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A SOCIO-ECONOMIC STUDY OF SOUTHWESTERN PUERTO RICO

INTRODUCTION

In overpopulated areas, like Puerto Rico, which in addition is characterized by scarcity of natural resources and a strictly agricultural economy, it is very essential that the minds of the governmental officers responsible to the people be constantly in action searching for practicable ideas and programs which may help to relieve the tremendous pressure of the population over the scanty resources. Otherwise, the only logical result to expect is a chronic and increasingly low standard of living together with all other economic and social problems naturally tied to it. The final expectation, therefore, can be nothing else but complete ruin and disaster. Fortunately, the people who have the responsibility of the present government of Puerto Rico have been always conscious of this fact and are trying by all possible means to make the best use of the existing resources in an

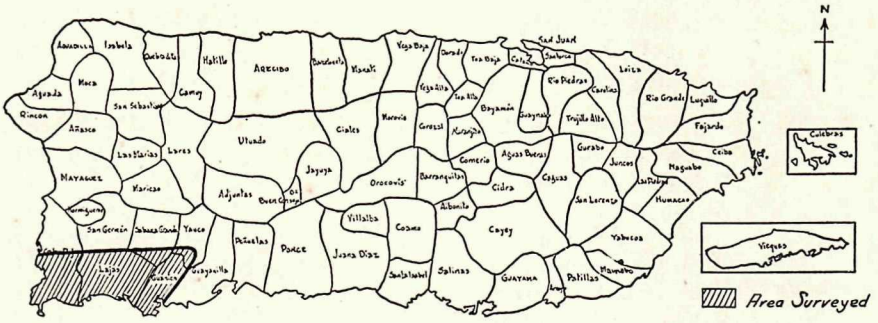

Figure 1. Map of Puerto Rico showing the area surveyed.

attempt to face the problem intelligently so as to raise to the maximum possible level the standard of living of the population.

According to the above-mentioned governmental policy, proper directives have been issued to all agencies and institutions which in one way or the other may give a hand to alleviate the situation. In the year 1941–42, the government directed all agricultural and other related agencies to integrate their efforts in an attempt to delineate action-plans which may contribute effectively to increase the productivity of the land. One of the first things considered was the development of the Lajas Valley located at the Southwestern part of the Island.

The Lajas Valley region, including its surroundings, comprises around 100,000 acres which extend from the municipality of Yauco to the southwestern tip in the municipality of Cabo Rojo (figure 1). As will be described later, this is a very fertile but dry region which, if properly developed, could be made one of the most important agricultural areas in Puerto Rico. For this purpose a committee named the Lajas Valley Com-

mittee, was officially created. Its main objective was to coordinate governmental action in such a way as to arrive at the most effective and practicable plan for the development of this area.

The first problem encountered by this committee was the lack of reliable information on which to base a scientific development plan for the area. The immediate task, therefore, was to look for the lacking information. Consequently, the first step taken was the preparation of a very inclusive outline of the needed information regarding all social, economic, and other technical aspects involved. The responsibility of gathering the information was given to the different agencies which were thought to be best suited for each purpose. The studies concerning the economic classification and use of the land as well as those related to the farm management problems of the area, were considered to be of paramount importance. The Department of Agricultural Economics of the University of Puerto Rico was made responsible for these phases of the general study.

As indicated above, the general objective of this report is to provide the Lajas Valley Committee with the necessary information regarding the classification, use and management of the lands in Southwestern Puerto Rico. Besides this general purpose there are other specific ones which are to be pointed out later in the discussion of the objectives of each main aspect of our study.

DESCRIPTION OF THE AREA

Social Background

Population[1]

The Lajas Valley area in Southwestern Puerto Rico includes the entire population of the municipalities of Lajas and Guanica, about half the rural population of Cabo Rojo, and about a third of the rural population of Sabana Grande. In 1940 the population of the area was 42,748, of which 34 per cent lived in Lajas municipality, 30 per cent each in Guanica and Cabo Rojo, and 6 per cent in Sabana Grande. In 1940, 81.9 per cent of the population was rural, compared to 69.7 per cent in Puerto Rico. The total population density, on an approximate area of 134 square miles, was 319 persons per square mile, compared with 546 persons per square mile in Puerto Rico. The highest density was 423 persons per square mile in Guanica. The average rural population density was 244 persons per square mile compared with 381, the average rural density of Puerto Rico. Of the total population of the four municipalities 17.6 per cent was colored in 1940, having increased slightly from 17.4 per cent in 1930.

[1] Data from report prepared by the Puerto Rico Planning, Urbanizing and Zoning Board based on the 1940 Census.

Rate of Population Increase. Since 1899 the population of the area has nearly doubled. Its rate of increase was 98.3 per cent, or slightly greater than the rate of 96.1 per cent for Puerto Rico. The period of greatest population increase occurred between 1899 and 1910, when the population of the area increased from 21,554 to 30,177, or 40.0 per cent compared to Puerto Rico's total population increase in that period of only 17.3 per cent. The direct cause of this increase was undoubtedly the establishment of Guanica Central shortly after 1900.

In all other census periods, except that between 1935 and 1940 the population of the area increased more slowly than that of the Island as a whole. The period of least growth occurred between 1920 and 1930, in which period the rate was only 2.3 per cent, compared to Puerto Rico's population increase of 18.8 per cent in that period.

Urban and Rural Population. In 1940, the proportion of the total population of the Lajas Valley area which was rural, 81.9 per cent, was considerably larger than that of the total population of Puerto Rico, which was only 69.7 per cent. However, the population of Guanica municipality was only 39.1 per cent rural. The town of Lajas, with a population of only 2,294, was included with the rural population, for the U. S. Bureau of the Census classifies as rural all persons living outside of towns with a population of 2,500 or greater.

Although the period in which urban population has been reported in the Lajas Valley Area has been too short to make possible any accurate estimate of trends, it appears that the proportionate increase in urban population has been slower than that recorded for all of Puerto Rico. However, in absoluted numbers, the urban population of the area increased 26.6 per cent between 1930 and 1940, while the rural population increased only 19.0 per cent. This strictly urban growth has taken place entirely in Guanica municipality.

In an area as small as the Lajas Valley, the recorded population increase of specific towns is often more valuable than a study of urban population alone. During the time that the population of the area doubled, the population of Guanica and Lajas towns more than tripled. The rate of increase has been consistently high during this whole period, and Lajas has grown more than Guanica. Undoubtedly the predominance of large land holdings has contributed to town growth in the area. The large number of agricultural laborers who work on the sugar cane estates have little opportunity to settle on the level valley floor, and must live in towns or small roadside villages, or in the slopes of the hills north of the valley. In addition, the greater employment possibilities and the greater social contacts and better living conditions available in town offer an added incentive to live there.

Natural Increase and Migration. Like many areas of predominantly

rural character, the Lajas Valley Area has had a high birth rate and a high rate of natural increase. However this high birth rate is not reflected proportionately in the recorded population increase of the area, indicating that there has been a surplus of population which has emigrated to other areas, presumably those of greater economic opportunity. In the 10 year period from 1931 to 1940 inclusive, 10,415 births and 4,234 deaths were recorded in the municipalities of Lajas and Guanica. If to the births and deaths for Lajas and Guanica are added the number of births and deaths in Cabo Rojo and Sabana Grande proportional to the per cent of their total population lying within the area, the estimated number of births in the Lajas Valley Area is 16,614 and of deaths 6,969. The natural or gross population increase is therefore 9,645. However the Census recorded a numerical increase in the population of the area of only 7,228, indicating that only about three fourths of the gross population increase of the area remained there, and the rest emigrated. Since the probabilities of under-enumeration of births is more likely than that of deaths, the estimate of gross population increase and thus of emigration, is conservative.

The situation is much the same in the municipalities of Lajas and Guanica alone. The gross population increase in the same period was 6,181, but the net recorded increase was only 4,729—a net emigration of 1,452 persons.

The weighted average birth rate for the area was 10 per cent higher than the average for Puerto Rico during the same period. Since the average death rate was lower than that for the Island, the rate of natural increase for the area is higher than that for the Island. There is little significant difference between the rates for the municipalities lying predominantly or entirely within the area. Apparently Sabana Grande responds to other influences, but their effect on the average for the area is slight.

Age and Sex Distribution. Age distribution in the Lajas Valley Area does not vary greatly from the distribution typical of Puerto Rico. A lower proportion is in the productive working ages, that is, from 15 to 44 years—and a higher proportion is in the youthful age—14 years and under—particularly under 5 years of age. In general, the age distribution in the area tends to be more typical of the rural population of Puerto Rico than of the urban.

Sex distribution like age distribution does not vary greatly from that typical of Puerto Rico, and again the tendency is toward rural rather than urban characteristics. In the four municipalities there are 102.5 males per 100 females, while in all Puerto Rico the ratio is 100.8 to 100. Curiously enough, Guanica, which has an urban population proportionally twice as great as Puerto Rico, has a significant predominance of males.

Employment. Of the 56,007 persons living in Lajas, Guanica and Cabo Rojo municipalities, 20,312 were reported in the labor force in 1940. There

was therefore one actual or potential wage earner per 2.8 persons as compared to 1 per 3.1 persons in all Puerto Rico. However, since the census was taken during the harvesting and grinding season for sugar cane, the employment figures given are seasonal, and higher than if the census had been taken later in the year.

There were 13,643 males and 6,669 females reported in the labor force, giving a ratio of one male per 4.1 persons, and one female per 8.4 persons. The highest ratio of male to female workers, 3.9 to 1, was reported in Guanica, and the lowest, 1.6 to 1, was reported in Cabo Rojo. Of those persons over 14, sixty per cent are in the labor force as compared to 52 per cent in Puerto Rico.

The majority of those employed were in private employment, only a little more than one per cent being employed in public emergency work. About 96 per cent of those in the labor force were employed, except in public emergency work, compared to 85 per cent in Puerto Rico. Of those employed, 62 per cent were wage or salary workers as compared with 72 per cent in Puerto Rico. The remainder are employers, self-employed or unpaid family workers. In Guanica 82 per cent of those employed were wage or salary workers, due to the influence on employment patterns of Guanica Central; 73 per cent were so classified in Lajas, and 52 per cent in Cabo Rojo. In the latter a large proportion of those employed were women doing needlework at home, accounting for the lower proportion of wage or salary workers.

