerial skill necessary for such a

large and complex operation. The greatest institutional constraint is the limited credit and the 18 percent rate of interest of Ecuadorian commercial banks to industry (Type 1 is considered industry in Ecuador), as shown in the Budget Table XII.

Table XXII. Additional Costs that must be Incurred to Capture Supplemental Benefits of Water Control and Land Preparation in Mechanized Summer Rice Farming in the Guayas Basin.

Type	Added Costs				Net Benefits		Net Gain/ ha.	Benefit/Cost Ratio
	Other Costs	Labor		Total	Basic	Differential		
	$	days	$		$	$	$	
4	0	69			2,539			
5	890	32	-740	150	2,090	-449	-299	-2.0
1	1,700	18	-660	1,040	4,807	2,268	1,228	1.18

It should also be noted that unit labor cost per day is calculated at $40 for Type 1 operation. This is due to the fact that higher qualified labor is required. Additional labor having the same skill levels would be required fi very many Type 4 or 5 farms were shifted to Type 1. The comparative returns of Types 6, 7, 8 and 1 seem to confirm Theodore Schultz's criteria that there are comparatively few significant inefficiencies in the allocation of the factors of production in traditional agriculture.

The highest returns per hectare are obtained by the traditional farming practices in Types 6, 7, and 8. In order to improve these returns, total mechanization and large investment, as shown in Type 1, are necessary.

Labor Use

The following table is a summary of labor use, increase or decrease, when passing from one type of farming to another.

Table XXIII. Labor Absorption Possibilities in Man Days/ha.

Type of Farm	1	2	3	4	5	6	7	8
1	——	+7	+56	+51	+14	+110	+126	+133
2	-7	——	+49	+44	+7	+103	+119	+126
3	-56	-49	——	-5	-42	+54	+70	+77
4	-51	-44	+15	——	-37	+59	+75	+82
5	-14	-7	+52	+37	——	+96	+112	+119
6	-110	-103	-54	-59	-96	——	+16	+23
7	-126	-119	-70	-75	-112	-16	——	+7
8	-133	-126	-77	-82	-119	-23	-7	——

Labor Absorption

If GOE policy is production oriented, the Government of Ecuador should expand credit and facilities to increase the number of totally mechanized (Type 1) farms where high rates of yields, low labor use and high returns to capital are possible with large investments. Some source of technical expertise would also be necessary.

As far as summer rice production is concerned, some significant increases are possible through mechanized operations since about 13 percent of summer production already is produced on 6 percent of the farms.

The main considerations are whether the increased production is destined for export or domestic utilization. If production increases are to be absorbed domestically, some thought must be given to the downward effect on prices.*

*An estimate of price elasticity of demand for Ecuadorian rice is -1.5. This means that all things equal a 1.5 (15) percent increase in output (if it is consumed) should lead to a 1.0 (10) percent reduction in price.

If the government policy is socially oriented, the government should investigate the feasibility of creating pozas in natural depressions that require a minor amount of earth moving to fully enclose. By simply extending banking loans to poza farmers at low interest rates their incomes would be positively affected (see budgets for Types 6, 7 and 8). The technical requirements of creating a Type 8 or 7 situation rather than Type 6, should be borne in mind. For each hectare of new poza land, somewhere around 1.6 men would be absorbed.

Assuming that the normal rice season lasts 150 days (20 weeks), and assuming that the average Ecuadorian farmer works in his farm 4 days per week, we have a total of 80 days/man equal to one man. Therefore, for every new hectare of Type 6 poza we have (128 ÷ 80 = 1.6), a potential absorption of 1.6 men (Table XXIV).

For every new hectare of Type 7 poza we have (144 ÷ 80 = 1.8), a potential absorption of 1.8 men (Table XXIV).

For every new hectare of Type 8 poza we have (151 ÷ 80 = 1.81), a potential absorption of 1.81 men (Table XXIV).

For transformation of Type 6 poza into Type 7, we potentially have a labor absorption of (16 additional days, 80 ÷ 16 = 5), 1 man for every 5 hectares transformed.

For transformation of Type 6 poza into Type 8 we potentially have (23 additional days, 80 ÷ 23 = 3.48), 1 man for every 3.5 hectares transformed.

For transformation of Type 7 poza into Type 8, we potentially have (7 additional days, 80 ÷ 7 - 11.4), 1 man for every 11.4 hectares transformed.

Table XXIV. Labor Absorption/hectare. Creation of New Paddies.