The greatest single source of employment was in agriculture, principally in sugar cane farms. Ninety-nine per cent of those employed in agriculture were men. Sugar cane farms employed proportionately more of the labor force than in Puerto Rico, since in the latter, other farms, principally tobacco and coffee, employed a large group. Needlework at home was the second greatest source of employment and those employed were for the most part women. Transportation, wholesale and retail trade, and personal service provided employment for proportionately fewer persons than in the rest of Puerto Rico.

Education and Literacy. The population ten years and older of the four municipalities was 72.7 per cent literate in 1940, compared with the average of 68.5 per cent for Puerto Rico in the same year. The variation between municipalities was slight. Cabo Rojo had the lowest literacy, 71.7 per cent, and Lajas the highest, 74.3 per cent. Thirty per cent of those 10 years and older were able to speak English; compared with 27.8 per cent for Puerto Rico. There was a considerable variation between municipalities with respect to ability to speak English, Guanica had the highest, 42.8 per cent due to the presence of a small colony of continentals in connection with the Central. Although the actual number of continen-

tals and persons born in other United States possessions amounted to only 85 persons in 1940, and represented less than 7 tenths of one per cent of the population, this proportion was nearly twice that of the Island as a whole.

According to data for 1943 submitted by the Insular Department of Education, there are 68 elementary urban and rural schools in the Lajas Valley Area, with 134 schoolrooms, 23 second unit classrooms, and 11 vocational school classrooms, with a total enrollment of 6,829 students. Census data give approximately 16,000 persons between the ages of 5 and 19 in the Lajas Valley Area in 1940, which means that at least 60 per cent of those of school age are not enrolled in school. In Cabo Rojo and Sabana Grande some children living within the area may be attending schools outside the area, which may reduce the proportion of those not enrolled to approximately 50 per cent, which is close to the proportion for the Island as a whole. In Lajas, Guanica and Cabo Rojo the per cent enrolled is 44, and 43 respectively, but in the two wards of Sabana Grande lying within the area the proportion is only 17 per cent.

In Lajas there are 8 second unit and 5 vocational classrooms and in the four wards of Cabo Rojo, lying within the area, there are 15 and 6 respectively. However, in neither Guanica nor in the two wards of Sabana Grande are there any second unit or vocational classrooms reported. Of the rural schools in the area, the majority are of one classroom.

Social Classes

There is a definite and marked social stratification in a rural society. The Southwestern Region of Puerto Rico is no exception. Strong social consciousness exists in the area involving differences of status which make groups of individuals separate into social classes from the rest of the community. This class consciousness depends very largely upon the competitive, conflictive, or cooperative relations of the different groups. It is not possible to distinguish sharply the factors which are causal in determining the social classes but, in Puerto Rico (including the Southwestern Area under study) the principal factor responsible for this stratification is the economic factor, that is, income, occupation, size and value of land holdings, the nature of land tenure, etc. Other causal factors such as education and ability, racial or nationality composition of the population, mobility and length of residence of families and the organizations in which the members of the society participate, although important, are secondary in nature.

The social pyramid of the area consists of three sections; namely, the upper, middle and lower section; which represent the three different classes which have developed there.

Upper Class. In the upper class the big landholders and the owners

and high employees of sugar mills are found. It is a small number of families with the highest income, and the complete control of most of the property and practically of all the activities in the area.

In the upper class the concept of primacy of lineage is frequently present. These families have developed name and wealth. For several generations they have established a prestige for a family name that distinguishes them from the rest of the people, not only within the community, but all over the Island.

The families in the upper class, because of their solid economic status and high education can afford to have a high standard of living. They are in very good health, have good housing facilities, excellent automobiles, very good diets and excellent clothing. The size of the family of this class is the lowest on the average consisting of four or five members in total. Generally, they have plenty of servants at home to do all domestic jobs and other employees to take care of the flower gardens, lawns and hedges.

These upper families are able to buy the daily newspapers, weekly magazines, novels and poetry books as well as other business publications. They usually prefer to send their children to private city schools and later to universities in other countries. Being on an advantageous economic position they are members of the most select social clubs in the Island; and they are able to make frequent trips to the capital city to attend dances, meetings, etc. They spend their vacations, two or three months during the year usually after the grinding season, travelling outside the Island. It is interesting to observe that they go to the capital city to buy most of their clothing and a great part of all the house necessities. In their opinion, they are unable to find what they want in the nearby towns or cities, where they only buy those things which they get short of, or which are most essential to their daily needs.

The upper class may be divided into two sub-classes, the upper-upper and the lower-upper. This division is fundamentally of an economic nature. The big landowners are in the upper-upper group, and the higher employees are in the lower-upper group. The big landowners, even if living close to their properties, are not in direct contact with the so-called inferior employees and with the laborers. They may get in contact with the higher employees usually on business matters, but not very frequently. They regard themselves as superior people who have lots of employees working for them. The higher employees, to them, are "very good and nice people with great ability to work on large business." However, they very seldom share with them social activities and gatherings. It is very rare that they come in contact with the other employees and laborers; however, the latter know well who they are, and recognize them as the owners of the holdings where they work. To the laborers it is a kind of attraction

to see them. The laborers hear their immediate boss talking about Mr. X. In their conversation with the other laborers they refer to them as "very rich people who are enlarging their capital by the exploitation of their labor and lives."

Middle Class. Next to the upper group of families rank those of middle size farmers and of the office employees, engineers, "mayordomo" and timekeepers. The bulk of these families constitutes the group which may be called the middle class of the area. There exist, however, differences in salaries and prestige among them with a consequent stratification into two further groups which may be called the upper-middle and the lower-middle classes.

The upper-middle group usually have a higher education, higher income, and consequently enjoy higher levels of living. They live in relatively good houses, either personally owned or the property of the sugar mill. These houses are usually provided with the essential comforts, though not expensive. Usually these families own an automobile for their personal use. Their salaries permit them to have a home servant which helps in doing the cooking and cleaning of the house. Their diets, health and clothing are relatively good. Most of their services and necessities are obtained in the nearest town or city. However, they make trips to the capital city once or twice a year, where they may have a good time and where they obtain some of the luxurious things which they are able to afford.

The upper-middle's family consists of five or six members. The children usually attend the public schools of the nearby town. After High School they are frequently sent to the University of Puerto Rico for a degree. Very seldom are they able to send them to universities outside the Island, and when they do, it is on the basis of sacrifices. It is important to observe that they have a high sense of morality and that they criticize deviations from their standards which are seen in the higher groups.

The upper-middles do not establish a definite line of distinction from the lower-middles. They share with them certain social activities such as birthdays, baptisms and Three Kings' Day parties. The classes above look at them as "good" and "efficient" people; however, they do not share social activities together. Some of the upper-middles, because of a better position in relation to their superiors, can enjoy certain privileges which indicate a tendency for mobility to a higher level. This, however, is not very frequent.

As indicated before, this group enjoys higher incomes and, therefore, can afford to spend some money on daily newspapers, magazines, novels, poetry books and other technical reading material. Because of their relatively privileged position in relation to the upper class, they are sometimes allowed to use hunting grounds, tennis courts, golf courses and other recreational

facilities owned by the higher class. In spite of this privilege, unwritten social regulations restrict its use to certain specific periods or days of the week.

The lower-middle class is formed by the smaller size farmers and the lowest salaried employees such as clerks, stenographers, typists, etc., who, because of a lower level of education or the fact that they may come from poorer families of the vicinity regard themselves as socially subordinated. Their attitude toward those above them, as well as the behavior of the upper classes, has contributed greatly to set them apart as a class group.

The lower-middle, because of their lower incomes, cannot afford to have a level of living high enough to be considered satisfactory. They spend a higher proportion of their income on food and other necessities and a very small amount on other luxurious things such as education, recreation, etc. They live in small houses either personally owned, provided by the sugar mill or rented. Their families generally consist of six members on the average. Their health, housing facilities, and diets can be described as fair. They own no private automobile and use buses or public cars as the general means of transportation.

These lower-middles are the first to use the rural country schools. Their children go to these schools usually up to the fourth grade. Afterwards they are sent to public town schools until they get their High School diploma. Very seldom a child is able to go to the University, and if they do, it has to be with some kind of outside help from a relative, or from the government in the form of scholarships. Of course, they have to be exceptionally good students to receive this kind of help. Persons belonging to this class are able to buy one of the daily newspapers, and once in a while a novel or any other book.

In their relationships with those above them in the social pyramid, they are somewhat timid. They are accustomed to receive orders and to accept them as final, no matter if they do not agree. When they receive a deference from the upper-middles, they feel as if they have been greatly honored by their superiors. Their social recreational activities are mostly limited to birthday celebrations, baptisms, Three Kings' Day parties, and occasionally, going to the movies in town.

Lower Class. Below the lower-middles, the largest and perhaps the most important group is found. These are the sugar factory and agricultural laborers. Because of the importance of this group, and due to the fact that most of the problems resulting from social and economic maladjustments are tied up to this underprivileged class, it is intended here to describe it in more detail.

First, it is convenient to establish a line of distinction which stratifies the laborers into two groups, one of which ranks a little higher than the

other, socially speaking. This group is the upper-lower; and the reason why they are on a higher social level is mainly due to the type of work they perform. Sometimes those laborers who have attained a higher grade in school, or have acquired more experiences through age or through travelling as laborers in different regions of the Island are also recognized as superiors. These upper-lowers have a higher social prestige that is recognized by both upper and lower classes. In fact, the reason why they have better jobs as laborers may be very likely due to this recognition. They usually perform such jobs as foreman, tractor and railroad machine operators, truck drivers, etc. They feel proud to have their superiors rely on them to get the work done; and consequently, they put all efforts to do it as best as possible. In a way, they serve as links between the bulk of unskilled laborers and the lower-middles. Although it is true that they keep good relations with the unskilled laborers, they sometimes are looked by them as "people who are no better than we are but trying to gain favors from the bosses."

The level of living of the upper-lowers is a little higher than those below them—the lower-lowers—however, the difference cannot be considered significant. It is true that they are paid a little higher, but the difference in salary, when expressed in terms of standard of living, does not amount to much. For this reason, and because of the fact that it is very arbitrary to set a definite line of distinction, it is intended here to discuss their social and economic problems as a single group.