Type 6	1.6 men
Type 7	1.8 men
Type 8	1.81 men

CONCLUSIONS AND NEED FOR FURTHER RESEARCH

In regard to objectives one and two it was found that the most traditional rice farmers of the Guayas Basin, those cultivating shallow lakes in natural depressions, were highly efficient in the allocation of their available resources. This seems to confirm the position held by Schultz.[7,37] Two ways for the Government of Ecuador to rapidly increase the income of the farmers within the lowest categories (Types 6, 7, 8) in the short run would be:

1) to provide low interest credit to finance crops, freeing them from the tyranny of money lenders and rice mills, which would lower the costs of producers;
2) to extend credits for the provision of water irrigation control in their shallow pond paddies through purchase of pumps or creation of artificial, inexpensive pozas.

The semimechanized operations (Types 4 and 5) can greatly increase their yields and returns only if they are helped to jump to totally mechanized operations of the Type 1 variety.

The better water management practices is shown to be an absolute need in Types 6, 7 and 8 if rice production is to be increased in traditional agriculture. Investment in pumps or possibly other water control devices have high benefit/cost ratios. For Types 1, 4 and 5,

which are mechanized farms, their rate of profit also varies with the efficiency of water management techniques.

In regard to objective number four it was found that summer semi-mechanized farming practices (Types 1, 4, 5) used less labor comparatively than more traditional practices (Types 6, 7, 8) but show eqaul or greater volumes of production per hectare. Depending on the general direction of the policies of the Ecuadorian government, Agricultural Policy could be production oriented and investment encouraged in Types 4 and 5. Or the policy could be socially oriented by investment in improvements of Types 6, 7 and 8 and through creation of new areas of shallow lakes which would have greater labor absorption impact.

This study concentrates on benefits of better water management on rice. Studies of other crops in the Guayas Basin, which have export potential should be made in order to have a more complete picture of overall benefits from irrigation investments and to promote a more efficient distribution of scarce comital resources among competitive crops in the area.

On balance, the study indicates the possibility of greater investment benefits from the "first stages" of improved water management in summer rice farming. The incremental benefit/cost ratio of moving all the way to completely mechanized in production is less than that of simply improving poza farms (1.18 vs. 2.56). If certain annual costs, such as those incurred in "mudding" paddies ($.384) in the Type 1 operation could be reduced, the 1.18 value could be improved substantially.

SELECTED BIBLIOGRAPHY

1. Comisión Nacional del Arroz. *Informe Anual de Labores, 1969.* Guayaquil, Ecuador.

2. Fatjo, Enrique J. *Arroz Precocido.* Hialeah, Florida: Pemar Engineering Company. 1968.

3. Pan American Union. *Survey for the Development of the Guayas River Basin of Ecuador.* Washington, D.C.: Pan American Union, Department of Economic Affaires. 1964.

4. Poling, James. "La Plaga Más Exótica del Mundo", *Readers Digest (Español).* Pleasantville, New York. January 1965.

5. Rios Pintado, Rafael. *Proyecto de Factibilidad Para Realizar la Multiplicación y Beneficio de Semilla Certificada de Arroz y Maíz.* (Thesis for Agricultural Engineering Degree) Guayaquil, Ecuador: Facultad de Economía y Veterinaria, Universidad de Guayaquil. December 1969.

6. Rostow, W.W. *The Stages of Economic Growth: A Non-Communist Manifesto.* Cambridge, Massachusetts: University Press. 1960.

7. Schultz, Theodore. *Transforming Traditional Agriculture.* Ithaca, New York: Yale University Press. 1966.

8. White, Thomas. "An Economic Appraisal of On-Farm Water Management in Developing Countries." (M.A. thesis in Agricultural Economics.) Logan, Utah: Utah State University. 1971.

APPENDIX I

Cuestionario Para la Evaluación de la
Producción de Arroz de Paddy

Bajo Riego en la Cuenca del Rio Guayas, Ecuador

Utah State University
Departamento de Economía

Fecha_____ de 19___.
Nombre del técnico_____
_____

Provincia_____

Cantón_____

Parroquia_____

Sitio_____

1. Nombre de la hacienda _____.

2. Nombre del agricultor _____.

3. Tamaño de la familia del agricultor: hijos _____ hijas _____.

4. Número de los hijos e hijas que trabajan en la finca: tiempo completo _____, tiempo convencional _____.

5. Trabajadores adicionales requeridos para la cultivación del arroz. (Indíquese cada operación que requiera trabajadores adicionales, el número de días y el sueldo) _____
_____
_____

6. ¿Trabaja el agricultor fuera de la finca? (Indíquese la clase del trabajo, el número de días por época y su sueldo)_____
_____
_____

7. Tenencia: Propietario _____. Arrendatario _____.
Otros _____.

8. Superficie sembarada en hectareas _____; cuadras _____.

9. Nombre de la variedad _____.

10. Cantidad de semilla sembrada por hectarea _____;
cuadra _____.

11. Fuente de crédito requeridos para costos de producción _____.
a. Cantidad _____.
b. Tasa de interés _____.

12. Fuente de crédito requerido para la compra de terrenos maquinaria, y fomento del terreno _____.
    a. Cantidad: Terreno _____.
       Maquinaria _____.
       Fomento _____.
    b. Tasa de interés: Terreno _____.
       Maquinaria _____.
       Fomento _____.