The average size of the families of the agricultural and factory workers is about 6 members. On the average, they have an annual income of around $250. However, a large number of these families obtain incomes which average a little over $150 annually. Family expenditures are greatly limited by their low incomes. They spend about two-thirds of their income in food, nearly 10 per cent in clothing and very insignificant amounts in house furnishings, fuel and light, medical care, personal care and recreation, and only three-tenths of one per cent in education. The reason why they spend such a small proportion of their income on education is obvious. As a result of this situation they are unable even to satisfy the important necessities of life. Their children attend the rural schools usually up to the fourth grade and very seldom attend the schools in town.

Living Conditions of the Lower Class

Diet. The diet of the agricultural and factory workers is entirely insufficient in quantity and quality for the normal development of the human body. It consists principally of starchy vegetables, dried cod fish, rice, beans, cornmeal and black coffee or coffee with milk. According to investigations made, it was found, for example, that 85 per cent of the laborers'

population breakfasted on black coffee, coffee with milk, or in a few cases coffee with milk and bread. Lunch for 88 per cent of them consisted of starchy vegetables, rice and beans, starchy vegetables with codfish and rice with beans, or cornmeal; and 93 per cent of the total had for supper rice and beans, or rice, beans and fish, the latter by only a few families. It was also found that the caloric intake was short and that the protein, fat, mineral and vitamin contents in the diet were entirely inadequate.

The effects of bad nutrition which extend through the years and even through generations is disastrous to a population. General debility caused by a deficient diet and the exhausting physical effort which the laborers undergo result in the loss of resistance against disease. It must be taken into consideration that this diet is difficult to substitute because it is not easy to obtain one which produces as many calories at such a low cost and which, moreover, contains some of the essential components, being at the same time liked by them.

Housing. A larger number of the agricultural workers as well as of the factory workers live in houses owned by the landlord. The housing facilities are very poor in general. The most common type of house is constructed of wood with a galvanized iron roof. Frequently the houses were constructed in places where the soil is very poor or swampy, in order not to use the better lands which are used for cultivation. The houses of these workers have only one or two rooms and a kitchen situated in a small lean-to shed. There is an average of 3.5 persons for each bedroom available.

The furniture in these houses is scanty and of the cheapest quality. A large proportion of them have only a few benches or empty boxes for chairs, a small table, one or two cots, and a homemade wooden box. However, occasionally a house is found which has an iron bed and some chairs.

Only a little over one-half of the houses have latrines of a simple type. In the remaining homes there are no latrines or sanitary installations of any type.

The fact that laborers live in houses which are the property of the landlord without paying rent, results in a status of housing insecurity. Until recently, if at any time the owner estimated that a laborer family was not rendering productive services to their interests, they were able to force them out of their properties. This situation is very well described by the term "agregado" (squatter) which is the common name given to them.

Clothing. Workers' families are far below the minimum adequated clothing requirements. A study made by the Home Economics Department of the University of Puerto Rico showed that the minimum adequated clothing requirements per year for a family of six should be about $116.00 (October 1, 1942 prices). Although these minimum requirements were very conservatively calculated, they are considerably higher than the amounts spent on clothing by workers' families. In other words, they were spending

from one-fourth to one-third of the amount of money which was necessary for minimum clothing standards. The typical average worker has a pair of pants, two shirts, one underwear set, a pair of shoes, and an old straw hat. His wife's wardrobe is more or less the same amount. Many male children wear no clothing at all. Some children wear either a blouse or drawers, seldom both.

Water supply. There are no water systems in the rural areas to provide water to the laborers. The majority of the families use water from wells, irrigation ditches, polluted rivers or springs, or use rain water collected from the roof and stored in cisterns. Occasionally people use a water straining device for collecting rain water. With a population density of 546 persons per square mile in Puerto Rico, as revealed by the 1940 census, and an almost total lack of facilities for the sanitary disposal of human excrement in the rural areas, there are practically no surface sources from which pure water can be supplied for drinking purposes, without being first properly treated. Consequently, there exists a continual threat of waterborne disease epidemics among the rural working class.

Health. The sugar cane areas of Puerto Rico are located on the coastal plains and the interior valleys of the Island. They are the best and most fertile lands in the country, but due mainly to topographical conditions, they are also the most unhealthy, because endemic diseases such as malaria and bilharsiosis are very common and bring the mortality rate in these regions to a higher level than in the mountainous areas.

Generally speaking, it may be said that the diseases which do most harm to the population are caused by exogenous transmissible agents: malaria, which prevails in the coastal areas and tuberculosis and intestinal parasites, which are today found over all regions. Mortality from gastric enteritis is the primary cause of infant mortality in these areas. Malaria, tuberculosis and intestinal parasites are the most serious problems of adults. It may be noted that general and infant mortality is higher in the sugar cane zone than in Puerto Rico as a whole.

There is an average of about 5,000 inhabitants per doctor in the sugar cane areas in comparison with 12,151 inhabitants per doctor in the other areas. These figures indicate that the supply of doctors in the sugar cane zones, although not sufficient, is higher than in the zones where sugar cane is not grown, which is an indication of the greater wealth and prosperity which exists in these zones in comparison with the areas where cane is not cultivated. It should be pointed out, however, that doctor services are very seldom available to workers' families due to their inability to pay for them. In spite of the greater supply of doctors, the mortality rate is higher, which is a further proof that there exists a greater number of illnesses in this area and that it is a more unhealthy region.

The health situation described above is characteristic of the sugar cane

laborers' families including those of the Southwestern part of the Island. It is evident that their poor health has its deepest roots in their difficult economic situation which results in an entirely inadequate diet, and the squalor in which these people live.

Castes

Caste groups in Puerto Rico are not so important as class groups. For this reason social classes were described above in very much detail, inasmuch as they are the most important factor of social stratification in the rural society of Puerto Rico.

The population of Southwestern Puerto Rico, the same as in the Island as a whole, is predominantly white. However, the percentage of colored people in the sugar cane area is by far higher than in other areas of the Island.

Caste lines in the social structure of Puerto Rico are more rigidly established by those groups which are higher on the social pyramid. Its importance decreases in the groups which have a lower level in the social ladder. Among the working class it is common to see marriages of white and colored people and the sharing of social activities between them. No significant evidence can be found as to differences in the work they perform. They are employed regardless of their color. However, although no clear distinction of caste lines can be observed, it has not completely disappeared. There are still many white families who hesitate to accept colored people as social equals and who do not participate together in social activities. To conclude, the tendency for the caste line to disappear is a movement which has developed mainly among the lower groups and which very probably will continue its development in an upward direction.

Institutional Organization

The Church. A very high percentage of the rural people belong to the Roman Catholic church. This represents the general faith of the people of the Island which developed under the Spanish Government. However, although rural people are considered to be very religious, they very seldom attend religious services. The rural church has developed very little on the island, especially in the sugar cane areas where very few, if any, are found. They are usually located by the side of a public road outside of the big land-holding. Their buildings are fairly good, but very poorly equipped.

The rural churches do not have a resident priest or pastor. They reside in the near towns from which they come to serve. The program of activities of the rural church is very limited. In the case of the Rural Roman Catholic Church practically the only service offered is a mass held usually once a month.

Churches of other denominations have recently increased their interest in the rural people. Their membership has been increasing. However, it is by far much lower as compared to that of the Roman Catholic Church. The development accomplished by these other churches has been mostly among the lower classes, since the higher class people have very little or no tendency at all to change their religion. They have a sense of social prestige tied up to the Catholic church. Members of the upper classes very seldom attend the rural churches. To satisfy their social consciousness of superiority they prefer to attend Catholic churches in town where they can associate with people of their same category.

As indicated above, the rural people are segregated into two main groups in relation to religious activities. This segregation is based on the location of the church which they attend. It is interesting, though, that both groups mostly attend the Roman Catholic Church. This segregation, however, may cause difficulties which must be carefully faced in any attempt to develop a religious program for the rural people.

The School. School facilities existing in Southwestern Puerto Rico have been discussed previously. This section will mainly attempt to describe briefly the social characteristics and influence of this institution in relation to the rural people.

School attendance, as well as church membership, is similarly divided into two groups on the basis of social classes' attitudes. The division is based on those who can and cannot afford to send their children to town schools.

The most common type of rural school serving the rural area is the one-room one teacher school. It is a governmental public school where attendance of children up to certain age is supposed to be compulsory. The highest education which is generally offered is the fourth grade. The school house is located by the side of a public road in a lot which is generally the property of the Government. Academically, teachers are, generally speaking, well prepared because of the opportunities for improvement offered by the Government. They are paid on a twelve months' basis but their salary is relatively low. Teachers are not exactly full members of the community in which they serve, but live usually in the nearby town travelling back and forth every day. In spite of this fact, the rural teacher is the outstanding professional leader of the community, and one of the persons most interested in the welfare of the rural people.

Close contact of the different social classes does not occur in the rural schools. As stated before, members of the upper classes prefer to send their children to the town school, and the uppermost classes have a preference for private city schools. The enrollment of the rural school, therefore, comes principally from the lower and middle classes. The lack of interest in rural school activities, logically present in the higher classes, is one of

the most serious problems of the rural schools. In spite of this situation they have achieved considerable progress in implementing its program in the community.

The Insular Government has been developing a program of Rural Education Improvement. Rural schools are being centralized into the so-called "Rural Second Units," which offer academic training up to the ninth grade, besides training in vocational education. Eventually, these "Second Units" will predominate in the rural areas of Puerto Rico and will offer better and less expensive education, as well as more facilities for social improvement in the community in general.

Local Government. There is no form of central local government for the whole Southwestern area under study. For governmental purposes the Island is divided into seven districts, each one including several municipalities. The latter is the smallest unit of government whose seat is centered in the town. In the Southwestern area of Puerto Rico there are four of those municipalities involved, namely, Cabo Rojo, Lajas, Guanica and Sabana Grande. Insular governmental activities such as public health, police service, education, justice, revenues, etc., are handled at the municipal level. The Southwestern area of Puerto Rico is, therefore, not a unit of local government by itself, but includes four municipalities from which governmental services are directly or indirectly obtained.

Services and Activities

Hospital Facilities. Hospital facilities are very limited in the Lajas Valley Area. There are 7 general hospitals with a total of 101 beds in the towns of Lajas, Guanica and Cabo Rojo. Four of the hospitals are private, having a third of the total number of beds. The rest are municipal hospitals. There were 1.7 beds per 1000 recorded population in 1939; Guanica had the highest proportion, 3.4 beds per 1000 population, and Lajas the lowest with only one bed per 1000 population. Since the town of Cabo Rojo lies outside the area proper, only 4 hospitals totalling 58 beds in Lajas and Guanica are actually located within the area. The nearest District Hospital at Aguadilla is too far from the area and, therefore, it should be removed from consideration here. The proposed construction of a District Hospital at Mayaguez would improve to some extent the facilities for hospitalization available to the population of the Lajas Valley Area.

Medical Services. In the areas where sugar cane is cultivated in Puerto Rico there exists an average of around 5,000 inhabitants per doctor. Doctors reside in towns and very seldom visit the rural zone, except their very best clients of the upper class. The upper class also get their medical services in the capital city or in the best private clinics of the largest cities. The middle class depends on the private doctor and small hospitals

of the nearby towns; and the lower class depends on the governmental public health services that may be available.

Sugar cane workers are covered by State Insurance Funds, collected from the employers. The State provides medical assistance and hospitalization to all insured workers who are injured while at work. It also provides compensation payments to injured laborers who, as a result of their injuries, are permanently, partially, or totally incapacitated for work.

An additional type of medical service is sometimes offered by Sugar "centrals" to agricultural laborers and their families. It is of a charitable nature and operates in this way: The sugar central hires a doctor in town and pays him either on a per patient or per time basis. Any laborer or member of a laborer's family in need of medical assistance should first obtain from an employee in the office a written authorization, so as to be examined by the doctor. If the doctor is paid on a per patient basis, the laborer has to see him in his town office. On the other side, if he has contracted to serve on a per time basis, the laborers have to wait for his periodical visit to the "central". Occasionally this charity help is expanded by helping the laborers who cannot afford it to buy the medicines prescribed.

Recreation. The degree of participation in recreational activities varies for the different social groups. There are different recreational activities; however, in none of them is there participation of all classes together.

The upper class has a great part of its recreation outside the area. They belong to very selective clubs in town which they attend regularly. They also visit the capital city to attend social meetings and parties, and also travel abroad for pleasure. In addition, the members of the upper class have their own recreational facilities. They keep tennis courts and golf courses for their use, but are very exclusive as to the persons who may share them. They also attend good theaters in town, if available.

The middle class members have most of their recreational activities within the community limits. Sometimes the "central" or big landholders keep forest grounds in the marginal lands of the area, which they use for hunting. Usually, members of the middle class share this facility but its use is restricted to certain specific periods. Baseball and basketball teams are organized in the community. The big landholders permit sometimes the use of certain open fields for this purpose. Horseback riding is another sport widely in use among the middle class member. Outside of the community the members of this class go to the cinema in town and to cock fights celebrated nearby.

The lower class participates very little in recreational activities. The young members participate to some extent in baseball and basketball games at school. The recreation most widely enjoyed by the lower class is the

popular travelling vaudeville that visits the community periodically, especially during the grinding season.

All the classes in general have other private social activities and celebrations such as dances, birthdays and other parties, but attendance at them is almost exclusive for the members of each class.

Meeting Places. There are no specific meeting centers in the area. The most common meeting places are the country retail stores and the office building grounds during pay days. In addition to these two places, the school serves that purpose too, especially during the celebration of school activities. The most common meeting places for the members of the middle class in the community are their own houses. The upper class seldom meet together in activities in the community. Their meetings are held in private clubs and other social gathering places in town.

Other Activities. Very few other activities are celebrated by or for members of the community. The most common are those held at the school by parents, teachers and/or students. The outstanding activities that hold the attention of everybody are the activities of the labor unions and those of the political parties.

Interest and Pressure Groups

The only interest and pressure groups in the life of the area are the labor union groups, the big landowners as members of the Association of Sugar Producers, and the political parties. There exist in the Island two labor union groups; namely, the General Confederation of Laborers and the Free Confederation of Laborers. The objective of the two labor unions are the same, that is, the improvement and betterment of the laborers. However, they are segregated, principally because their leaders belong to different political parties.

Commonly, laborers strike every year at the beginning of the grinding season. Usually it takes several weeks to settle the dispute, which results in wage agreements for the season. Neither the labor strikes nor the settling of the dispute is carried on a community level basis. They are island-wide problems handled by the Association of Sugar Producers and the top leaders of the labor union involved. The strikes are very important events in the community because they arouse considerable expectation and activity.

The local leaders in labor union movements are very seldom members of the community. They often live in a nearby community or a neighboring town.

The other pressure groups in the area are the political parties. The activity of these groups comes only once every four years before general elections. The upper classes, in general, are affiliated with the conservative

parties and the lower classes with the social reform party. Always there has been a great struggle between big owners and laborers during the political campaign. Owners use all sorts of pressure techniques to force laborers to vote for the conservative Parties. In 1940, for the first time, a social reform party called the Popular Democratic Party, gained control of the Government in the Island. This party has already started the Social Reform Program they offered to the people. One of its outstanding phases is the Land Reform Program, and undoubtedly the most interesting to the people of the rural area, because of its great bearing on the social and economic life.

Physical Background

Geology[2]

The Lajas Valley extends from Yauco on the east to Boqueron Bay in the west. Its south wall is formed by the Cretaceous San German limestone and tuff. The band of San German limestone appears five times in the tightly compressed folds of the Upper Cretaceous pyroclastic rocks, between the south coast in the vicinity of Parguera and the Guanajibo valley. nearly all these Cretaceous rocks dip south and plunge into the Caribbean Sea. The arches or anticlines rose from 2,000 to 5,000 feet above the adjacent synclines, and from coast to coast, the individual folds measure from one to two miles. The northern boundary is less strongly set off from the low hills of complex mountains. The width of the valley is approximately three miles, with a length of over 27 miles. Southwest of Lajas the valley narrows, then levels at Guanica and Boqueron bays to an altitude of 150 feet feet just south of Lajas. The underlying rock of the lowland is chiefly tuff with small patches of shale.

Excavation of the Valley. The Lajas valley was excavated by subsequent streams working on tuffs and ashy shale, the non-resistant zone of Cretaceous rocks. The central and eastern portions of the valley were carved by the waters of the Cain, the Flores and the Susua rivers located respectively at the north of Sabana Grande, San German and Yauco and all flowing into Guanica Bay. The western portion of the valley was carved by the Boqueron River and its branches.

Submergence of the Valley. The Lajas valley submerged below sea level. In the Post-glacial Period (Pleistocene Age) the western waters of the Atlantic Ocean and the Caribbean Sea connected Boqueron Bay and Guanica Harbor. The Cretaceous ridge of southwestern Puerto Rico was then an island. The subsistence of the Lajas Valley was unrelated to the

[2] Data on the geology of the area from a report prepared by Dr. J. S. Bonnet—Head of the Department of Soils of the Agricultural Experiment Station of the University of Puerto Rico.

regional submergence of forty feet which provided both of its ends with the bays of Boqueron and Guanica. The subsistence of these bays was probably accentuated by the lowering of sea level during the development of the Wisconsin Glacier.

Filling of the Valley. The valley was filled by the fluvial erosion of intermittent streams and by the Susua River in the extreme west of the Guanica lowland. The filling was probably correlated with insular uplift and tilting.

Relation of the Tertiary Coastal Plain to the Older Series. No part of Puerto Rico shows more clearly the relation between the coastal plain and the oldland than the region near Guanica on the south coast. The Tertiary has been deposited upon a very hilly oldland representing the dessected eastward pitching end of the Boqueron-Yauco anticline. Immediately south of Yauco the hills are of crystalline limestone of the older series and these are overlapped on the southeast by the Tertiary cuesta. Although they are more or less interrupted by gaps, permitting direct access from the flood plain of the Susua River eastward to the Tertiary, these oldland hills can be traced in a swinging area as far south as Guanica. Here, just east of the town, some bedded volcanics are associated with the limestone. They strike northeast-southwest or east-west and are presumably a continuation of the formations having an east-west trend at Guanica Central. The presence of a large hill of Tertiary as well as abundant occurrences of the basal gravels proves that this valley had reached approximately its present development before Tertiary time. This belief, that modern erosion changes are not to any considerable degree accountable for the present size and shape of the older series hills, but that they are simply being unburied of their Tertiary cover, is abundantly strengthened by a study of the district adjacent to Guanica Central. At Guanica Central the oldland hills can be seen actually emerging from beneath the coastal plain, and on their flanks there still remains a coating of chalk, attesting the recency of their unburial. This deposit may be seen at the base of the crystalline limestone hill near the stone-crushing plant of the Guanica mill. Nearer to Guanica Central, the coating left upon some of the dark older series volcanic rocks appears like a sheet of plaster or white-wash only a fraction of an inch in thickness.

Reddish Sands in Southwestern Puerto Rico. The presence of a thin coating of reddish, siliceous sand covers part of the surface of the southwestern tip of Puerto Rico. The rocks upon which this sand rests are not extensively exposed, but where seen it is tuff of the same general character as that of Ensenada. The origin of the siliceous sand is probably in the numerous quartz veinlets which occur in the shale and tuff; also from chert masses in these rocks. The red color is due to iron oxide coating the grains and preserved in the arid climate which now characterizes the extreme

southwest corner of the district. The concentration of sand at this point is most likely the combined work of streams and sea. Conclusive evidence of former streams entering this area from the north of the playa suggests the presence at one time of a stream of considerable size. The level character of the surface is in large part the work of the sea when it stood at a higher level.