13. Sistema de siembra:
    a. Espeque _____.
    b. Máquina _____.
    c. Transplante _____.
    d. Voleo _____.
    e. Avión _____.

14. Método de riego:
    a. Bombeo _____.
    b. Toma (gravedad) _____.
    c. Abra _____.
    d. Abra con bombeo _____.
    e. Otro _____.

15. Facilidades de riego:
    a. Nivelación (completo - nivelado a zero o parcial)_____.
       1) Costo de nivelación por hectarea _____; por cuadra _____.
       2) Cantidad de tierra movida en metros cúbicos por hectarea _____ _____ por cuadra _____.
       3) Método de nivelación usado _____.

    b. Muros:
       1) Tamaño promedio de las parcelas: en hectareas _____; en cuadras _____.
       2) Método de construcción _____.
       3) Costo por metro cúbico _____; por metro linear _____.
       4) Dibuje un corte transversal típico indicando las dimensiones, etc.:

    c. Canales:
       1) Costo de canales por hectarea _____; por cuadra _____.
       2) Costo por metro linear:
          canal madre _____; canales secundarios _____.
       3) Dibuje un corte transversal indicando las dimensiones, etc:
          Canal madre:

Canales secundarios:

d. Compuertas y otras estructuras para control del agua:
   1) Estructuras donde entra el agua en la finca:
      a) Escriba una descripción en detalle:

      _____
      _____
      _____
      _____

      b) Dibuje una representación de las estructuras indicando las las dimensiones:

      c) Costo: total _____; por hectarea _____; por cuadra _____.

   2) Compuertas y otras estructuras en los canales:
      a) Escriba una descripción en detalle:

      _____
      _____
      _____
      _____

      b) Dibuje una representación de una compuerta típica y las otras estructuras indicando las dimensiones:

      c) Costo: Total _____; por hectarea _____; por cuadra _____.

   3) Estructuras en los muros:
      a) Escriba una descripción en detalle:

      _____
      _____
      _____
      _____

b) Dibuje una representación de las estructuras indicando la dimensiones:

c) Costo: Total _____; por hectarea _____; por cuadra _____.

16. Dibuje un mapa en detalle de las siembras del arroz indicando canales, compuertas y otras estructuras para controlar el agua, muros y carteros (haga mapa en una de las hojas del papel gráfico).

17. Determinación de la cantidad de agua utilizado en el riego del arroz.
a. Para los agricultores que no usan bombas ni tienen una estructura para medir el agua:
1) Divida el campo en parcelas segun los bordes de las parcelas murendas o por la superficie sembrada al mismo tiempo - indique las alturas y las areas de cada parcela asi determinada (MAPA TOPOGRAFICO DE LAS SIEMBRAS).

2) Profundidad del agua en la parcela (haga estos calculos para cada área que ha sido sembrada durante el mismo tiempo).
a) Primer riego:
Nivel del agua antes del riego_____
_____
Nivel del agua despues del riego _____
_____

b) Segundo riego
Nivel antes _____
Nivel despues_____

c) Tercer riego
Nivel antes _____
Nivel despues _____

d) Otros
Nivel antes _____
Nivel despues_____

3) Dibuje un corte transversal de la estructura por donde entra el agua del estero a las parcelas de arroz.

Determine:

a. Profundidad del agua en la compuerta cuando está entrando a las parcelas _____

b) El período de tiempo durante lo cual se deja entrar el agua _____

c) Velocidad del agua en metros por segundo _____

b. Para los agricultores que usen bombas:

1) Tamaño y capacidad de la bomba _____

2) Número de horas de bombas, por hectarea _____; por cuadra _____.

18. Escriba una descripción en detalle de las practicas de riego: _____

_____

_____

_____

_____

_____

_____

19. Costos variables de producción: por hectarea _____ por cuadra _____

	Clase de Trabajo	Item	Unidad	Cantidad	Precio Unitar.	Costo Total
Preparación del Terreno	Socola	Mano de obra				
		Maquinaria				
	Quemada	Mano de obra				
		Maquinaria				
		varios				
	Arada	Maquinaria				
		Mano de obra				
		operario				
		varios				
	Fangueada	Maquinaria				
		operario				
		Mano de obra				
		varios				
	Arrastrada	Maquinaria				
		operario				
		Mano de obra				
		varios				