Topography[3]

The Lajas valley itself is bounded on the north by a ridge of hills, ranging in height up to some 900 feet above sea level, which separates it from the Guanajibo Valley; and on the south by another secondary ridge of hills some 300 to 800 feet in height which separates it from the South Coast. It comprises the flat floor of the valley together with its flanking slopes and has a width of about three miles; extending in an eastward direction for a length of some 17 miles from the west coast to the Susua River. Its flat bottom in general rises slowly on a slight grade from Boqueron Bay on the west coast to a low summit (50 feet above sea level) at the Palmarejo road, and then descends eastward to the level of hightide at Guanica Lake. Considerable portions of the valley bottom, known as the "Anegado" are below sea level and are swampy. The second area of the lowlands includes the Coastal Plains to the south which occur in irregular width, along the Caribbean seaboard between the southwest corner of the Island and Guanica. The sloping lands bordering these areas are of limited extent merging quickly into rough and steep hills.

Soils

The cultivated soil series of Lajas Valley cover approximately 34,801 acres. A brief classification of the soil series and acreage covered by each of them is reported in table 1. A complete description of these soils is found in the Soil Survey of Puerto Rico.

Besides the soils indicated in table 1, there are also 4,518 acres of flooded alluvial clays, of the Guanica series, that if properly drained, can also be cultivated.

The alluvial clays of the valley are poorly drained. Successful farming operations require, therefore, adequated attention to the drainage problem. In the Aguirre clays the drainage is further impaired by salt concentration due to seepage and evaporation.

Tests made by the Soils Department of the Agricultural Experiment Station at Rio Piedras have revealed that a conductivity ratio over 128/150, where the numerator expresses the specific conductance of the first-foot

[3] Data from report prepared by the Puerto Rico Water Resources Authority.

surface of soil and the denominator that at the average four-foot depth, in a 1:2 soil suspension of Aguirre clay, is detrimental to the growth of sugar cane, the most important crop in Lajas valley. It was found that those fields with a conductivity ratio below 172/234, can be leached with five feet of fresh water to a salt concentration favorable for cane growth. It was also found that there are about 5,000 acres of alluvial clays in Lajas valley which have an excessive salt concentration injurious for crop growth. This salty area may be reclaimed with gypsum or sulphur.

TABLE 1. ACREAGE OF ARABLE SOILS IN THE LAJAS VALLEY*

Soil Series	Classification	Acres
Fraternidad	Alluvial and colluvial clay	8,139
Aguirre	Alluvial clay	7,881
Jacana	Residual from andesitic tuffs and tuffaceous shales	4,709
Yauco	Residual from limestone	3,095
Caguas, Sabana Seca	Planosols	2,257
Santa Isabel	Alluvial clay	2,161
Paso Seco	Alluvial	2,145
San Anton	Alluvial	2,086
Lajas, Aguilita	Residual from limestone	717
Teresa, Coloso (poorly drained)	Alluvial	503
Descalabrado	Residual from tuffs	466
Cabo Rojo	Residual from old marine	358
Toa	Alluvial	179
Coloso	Alluvial	105
Total		34,801

* Estimate made by Dr. J. A. Bonnet, head of the Department of Soils, Agricultural Experiment Station, University of Puerto Rico.

Rainfall[1]

The Island of Puerto Rico, lying within the tropics and surrounded by the equatorial waters of the Atlantic Ocean and the Caribbean Sea, enjoys the abundant rainfall which is characteristic of many tropical island regions. The amount of rainfall, however, in spite of the relatively small area of the Island, varies greatly in different locations, ranging from less than 30 inches a year at some places on the coastal plains, to as much as 200 inches in the high mountains of the northeastern section. This diversity is due principally to the effect of the wind and topographic relief. High mountains form a more or less continuous barrier across the Island from east to west; the prevailing northeast trade winds sweeping in from the ocean drop most

[1] Data from report prepared by the Soil Conservation Service, Puerto Rico; and by the Puerto Rico Water Resources Authority.

of their rains on the northern slopes of this divide. These conditions result in a narrow belt of relatively dry country along the south coast of the Island which includes also the Lajas Valley area.

As a general rule, rainfall in Puerto Rico decreases from east to west. In the Southwest section of Puerto Rico, this general rule is evidently reversed, showing a steady increase from east to west. The normal rainfall at Samán, Desengaño, Beatriz and Santa Rita, all of which lie within the Lajas Valley area and about in the same parallel of latitude, shows a steady increase from east to west. In the above order named, Samán is the most westerly station and Santa Rita the most easterly. The normal

TABLE 2. RAINFALL DISTRIBUTION IN SOUTHWESTERN PUERTO RICO BY GAGING STATIONS AND BY MONTHS

Month	Saman		Costa		Desengaño		Beatriz		Santa Rita		All Lajas district	
	1942	Normal	1942	Normal	1942	Normal	1942	Normal	1942	Normal	1942	Normal
						inches						
January...	1.05	1.18	0.35	0.83	0.80	0.99	0.25	1.12	0.41	0.71	0.25	1.27
February..	0.00	1.99	0.00	1.41	0.00	1.97	0.95	1.64	2.25	1.51	1.00	1.96
March....	0.50	2.32	0.00	1.52	0.35	2.13	1.70	1.73	0.30	0.93	1.85	2.26
April.....	6.20	2.07	1.10	0.85	4.40	1.76	2.55	1.46	4.84	2.36	3.35	2.45
May.....	6.20	5.42	2.70	4.19	7.00	6.02	4.35	4.69	7.91	4.44	6.66	5.65
June.....	2.95	2.48	1.70	2.10	2.90	2.26	3.05	1.95	3.60	2.38	2.71	2.66
July.....	6.55	3.62	4.30	1.80	4.80	3.91	4.50	3.14	2.70	2.19	4.16	3.72
August....	6.70	5.65	2.45	4.01	4.70	5.39	3.55	4.11	0.98	3.66	6.55	5.09
September	2.30	6.55	3.20	4.31	2.80	6.30	4.35	6.08	6.11	4.48	2.49	6.68
October...	8.75	5.55	9.42	4.85	8.65	5.55	7.10	6.69	4.16	5.90	6.00	6.13
November.	4.80	6.01	1.95	3.22	4.30	5.54	5.15	4.08	5.67	4.21	7.00	5.83
December.	4.60	2.66	2.65	1.35	5.00	2.60	0.70	1.84	0.57	1.61	2.00	2.27
Total...	50.60	45.50	29.82	30.44	45.70	44.42	38.20	38.53	39.50	34.38	44.02	45.97

average rainfall for these stations are 45.50, 44.42, 38.53 and 34.38 inches, respectively (table 2).

Records show also that in this area there is a decreasing trend from north to south. For instance, the station of Costa, which lies closer to the coast line has an average rainfall of 30.44 inches.

Table 2 indicates also the monthly average precipitation for the area as a whole. The average yearly rainfall in the Lajas Valley is 45.97 inches. In tropical areas, where the temperature is high, the humidity low, and the rate of evaporation high, this amount of rainfall results in an arid to semi-arid climate.

Rainfall is not only scarce in the Southwest but is also poorly distributed. The general rainfall pattern is similar to that for the rest of the Island with a five months' dry season from December to April and a distinct rainy

period from May to November. Fortunately, this rainfall distribution, though not the amounts, conforms to the requirements of the major crops grown in the area, that is, sugar cane, cotton and corn.

The general rainfall pattern is the same for most stations in the area. There exists average rainfall in June and July, increasing in August, to a maximum in September or October, with a drop in November. The next five months from December to April constitute the dry season, and then a very decided peak occurs in May, almost reaching the rainfall of September and October.

There exist variations from year to year in the amount of precipitation, but in 1942, the year in which the farm management survey of the area was undertaken, the rainfall condition was approximately normal.

Economic Background

The presentation of the economic background of Southwestern Puerto Rico will be limited only to the discussion of marketing and industries in the area. Other economic aspects such as land tenure, credit and transportation facilities will be described separately in later sections of this thesis.

Marketing

To understand better the marketing activities carried on in this area it is better to look over the different agricultural products separately.

Sugar cane, as will be shown later, is by far the most important crop in the area. Sugar cane is transported from the field to the factory in ox-carts, trucks, or railways. Although the Guanica Central is the only sugar mill lying in the Lajas Valley proper, part of the crop is also sent to other nearby sugar mills.

The business relations between sugar cane growers and mills are usually governed by a grinding contract stating the terms under which the cane is ground. It should be added here that these contracts have to be made in accordance with certain legal stipulations established by insular laws and by the Agricultural Adjustment Administration. Perhaps the most important section of this contract is the one dealing with the method of payment. The farmer receives from 63 to 65% of the sugar produced, the percentage varying in accordance to the sucrose content of his cane.

The farmer may sell his sugar or may let the central do the marketing. The latter method is the most common. All the sugar produced in Puerto Rico is marketed to the United States. The central discounts all marketing expenses and liquidates the remaining part to the farmer.

The Puerto Rico Cotton Marketing Association was organized in 1935 for the purpose of assisting farmers to market their products. Any farmer

engaged in growing cotton may obtain membership and market his product through the Association. Up to 1941, this Association with headquarters in the Northwestern producing area handled all the cotton produced in the Island. Since 1942, cotton has also been marketed through a private dealer located in the southern producing area. The Cooperative Association, however, has continued handling most of the cotton crop, and the prices obtained by farmers through this agency have been always slightly higher.

Both of the above-mentioned firms maintain country warehouses scattered throughout the producing area. Cotton is transported to these warehouses by either ox-carts, trucks, or by railways. From the warehouses the produce is taken to the gins owned by the aforementioned concerns. All the lint cotton is finally exported to the United States.

The cotton cooperative establishes prices for the different grades of cotton delivered by the producers using the so-called arbitrary price differential method. From the gross sales of cotton and cotton seeds they deduct the administrative, ginning and marketing expenses plus a certain amount to build up reserves. The amount left is distributed to producers on the basis of prices arbitrarily fixed by the Cooperative for the different grades delivered. This method of determining the prices paid serves to stimulate growers to produce a larger proportion of high quality cotton. The second cotton dealer, although being a private concern, has followed very closely the price-fixing policy established by the Cooperative.

Other farm products produced in the area are sold by the farmers themselves, either directly to the consumers, to country dealers, or at the public markets especially at those located in the nearby towns. There are public market places in each one of the towns lying within and around the area, however, only those at Mayaguez, San German, Yauco and Ponce may be considered of importance. Very seldom, and only in the case of large producers, minor crops are taken to the distant market places of the Island.