	Clase de Trabajo	Item	Unidad	Cantidad	Precio Unitar.	Costo Total
Preparación del Terreno	Nivelada	Maquinaria				
		operario				
		Mano de obra				
		varios				
	Otros Gastos					
Siembra		Semilla				
	Preparación Semillero	Maquinaria				
		Operario				
		Mano de obra				
		Fertilización				
	Transplante	Mano de obra				
		Maquinaria				
		Operario				
		Varios				
	Resiembra	Mano de obra				
		Maquinaria				
		Operario				
		Varios				
	Siembra directa	Maquinaria				
		Operario				
		Mano de obra				
		Varios				
		Avión				
	Preparac de semillero	Mano de obra				
		Varios				
Fertilización	Fertilizantes	N				
		P				
		K				
	Aplicación	Maquinaria				
		Mano de obra				
		Varios				
Control de maleza y plagas	Herbicides					
	Aplicación	Maquinaria				
		Mano de obra				
		Varios				
	Insecticidas					

	Clase de Trabajo	Item	Unidad	Cantidad	Precio Unitar.	Costo Total
	Aplicación	Maquinaria				
		Mano de obra				
		Varios				
	Deshierba veces	Mano de obra				
		Varios				
	Pajareo (Número de gente/ha)	Mano de obra				
		Varios				
Riego	Bombeo	Bomba				
		Operario				
		Varios				
	Cuidado de agua (Número de gente)	Mano de obra				
		Varios				
	Reparación de muros	Maquinaria				
		Operario				
		Mano de obra				
		Varios				
	Rosa de muros	Mano de obra				
		Varios				
	Limpieza de canales	Maquinaria				
		Mano de obra				
		Varios				
	Rosa de canales	Maquinaria				
		Mano de obra				
		Varios				
Cosecha	Combinada	Maquinaria				
		Operario				
		Mano de obra				
		Transporte				
		Varios				
	Cosecha a mano	Mano de obra				
		Varios				
		Transporte				
	Otros					

	Clase de Trabajo	Item	Unidad	Cantidad	Precio Unitar.	Costo Total
Administración (indíquese el % del tiempo del agricultor dedicado a esto)						
Costos de Mercadeo						
Otros Gastos						
Gastos Totales						
Cantidad de Arroz Producido						

20. Valor de la tierra no desarrollada por hectarea _____; por cuadra _____.

21. Valor de la tierra desarrollado por hectarea _____; por cuadra _____.

Lista de maquinaria:

Item	Costo	Vida	Valor	Valor Residual	Costos Variables de Operación		
					Combustible	Aceite grese	Repara...

APPENDIX II-1

DISTRIBUTION OF POPULATION IN THE GUAYAS BASIN

ECUADOR

National Council on Planning and Economic Coordination

SCALE 1:500,000

1964

Source: Data based on aerial photographic interpretation and field checks by the Organization of American States survey team.