Industries[5]

There are only a few industries of significance in Southwestern Puerto Rico that are not directly dependent upon agriculture. The needlework industry, the production of salt, the fishing industry, and the manufacture of clay products—pottery, tiles and bricks—are perhaps the most important, followed by charcoal and bark stripping for tanning production.

Salt Production. The southwestern part of the Island is, as stated before, an area of very low rainfall and extremely high rate of evaporation, thus conditions are especially good for the production of common salt from sea

[5] Data from report prepared by Mr. Donald F. Griffin, Planning Technician, National Resources Planning Board, San Juan, Puerto Rico.

water by natural evaporation in artificial ponds. There are already several salinas along the coast in response to these ideal conditions.

Southwestern Puerto Rico produces almost 30,000,000 pounds of salt per year. As yet there are no salt refining plants. The crude salt is merely ground locally and used for cooking and preserving. The relatively high price of imported refined salt puts it beyond the reach of the great number of low income consumers, who are forced to use crude salt.

A salt refining plant might be one of the projects to be carried out in the south coast area, which could supply refined salt to the Island. Furthermore, the Island could cover its own requirements of chlorine, caustic soda and hydrogen, which are obtained by the electrolytic decomposition of salt (sodium chloride). The present annual consumption on the Island of these products is about 2,000,000 pounds of salt, but the projected industrial developments in edible oils, soaps, and paper will, upon completion, probably increase this requirement to 3,000,000 pounds of salt. The development of plants for preserving and curing meats and fish would mean further consumption of salt.

This salt industry could be established more advantageously in this area since fuel and distribution facilities will be about the same at any other point of the Island while the basic raw material will be at hand. A thorough study by the Puerto Rico Development Company on conditions, and possibilities of these developments is very advisable.

Fishing. The most important fishing centers in southwestern Puerto Rico are Puerto Real, Boqueron, and Guanica, where probably 200 families rely on fishing for their living. The area is highly favored for the fishing industry because of the irregularity of the shore-line, the numerous spawning and feeding grounds, and the regularity of its adjacent sea bottom. An estimated 20,000 pounds of fish are landed weekly at the above-mentioned ports, but this quantity might be increased many fold if better boats, gear and up to date cold storage, refrigeration and warehousing facilities were available.

There is under consideration the organization of farmer-fisherman cooperatives which would create a central outlet for fish and also make arrangements for the sale of the catch. Substantial savings would be effected through centralized purchase of gear and supplies. Tracts of land of one half to one acre might be distributed to present or potential fishermen. Such real incentives to the fishermen would undoubtedly result in an increase of the catch; and a better system of handling and distribution of fish and fishery products would mean higher income and a better standard of living for fishermen. As in the case of salt production a thorough study on this industry should be also undertaken before embarking on a development program of this type.

Bark Stripping for Tannin Production. The species *Rhizophora* or Red Mangrove, most commonly used as a source of tannings, contains from 30 to 38 per cent of tannins of the catechol group. Several hundred acres of this species exist in southwestern Puerto Rico. The recent inauguration of a tanning industry in Puerto Rico resulted when, as a means of obtaining preservatives for fish lines and nets, the U. S. Fish and Wild Life Service at Mayaquez developed an economical method of extracting the tannins from the mangrove bark, which can compete favorably with imported tannin. This extract has been successfully tried out in the treatment of skins at tanneries located near Mayaguez and at Cataño. It has been reported that the skins treated compared favorably with those treated with quebracho extract imported from South America. As a result of this successful experiment, the Insular Forest Service made available 1500 acres of mangrove forest at Boqueron and La Parguera. Fifty men were put to work cutting trees and stripping 3000 pounds of bark per day, while the extraction plant employed three men. As three thousand pounds of bark will produce 1500 gallons of tannin extract, or enough to treat 3000 pounds of green hides, the equivalent of 1700 pounds of leather, and as Puerto Rico's total present requirement for locally tanned leather, averages 5,000 pounds per day, it is estimated that approximately 150 men could be permanently employed on tree cutting and bark stripping operations alone. Present requirements of the fishing industry are 6000 pounds of bark annually to preserve fishing lines and nets. Future requirements may increase to as high as 30,000 pounds per year.

Charcoal Production. Charcoal is used for fuel throughout the Island. Charcoal production will probably remain a subsidiary farming operation in spite of the fact that there are some mangrove forests and the Guanica forest belonging to the Insular Government in the southwestern part of Puerto Rico that might yield considerable wood for charcoal purposes. In general, however, wood suitable for charcoal purposes in this area does not exist in large quantities.

Other Industries. Quarries might be opened in the huge deposits of limestone in the Lajas area in order to produce limestone for commercial uses. Furthermore research is needed on this subject.

The livestock industry, if proved to be economically feasible in certain sections of the area, could certainly be improved by intensification along the line, from the better raising practices to the processing of the animals with the resulting by-product industries, such as the making of leather, glue and fertilizer.

The tourist industry is another possibility for development in the area. The region has many features such as dry climate, forests, beaches, fishing and scenic vistas which might be very attractive to tourists.

Information on other industries such as needlework, the manufacture of clay products—pottery, tiles and bricks—is not available and it is recommended that studies on these lines should be undertaken.

LAND CLASSIFICATION OF THE AREA

Introduction

The importance of efficient use of the land in an Island like Puerto Rico, with 546 persons per square mile, is evident. Studies on land utilization and land classification are basic to the intelligent guidance for more effective land use.

The lack of a systematic study of land use and land classification is acutely felt in Puerto Rico. On several occasions government officials and students of the Puerto Rican situation have ventured opinions on land use in the Island which have not been substantiated by facts. There is the danger that opinions of this nature may influence public action. Therefore, the need to provide scientific facts upon which to base public action is quite evident.

Land classification studies in the United States have been very fruitful of results. They have served as orientation of teaching and of extension and research programs in agricultural economics. It has been found that most farm managements recommendations made without regard to land classes are less valuable than studies where land classes are taken into consideration. Land classification studies provide an excellent background for the planning of public services to rural areas. Extension recommendations made on the basis of land classification have a much better chance of favorable reception by farmers. Land use and classification studies yield facts which are very relevant to natural resources conservation programs.

History of Land Utilization Studies in Puerto Rico

The Department of Agricultural Economics of the Agricultural Experiment Station of the University of Puerto Rico initiated its activities in the year 1934. As was reasonable to expect the first years were devoted almost entirely to the task of gathering and analyzing basic data on the economic problems of the agriculture of the Island. Therefore, the first studies made, in line with this objective, were mostly farm management and type of farming surveys of the major agricultural areas of Puerto Rico.

In the year 1940, the first study of land use was undertaken. The objectives of this project were to study the utilization of pasture lands from the standpoint of a well-rounded land use pattern and of its income and food producing potentialities. Surveys were initiated in two areas, namely, the Northwestern coast and the Tobacco region. Under this proj-

ect, detailed information was gathered on the use of the land by fields for a number of years and within the 1939–40 crop year. A total of 118 farms in the Northwestern section and of 196 farms in the Tobacco region were surveyed analyzed.

The results of the above-mentioned study proved to be very encouraging and valuable. Therefore, in 1941 the Department expanded the project with the final objective of classifying all the lands of Puerto Rico from the economic standpoint. Its general objective was to help to bring about necessary adjustments to increase the efficiency in the use of land. The municipality of Caguas was selected as the best area to start with, due to the fact that there existed a wide variation of physical and economic factors which were very valuable in arriving at the best system of land classification to follow in other areas. A complete land-cover map of the whole area was drawn. Unfortunately this project had to be postponed. The United States entered into World War II, and, complying with national directives, all the research work had to be oriented toward objectives most directly related to the war efforts. However, the land cover map made proved very valuable to the Puerto Rico Planning, Urbanizing and Zoning Board in the preparation of a master plan intended to determine the best location of communities to be established by the Land Authority of Puerto Rico under Title V of said program. It also proved very useful to the same agency in providing criteria to follow in the preparation of a map of existing and proposed roads of the Island.

In the year 1942, when the idea of working a coordinated action-plan aimed towards the fullest development of agricultural resources in Southwestern Puerto Rico was conceived by several governmental officials, one of the first points considered was the need of making an economic classification of the lands of said area. The information resulting was aimed to help in determining the possibilities for social and economic improvements of the area in regards to the establishment of an irrigation project, agricultural development, land tenure policies, industrialization and improvements of public services and facilities. It was decided that this phase of the study should be undertaken by the Agricultural Experiment Station of the University of Puerto Rico.

Objectives of the Economic Classification of the Lands of Southwestern Puerto Rico

The classification of the land on the basis of the intensity of use to which it is adapted is necessary before a desirable program of land use can be drafted. The general purpose of the economic study of land utilization in Southwestern Puerto Rico is to determine the location and extent of areas of land adapted to different degrees of intensity of use, and to suggest

plans for the development of the resources of the area. A further purpose of the study is to determine the relationship between the intensity of use to which different classes of land are adapted and various factors connected with the organization and operation of the farms of the area.

There are also certain specific objectives in mind. Land classification studies have been found very valuable in appraising lands for taxation and other purposes, in orienting credit and insurance agencies in their rural policies, in rural zoning and land use planning including such programs as resettlements, reforestation, recreation, reclamation and conservation projects, in guiding standards and costs of public services, and in orienting teaching, education and research in agriculture as a whole. All these objectives were kept in mind when undertaking the task of classifying the lands of Southwestern Puerto Rico.

Method of Procedure

Economic land classification involves both inductive and deductive analysis. The inductive process consists of the appraisal of relative success and failure of various types of land use which have been tried or which still exist in the areas being classified. The process is hampered by the fact that relative or absolute success of failure cannot be imputed solely to the type of land use practiced. Other factors, including size of farms, conditions of tenure, availability of operating capital, and efficiency of management are likely to be as strongly influential in determining success as is the type of land use. These obstacles, however, can be largely overcome through judicious and adequate sampling.

Farm survey records provide the best data obtainable not only because a record of actual land use may be reconstructed from them, but also because detailed analysis can be made of labor and capital, costs of production and financial returns. The outstanding merit of farm survey records lies in their exposition of the relationships of land, labor, and capital in actual operating farm organizations. Detailed farm survey records serve their highest usefulness when the sample is selected in such a manner as to provide a representative and adequate cross-section of the several land-types under investigation. The data thus developed are used in the evaluation of the specific land types.