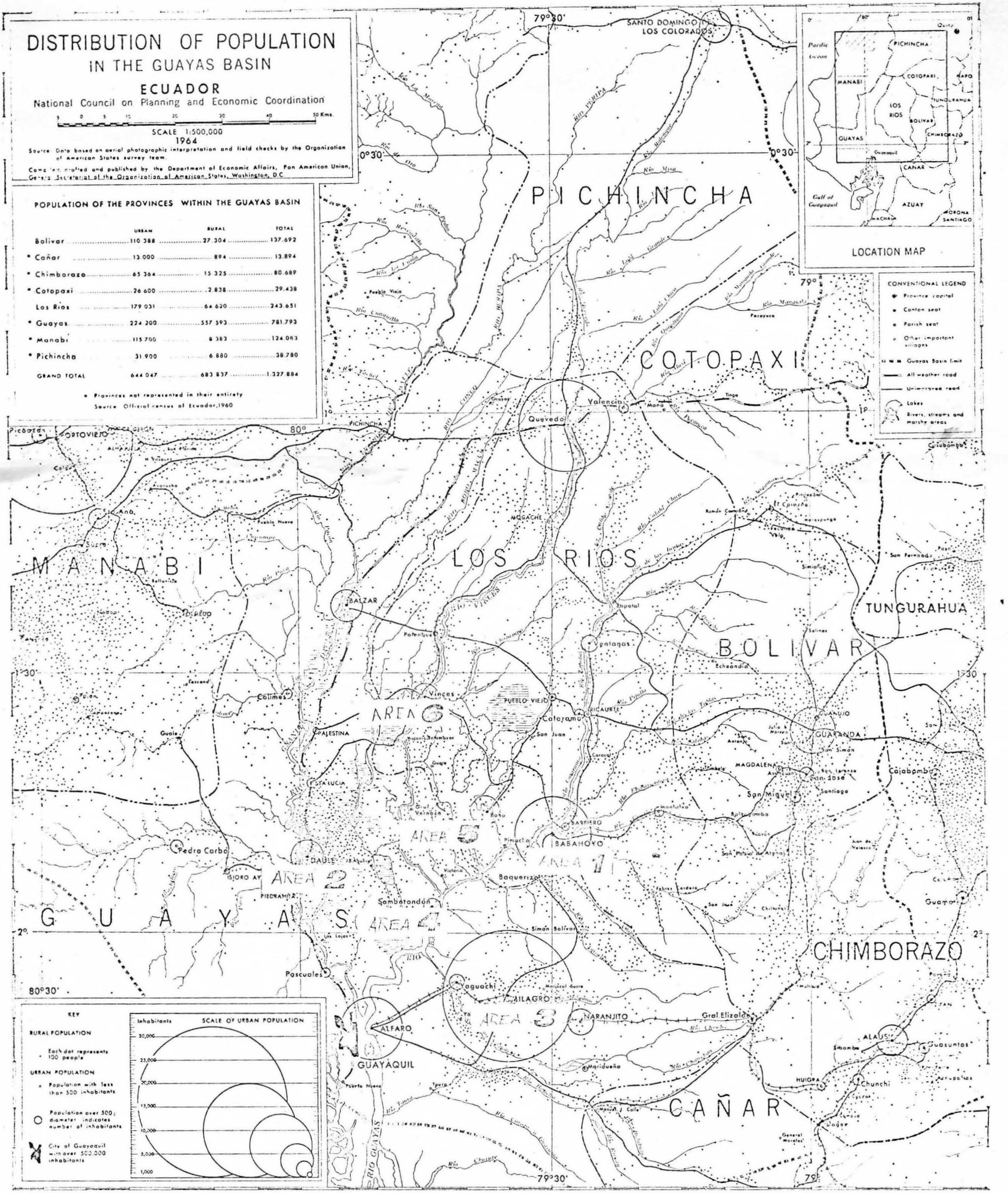
Compiled, drafted and published by the Department of Economic Affairs, Pan American Union, General Secretariat of the Organization of American States, Washington, D.C.

POPULATION OF THE PROVINCES WITHIN THE GUAYAS BASIN

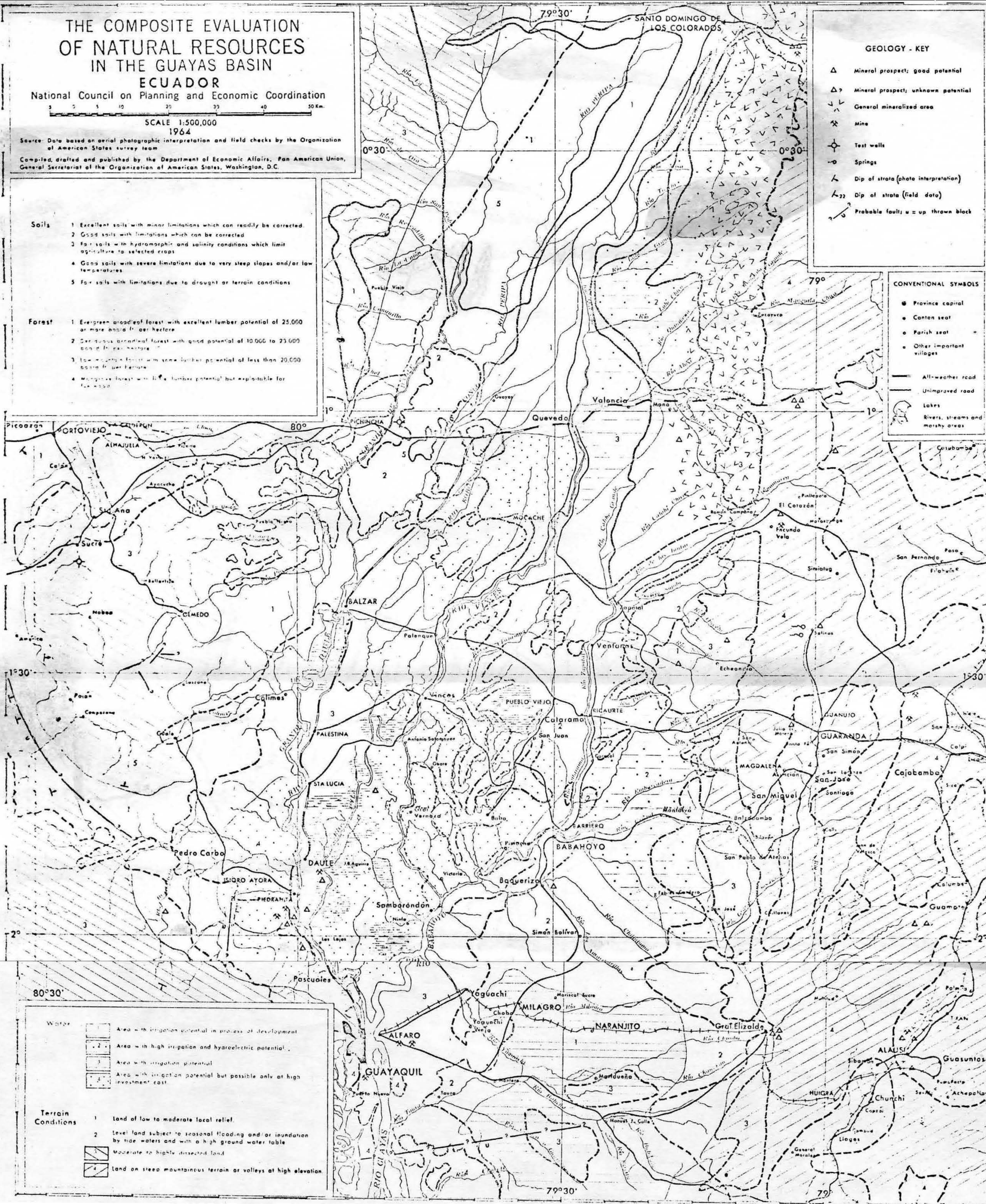
	URBAN	RURAL	TOTAL
Bolivar	110 388	27.304	137.692
* Cañar	13.000	894	13.894
* Chimborazo	65 364	15 325	80.689
* Cotopaxi	26 600	2.838	29.438
Los Rios	179 031	64 620	243.651
* Guayas	224 200	557 593	781.793
* Manabi	115 700	8 383	124.083
* Pichincha	31.900	6.880	38.780
GRAND TOTAL	644 047	683 837	1.327.884