The purely deductive type of reasoning is best exemplified by the budget approach. In practice, the deductive method usually starts with the land-type inventory and appraisal of climatic environment, assumptions as to the adaptability of various crops and livestock, and estimated yields and productions. Using predicted prices of farm products and calculating production cost (assuming reasonably good farm managment techniques) the analysis then proceeds through the farm-budget approach to construct

plans for hypothetically suitable farm units. Some weakness is inherent in this system in the extent to which the structure of logic rests upon assumptions which are not susceptible to ready verification, and to the disproportionate influence which minor variations in imputed production, cost or price exercise upon the net operating income or loss which is the final measure of farm success. Through the deductive approach, tentative hypotheses may be established with regard to the type of land use best adapted to the physical environment and within the existing or projected economic and social setting. These hypotheses are, however, subject to checking through comparison with the hypotheses arrived at through inductive analysis.

The inductive and deductive processes are similar in the respect that both start giving full consideration to the physical characteristics of the soils taking into account physiographic features such as variations in soils, climate, relief, stoniness and native vegetation. Furthermore, both are used in attempting to ascertain within the limits of agronomic adaptation the highest economic, social and technological conditions. The results arrived at by both methods ordinarily may be expected to be in rather close agreement. While each has its limitations, the greatest value lies in their complementary rather than separate use.

In classifying the lands of Southwestern Puerto Rico we followed mostly the inductive type of reasoning. It is true, however, that we were compelled to adapt our method of procedure to the limitations imposed by the special characteristics of the region as well as by the limited funds and time available to do the job.

We had at our disposal the following basic material with which to start the classification:

1. A soil survey map of the area which was prepared by the United States Department of Agriculture in cooperation with the University of Puerto Rico Agricultural Experiment Station, published in 1942.
2. A soil classes map of the area prepared by the Soil Conservation Service at San Juan, Puerto Rico in the year 1942. The soil types of the whole area were associated into eight different classes according to their use capabilities from the soil conservation point of view.
3. A Geological Survey topographic map of the area prepared by the United States Department of Interior.
4. A road map of the area prepared in the year 1942 by the Puerto Rico Planning and Urbanizing Board which includes primary and municipal roads either existing or proposed.
5. A map of land tenancy of the area prepared by the Puerto Rico Planning, Urbanizing and Zoning Board in the year 1943.
6. A total of 240 farms' management records taken in the area for the

crop year 1942–43. These farms were selected in such a manner as to provide a representative and adequate cross-section of the whole area. The survey was made in the year 1943 by the Department of Agricultural Economics of the Agricultural Experiment Station of the University of Puerto Rico. The results obtained from this farm management survey are presented in a later section of this study.

With this material on hand we had enough basis to start the economic land classification of the area. The only thing missing was a land-cover map. Using the topographic map as a base, a number of enumerators visited the area and a map showing the use of all the land was prepared. The scale of the topographic map used is such that 1 inch on the map equals 25,000 inches on the ground. Other maps available were converted to this same scale. A series of symbols were used in the map to represent the different land uses found as well as the farm buildings and other features such as irrigation pumps, electric lines, salinas, etc. This map was brought to the office where boundaries of the different land use areas were carefully drawn.

In determining the boundaries of the different economic land classes, the topographic map was first used. All the information on the road map prepared by the Puerto Rico Planning and Urbanizing Board was transferred to the topographic map Tentative land-class boundaries were traced on the topographic map by superimposing the information available on the soils association map prepared by the Soil Conservation Service, and that of the land-cover map prepared by the Department of Agricultural Economics. The roads information, the topographic map, the soils association map and the land-use map were found to be in general agreement. The lines around areas of different economic land classes were finally drawn on the map after harmonizing doubtful areas through sound judgment and best knowledge of the region.

The final map prepared was based primarily on intensity of land use. A total of eight different economic land classes were drawn and enumerated. The higher the number the less intensively the land was used. A copy of this map is presented at the back.

The different economic classes finally established were defined as follows:

R—Recreational and residential lands.

I—Level lands in intensive agricultural use and requiring no special conservation and/or drainage practices.

II—Level lands in intensive agricultural use but requiring special drainage and/or irrigation practices.

III—Lands in intensive agricultural use but with insufficient rainfall and/or rough topography therefore requiring irrigation and/or complex conservation practices.

IV—Level lands in extensive agricultural use with insufficient rainfall and/or drainage problems.

V—Rolling lands in extensive agricultural use with lack of rainfall and/or insufficient water retention.

VI—Lands in extensive agricultural use with insufficient rainfall and rough topography.

VII—Lands in extensive agricultural use but best suited for forestry and/or recreational purposes.

VIII—Lands out of agricultural use.

The final work done was the comparison of the different economic land classes with respect to various factors. For this purpose the 240 farms surveyed in the area were localized in the map and the land class predominating in each one was noted. It was found necessary, due to the small number of farms that fell in certain class groups, to establish the comparison by combining the farms falling in land class I and II, IV and V, and VI and VII. A very large number of farms fell in land class III; therefore, these farms were left alone as a single group. Thus, a total of four different groups were established for comparison. The relation of economic land class to size of business, land use, livestock, use of pasture land, irrigation, rates of production, labor efficiency, farm expenses, farm receipts, farm earnings, and to farm mortgage indebtedness and other factors, was established; and the results are presented in a later section of this thesis.

DESCRIPTION OF THE FARMS IN THE AREA

Objectives of the Farm Management Study

The study of the farm management aspect of the area was considered by the Lajas Valley Committee to be of paramount importance in providing basic information to legislators, administrators, students of our economic life, and others who may have to counsel or act in the determination of agricultural policies to be followed in the improvement of the area. The responsibility of undertaking this study was put in the hands of the personnel of the Department of Agricultural Economics of the Agricultural Experiment Station of the University of Puerto Rico.

This study is also intended to describe briefly the farms of the area with regard to their set-up, land tenure, cropping system, source of income, expenses, and returns for the operation and management of the farms. It is attempted to discover the reasons for variations in earnings and to show the relationship and influence of certain factors to the financial returns of the farms. This will not only increase the basic knowledge of our agriculture, but will also be of immediate practical value to farmers in adjusting farm operations, aiming towards higher profits.

Method of Procedure

The Agricultural Extension Service and the Land Authority of Puerto Rico cooperated in gathering the field information on which this study is based. The survey method was used. Enumerators visited the farms and asked specific questions to cooperating farmers concerning their farm business for the year 1942–43, and the answers were recorded on a specially prepared form. The information given by the farmers operating larger farms was usually from account books. For smaller farmers the answers given were mostly from memory.

The sample surveyed was elected at random, thus resulting in a representative cross section of the Lajas Valley area.

TABLE 3. DISTRIBUTION OF FARMS AND CUERDAS STUDIED BY MUNICIPALITIES

240 farms, Southwestern Puerto Rico, 1942–43

Municipality	Number of farms	Per cent of total	Cuerdas		
			Total	Per farm	Per cent of total
Lajas	137	57	18,112	132	50
Cabo Rojo	66	28	7,436	113	20
Guanica	16	7	9,247	578	25
Yauco	12	5	807	67	2
Sabana Grande	9	3	1,023	114	3
Total	240	100	36,625	153	100

A total of around 260 farmers were visited in the municipalities of Cabo Rojo, Guanica, Lajas, Sabana Grande and Yauco. When the enumerators returned from the field, each record was carefully checked and if any items were found missing, another visit was made. These records were rechecked in the office and each one was carefully analysed. Records considered to be not representative nor sufficiently accurate were eliminated. A total of 240 records were finally selected for the study.

The Farms and the Farmers

Distribution of Farms and Cuerdas Studied

The 240 farms studied, comprising a total of 36,625 cuerdas, were scattered over the five municipalities of the Lajas Valley; namely, Lajas, Guanica, the southern part of Cabo Rojo, the eastern part of Yauco and the southern section of Sabana Grande (table 3).

Fifty seven per cent of the farms, with one-half of the cuerdas studied, were located in the municipality of Lajas. Cabo Rojo ranked second as

to number of farms studied with a total of 28 per cent. However, it included only one-fifth of the total acreage as compared to Guanica which, with only 7 per cent of the farms, comprised one-fourth of the acreage studied. This shows definitely that the concentration of land is greater in Guanica. As a matter of fact, the sugar cane farms belonging to the Guanica Sugar Mill which lie within the area were included in this survey. As a result, the farms located in Guanica were the largest in size and averaged 578 cuerdas as compared to 153, which is the average size of the farms studied.

Only small sections of the municipalities of Yauco and Sabana Grande lie within the Lajas Valley area. The acreage studied in these municipalities amounted only to 5 per cent of the total. It is interesting, however, to observe the fact that the smallest farms studied, on the average, were located in Yauco.

TABLE 4. LOCATION OF FARMS IN RELATION TO ROADS

240 farms, Southwestern Puerto Rico, 1942–43

Distance to paved road	Number of farms	Per cent of total
Less than 1.0 km.	139	58
1.0–1.9	55	23
2.0–2.9	21	9
3.0–3.9	16	6
4.0 and over	9	4
Total	240	100

Location of Farms in Relation to Roads

Transportation facilities exert a considerable influence on the farm business, economic relations, and social attitudes of growers. This factor is especially important in dealing with sugar cane farms because of the fact that sugar cane is a bulky product which needs cheap transportation from the field to the factory. In Southwestern Puerto Rico, which as will be shown later in this report is principally a sugar cane region, good transportation is, therefore, of great significance.

There are very good transportation facilities in Southwestern Puerto Rico. The majority of the farms studied are located on, or very near, good roads usually macadamized. As shown in table 4, 58 per cent of the farms studied are located at a distance of less than one kilometer to a paved road. Around one fourth of the farms are at a distance of from one to 1.9 kilometers and only 4 per cent are located 4 kilometers or farther from the nearest paved road.

Several important insular highways run across the area and many other

gravel or dirt roads are also found. These, however, do not supply the entire needs for roads and thus, some of the farms in the area are located off the roads. The Insular Government very wisely has recognized this situation and is planning new constructions in the area and the improvement of several existing roads.