* Provinces not represented in their entirety

Source: Official census of Ecuador, 1960



APPENDIX II-2


THE COMPOSITE EVALUATION
OF NATURAL RESOURCES
IN THE GUAYAS BASIN
ECUADOR
National Council on Planning and Economic Coordination
SCALE 1:500,000
1964
Source: Data based on aerial photographic interpretation and field checks by the Organization of American States survey team
Compiled, drafted and published by the Department of Economic Affairs, Pan American Union, General Secretariat of the Organization of American States, Washington, D.C.
Soils
1 Excellent soils with minor limitations which can readily be corrected
2 Good soils with limitations which can be corrected
3 Fair soils with hydromorphic and salinity conditions which limit agriculture to selected crops
4 Good soils with severe limitations due to very steep slopes and/or low temperatures
5 Fair soils with limitations due to drought or terrain conditions
Forest
1 Evergreen broadleaf forest with excellent lumber potential of 25,000 or more board ft. per hectare
GEOLOGY - KEY
Mineral prospect; good potential
Mineral prospect; unknown potential
General mineralized area
Mine
Test wells
Springs
Dip of strata (photo interpretation)
Dip of strata (field data)
Probable fault; u = up thrown block
CONVENTIONAL SYMBOLS
Province capital
Canton seat
Parish seat
Other important villages
All-weather road
Unimproved road
Lakes
Rivers, streams and marshy areas
Water
Area with irrigation potential in process of development
Area with high irrigation and hydroelectric potential
Area with irrigation potential
Area with irrigation potential but possible only at high investment cost
Terrain Conditions
1 Land of low to moderate local relief.
2 Level land subject to seasonal flooding and/or inundation by tide waters and with a high ground water table
Moderate to highly dissected land
Land on steep mountainous terrain or valleys at high elevation.
SANTO DOMINGO DE LOS COLORADOS
PORTOVIEJO
PICHINCHA
Quevedo
Valencia
MOCACHE
BALZAR
Palenque
Ventanas
Echeandía
Colimes
Vinces
PUEBLO VIEJO
Catarama
RICAURTE
San Juan
PALESTINA
STA LUCIA
GUARANDA
San Simón
San José
San Miguel
Cajabamba
MAGDALENA
Pedro Carbo
DAULE
ISIDRO AYORA
PIEDRAHITA
Samborondón
BABAHOYO
Baquerizo
Simón Bolívar
Pascuales
Yaguachi
MILAGRO
NARANJITO
Gral Elizalde
ALFARO
GUAYAQUIL
ALAUSI
Guasuntos
HUIGRA
Chunchi
El Corazón
Facundo Vela
Simiatug
San Fernando
Sucre
Sta Ana
OLMEDO
Picoazán
ALHAJUELA
Guamote
Columbe
Tauro
Mariscal Sucre
Manuel J. Calle
General Morales
RIO GUAYAS
80°
80°30'
79°30'
79°
0°30'
1°
1°30'
2°

APPENDIX III

Table 25. List of Cooperatives in the Guayas Basin, Ecuador.

NOMBRE DE LA COOPERATIVA	PARROQUIA	CANTON	PROVINCIA	EXTENSIONISTA	Fecha Legaliza	Nº Acuerdo	Nº Socios Fundadors	Nº Socios Actuales	Nº de Cuadras	Cuadras en Propiedad
La Unión	Daule	Daule	Guayas	G. Naranjo	Mayo 28/68	232	15	15	100	-
Narcisa de Jesús	Piedrahita	Daule	Guayas	G. Naranjo	Agosto 7/68	11688				
San Felipe	Balzar	Balzar	Guayas	G. Naranjo	Sep. 30/70	0317	23	23	80	-
Nueva Esperanza	Sta. Lucía	Daule	Guayas	G. Naranjo	Agosto 6/70	0100	23	35	250	100
Progreso	Sta. Lucía	Daule	Guayas	G. Naranjo	Julio 28/70	0083	16	14	60	-
Legua de los Indios	Baba	Baba	Los Rios	R. Lopez	Marzo 18/70	4188	102	96	482	-
Santa Isabel	Baba	Baba	Los Rios	R. Lopez	Agosto 6/70	0101	35	36	360	-
22 de Octubre	Guare	Baba	Los Rios	R. Lopez	Agosto 18/70	0176	28	34	150	-
El Roblecito	Ricaurte	Urdaneta	Los Rios	R. Lopez	Mayo 29/68	11-320	42	35	515	515
San Juan	San Juan	Puebloviej	Los Rios	R. Lopez	Abril 30/69	18-36	23	20	250	-
Los Rios	Caracol	Babahoyo	Los Rios	E. Armendáriz	Sep. 30/70	03-16	23	29	258	-
Las Mercedes	Babahoyo	Babahoyo	Los Rios	E. Armendáriz	Julio 31/63	8879	23	74	527	527
La Beldaca	A. Baquerizo	Yaguachi	Guayas	E. Armendáriz	Sep. 29/69	2561	26	26	80	-
Lajas	A. Baquerizo	Yaguachi	Guayas	E. Armendáriz	Nov. 7/68	0295	44	50	789	789
Yaguachi	Yaguachi	Yaguachi	Guayas	D. Benitez	Junio 11/68	11412	13	31	150	-
Huancavilca	Milagro	Milagro	Guayas	M. Salazar	Julio 16/69	2275	27	51	1,400	-
La Isla	M. Maridueña	Yaguachi	Guayas	M. Salazar	Agosto 5/70	0106	20	21	407	407
Río Ruidoso	Taura	Naranjal	Guayas	M. Salazar	Marzo 18/70	4109	14	25	657	624
Nueva Fortuna	Taura	Naranjal	Guayas	M. Salazar	Enero 27/70	3355	18	25	782	754
Los Angeles	El Triunfo	Yaguachi	Guayas	M. Salazar	Enero 27/70	649	41	37	475	310
La Carmela	El Triunfo	Yaguachi	Guayas	M. Salazar	Junio 11/65	11413	44	46	869	-
Marcos Benetazzo	Barreiro	Babahoyo	Los Rios	E. Armendáriz	Marzo 16/71	1165	18	34	189	-
PRE-COOPERATIVAS										
Buena Fe	Vinces	Vinces	Los Rios	R. Lopez			28	28	120	-
Tinoco	Baba	Baba	Los Rios	R. Lopez			36	36	200	-
11 de Agosto	Pimocha	Babahoyo	Los Rios	E. Armendáriz			39	44	234	-
Beneficencia	Sambo Rondón	Sambo Rondón	Guayas	D. Benitez			56	56	300	-
31 de Octubre	Sambo Rondón	Sambo Rondón	Guayas	D. Benitez			30	52	320	-
Nueva Narcisa	Sambo Rondón	Sambo Rondón	Guayas	D. Benitez			38	38	174.3	-
Margarita	Tarifa	Sambo Rondón	Guayas	D. Benitez			30	40	150	150
Villa Mercedes	Tres Postes	Yaguachi	Guayas	D. Benitez			25	130	800	-
San Luis	Tarifa	Sambo Rondón	Guayas	D. Benitez			35	42	300	-
									11,427.	
									16,347 has.	

Source: FENACOPARR

APPENDIX IV

Another point which is highly interesting is the fact that the national rice consumption has been calculated for 1969 to be of the order of 2,160,000 qq of rice of 100 pounds, or 38.20 kilos per capita per year as reported by the National Rice Commission in 1969.[1,8] In official circles, it is stated that Ecuador does not export rice at the present time and that it has not exported large volumes of rice in the last 10 years. Nevertheless, we see in the afore-mentioned Table II, that 12 years show a rice production which would demonstrate the contrary. The fact is that a certain amount of the harvest, 25 percent more or less, is exported legally and illegally. The illegal contraband exportation is carried on in two different geographical areas and by two different ethnic groups.

The contraband is limited to the best quality of rice, the rice of the largest grain size.

The Contraband to Peru.--This is carried on directly by the people living on the Pacific Coast of Ecuador and specially in the Guayaquil area and the Province of El Oro. These people are not Indians and should be considered to be of the "mestizo" type as are most of the people on the coastal area. The rice is trucked to the town of Huaquillas in Ecuador which is only 30 minutes distance from the town of "Aqua Verde" in Peru. The transportation between these two towns is carried on by professional smugglers who live permanently in the area. The reason for the contraband is that the price of that quality of rice in Peru is 25 soles per kilo. The exchange rate with the Ecuadorian sucre is 0.50 sucres per sol, which makes the price of that quality of rice in Peru equivalent to 12.50 sucres per kilo while in Ecuador, the market price of that quality of rice is 4 sucres per kilo, or 310 percent higher in Peru than in Ecuador.

The Contraband to Colombia.--Most of the Indians of Ecuador live in the Andean Mountains and only a few of them are farmers on the coastal area. The Indians generally are small consumers of rice and the government has been trying to subsidize transportation of rice to the Sierra in the Andes in order to increase rice consumption. The Indian merchants who receive the rice with Tornaguia (transport permit) will take it by the mountain roads to the Colombian frontier to the area called "Rumichaca", named after a famous Inca bridge. The Ecuadorian town in the Rumichaca frontier is "Tulcan" while the Colombian town is "Ipiales". Both towns are not more than 10 minutes (by car) apart from each other. The Ecuadorian rice, as well as other agricultural products, such as (canned) tuna fish, is smuggled into Colombia and traded for Colombian textile products and some other Colombian industrial products, which are taken into Ecuador. Trading for contraband goods is actively done on both sides of the frontier.

So, these are the routes by which a percentage of the Ecuadorian rice production leaves the country illegally.

The price obtained in Colombia for the Ecuadorian rice is 8 Colombian pesos per kilo. The exchange rate is 1.10 sucres per 1 Colombian peso. So the price, in sucres, paid for Ecuadorian rice in Colombia is 8.80 sucres, which is more than 200 percent of the Ecuadorian market price.

Appendix Tables XXVI and XXVII on the next page, give us an idea of the actual and potential exports in Ecuador. Consumption in Appendix Table XXVII is taken as a constant since it was calculated at 2,160,000 quintals or 38.20 kilos per capita for 1969.[1,8] For years before 1969, national consumption probably showed smaller figures.

Appendix Table XXVI. Imports and Exports of Rice.

Year	Exports and Imports in Metric Tons		
	Exports (mt tons)	Imports (mt tons)	Exports in qq (100 lbs)
1961	24,269	—	533,918
1962	5,161	—	113,542
1963	33,864	—	744,590
1964	10,571	—	232,540
1965	—	5,000	—
1966	22,474	—	494,428
1967	2,300	—	50,600
1968	—	4,000	—
1969			

Source: White[6,116]

Appendix Table XXVII. Production, Consumption, Exports, Imports and Potential Illegal Exports in Quintals.

Year	Production	Consumption	Exports	Imports	Potential Illegal Exports
1961	3,728,066	-2,160,000	-533,918	—	1,034,148
1962	3,771,790	-2,160,000	-113,542	—	1,498,248
1963	3,818,298	-2,160,000	-744,590	—	913,708
1964	2,972,068	-2,160,000	-232,540	—	579,528
1965	3,272,556	-2,160,000	—	+110,000	1,222,566
1966	3,465,726	-2,160,000	-494,428		811,298
1967	3,138,300	-2,160,000	-50,600		927,700
1968	1,818,220	-2,160,000		+88,000	-253,780
1969	3,620,760	-2,160,000			1,460,760

VITA

Percy G. Aitken Soux

Candidate for the Degree of

Master of Science

Thesis: Relative Rates of Return to Controlled Irrigation Among Classes of Summer Paddy in the Guayas Basin, Ecuador.

Major Field: Agricultural Economics

Biographic Information:

Education: Attended schools in Potosi, Cochabamba and La Paz, Bolivia in South America. Graduated from high school from the "Colegio Nacional Pichincha", Potosi, Bolivia. Received B.S. from Kansas State College in 1954 and completed requirements for an M.S. from Utah State University in 1972.

Personal Data: Son of George G. A. Aitken and Lily Soux Hernandez, married Clara Garrett in 1957. Presently parents of Georgette, Percy Jr., Lorena and Christian.