Land Tenure

In Southwestern Puerto Rico as well as in the other important sugar cane areas of the Island, a great number of the farms are not solely owned by the operators. Some are totally owned, others are totally cash rented, and others are completely sharecropped or managed. It is also very frequent to find cases in which a combination of two or more of these differ-

TABLE 5. LAND TENURE BY SIZE OF FARM

240 farms, Southwestern Puerto Rico, 1942–43

Size groups	Number of farms	Per cent cuerdas				
		Owned	Cash rented	Share-cropped	Managed	Total
Less than 20.0 cuerdas	82	81	10	—	9	100
20.0–39.9	41	68	10	2	20	100
40.0–59.9	28	79	6	2	13	100
60.0–99.9	25	59	6	—	35	100
100.0–149.9	21	62	24	—	14	100
150.0–249.9	17	83	6	—	11	100
250.0–499.9	13	79	17	—	4	100
500.0–999.9	7	68	32	—	—	100
1000.0 and over	6	46	18	—	36	100
Total	240	60	17	*	23	100

* Less than one per cent.

ent types of tenure is found on a single farm. For this reason the author believes that the land tenure pattern of the area can be better described by classifying the acreage instead of the farms studied.

A total of three-fifths of the acreage studied was reported to be owned by the operators, 17 per cent was cash rented and the remaining 23 per cent was managed (table 5). Sharecropping as a type of tenure in the Lajas Valley area is of very little importance.

No direct relationship was found between type of tenure and size of farm as measured by total acreage. However, a little over four-fifths of the acreage in the farms reporting less than 20 cuerdas in total was owned by the operators, as compared to 46 per cent which is the case in the largest land-holdings of 1000 cuerdas or more. In other words, there seems to be a tendency for big land-holders to own less land, in proportion, than small

farm operators. Apparently they have found very effective to increase the size of their farm business through renting of additional lands or by operating them under management.

Topography of Land

Nearly two-thirds of the land studied is of a level topography (table 6). The remaining one-third was classified by the enumerators as broken.

The proportion of level land was found to increase with increases in the size of the farm. Evidently, big land-holders in this area as well as in Puerto Rico as a whole, have not only been able to concentrate big extensions of land, but have also succeeded in controlling the most fertile level lands of the valleys.

TABLE 6. TOPOGRAPHY OF LAND BY SIZE OF FARMS
240 farms, Southwestern Puerto Rico, 1942–43

Size groups	Number of farms	Total cuerdas in farm	Per cent cuerdas	
			Level	Broken
Less than 20.0 cuerdas	82	911	45	55
20.0– 39.9	41	1,100	47	53
40.0– 59.9	28	1,381	54	46
60.0– 99.9	25	1,893	61	39
100.0–149.9	21	2,526	58	42
150.0–249.9	17	3,148	50	50
250.0–499.9	13	4,094	64	36
500.0–999.9	7	3,909	81	19
1000.0 and over	6	17,663	70	30
Total	240	36,625	65	35

Soil Types

One of the striking characteristics of the soils of Puerto Rico is the wide number of soil types existing. For instance, in spite of the fact that the area under study is a relatively small one, a total of seventy different soil types were reported in the farms studied. This wide variation of soils is not only present in Puerto Rico and in this region as a whole, but also in each individual farm.

Out of the 70 different soil types reported, only 13 amounted to more than 500 cuerdas (table 7). Among them, in order of importance, as measured by acreage, are the Fraternidad, Aguirre and Jacana clays which amounted to 16, 15 and 10 per cent, respectively, of the total acreage studied. Although there were many other soil types present, none of them amounted to more than 6 per cent of the total acreage.

The farms studied were located on topographic and soil maps. It was

possible, in this way, to arrive at the productivity rating of the different soil types. The productivity rating is a numerical expression of the capacity of production of soils ranging from 1 for the most productive soil to 10 for the least productive. According to this rating, the most productive soil type reported is the Santa Isabel clay; but it amounts to only 4 per cent of the total acreage studied. The Fraternidad and Aguirre clays, which are the most important from the point of view of acreage, ranked second in productivity. In general, the soils of the Lajas Valley Area can be described as of a medium to high productivity.

TABLE 7. SOIL TYPES

240 farms, Southwestern Puerto Rico, 1942–43

Soil type	Number of cuerdas	Per cent of total	Productivity rating
Fraternidad clay	5,760	16	2
Aguirre clay	5,516	15	2
Jacana clay	3,814	10	8
San German clay	2,202	6	10
Caguas clay	2,111	6	5
Aguilita stony clay	1,583	4	10
Santa Isabel clay	1,361	4	1
Aguilita clay	1,340	4	10
Amelia clay	883	2	5
Mucara silty clay loam	867	2	7
Lajas clay	636	2	10
Descalabrado silty clay rolling phase	600	2	10
Lajas clay, rolling phase	512	1	10
Other*	9,440	26	—
Total	36,625	100	—

* Includes 57 soil types ranging from 5 to 485 cuerdas.

Farm Population

A total of 72 per cent of the farms studied reported population living on the farm (table 8). In general, a smaller per cent of the larger farms reported farm population. This fact points out again the problem existing in Puerto Rico relative to the squatters or "agregados." The big landholders usually live in nearby towns. They are also very reluctant to allow agricultural workers to live on their farms.

The average operator's family consisted of 5.2 members for all farms and of 7.2 members for the farms reporting. Its average size was found to be larger for those families living on small farms. This corroborated once more the well known fact that the larger families are found among the

people of lower incomes and, consequently, of lower standards of living. Southwestern Puerto Rico is no exception.

There are other families living on the farm which are mostly "agregados", and relatives of the operator in the case of the smaller farms; or agricultural workers in the case of the larger holdings.

As is natural to expect, the larger farms supported a larger population, although the burden is very probably heavier for the smaller ones. The total farm population on the average amounted to 24 persons per farm.

TABLE 8. FARM POPULATION BY SIZE OF FARMS

240 farms, Southwestern Puerto Rico, 1942–43

Size groups	Total number of farms	Operator's farm family			Other farm population (all farm)	Total farm population
		Per cent of farms reporting*	Number of persons			
			Farms reporting	All farms		
					average per farm	
Less than						
20.0 cuerdas	82	89	6.8	6.1	6.0	12.1
20.0– 39.9	41	71	7.2	5.1	5.2	10.3
40.0– 59.9	28	86	7.7	6.6	9.6	16.2
60.0– 99.9	25	68	6.7	4.6	20.0	24.6
100.0–149.9	21	48	7.9	3.8	16.7	20.5
150.0–249.9	17	59	11.1	6.5	20.3	26.8
250.0–499.9	13	31	4.5	1.4	20.5	21.9
500.0–999.9	7	71	5.6	4.0	57.7	61.7
1000.0 and over	6	16	10.0	1.7	258.7	260.4
All farms	240	72	7.2	5.2	18.3	23.5

* Families living at the farm part of the year only were not included.

Age of Operators

The age of the 240 operators ranged from 24 to 85 years. Only 3% were under 30 years of age (table 9). The largest age group, 78 persons or 33 per cent of the total, was from 40 to 49 years of age. The second most important group, 54 heads or 23 per cent of the total were from 50 to 59 years old. This age distribution is about normal and compares favorably with that of other regions in the Island.

Education of Operators

The importance of the level of education of the farmers' group has been emphasized in previous social and agricultural economic publications. Poorly educated farmers are handicapped in understanding the economic factors affecting earnings and are at a disadvantage in handling a farm effec-

tively in these days of commercialized agriculture and strong competition. Another no less important influence of the lack of education is that poorly educated farmers are unable to adjust their farming operations in line with the technical progress. Undereducated farmers, furthermore, are very suspicious and reluctant of papers, signature, figures, government employees, technicians, etc., and tend to prefer the simplest and most informal ways of running a farm. This constitutes a heavy burden and a drawback to

TABLE 9. AGE OF OPERATORS

240 farms, Southwestern Puerto Rico, 1942–43

Age group	Number	Per cent of total
Less than 30 years	8	3
30–39	44	18
40–49	78	33
50–59	54	23
60–69	43	18
70 and over	13	5
Total	240	100

TABLE 10. EDUCATION OF OPERATORS

240 farms, Southwestern Puerto Rico, 1942–43

Educational status	Number	Per cent of total
Not reporting	24	10
No schooling	27	11
Schooling:		
1–4 years	77*	32
5–8 years	72	30
High school	26	11
College or Universtiy	14	6
Total	240	100

* Includes those reporting knowing only how to read and write.

their own business. Agriculture is a dynamic industry and farmers need to be educated and trained enought to keep pace with changing times.

The fact that 11 per cent of the farmers studied did not know how to read and write and that 32 per cent had less than 5 years of schooling is an indication of the tremendous educational job that is ahead (table 10). Only 11 per cent of the operators reported highschool education and the small number of 6 per cent had college or university training. The relative lack of education on the part of farmers is something that should be kept in mind when delineating any development program for the area.

Farming Experience of Operators

The framing experience of the operators of the farms studied can be described as very long, as shown on table 11.

Only 15 per cent of the total reported less than 10 years of experience and nearly two thirds have 20 or more years.

TABLE 11. FARMING EXPERIENCE OF OPERATORS

240 farms, Southwestern Puerto Rico, 1942–43

Years farming	Number	Per cent of total
Less than 10 years	36	15
10–19	48	20
20–29	50	21
30–39	45	19
40–49	35	14
50 and over	26	11
Total	240	100

Organization of the Farms Studied

Invested Capital

The average total investment per farm for the year of the study was $25,675 (table 12). Of this, 82 per cent was invested in real estate, 8 per cent in livestock, and 7 per cent in machinery. The average per farm for these three items was $12,109, $2,147 and $1,803 respectively.

The most important single item of investment was land, which accounted for 76 per cent of the total and averaged $19,504 per farm.

In order of importance come livestock, machinery, and farm buildings. The latter, of which the operator's house was the most important, amounts on the average to 5 per cent of the total or $1,354 per farm.

Equipment made 2 per cent of the investments with an average of $599 per farm. Supplies and other investments represented insignificant items and reached only to $17 per farm.

Machinery and Equipment

The average value of machinery and equipment per farm amounted to $2,402 (table 13). Machinery made three fourths of this value.

Although only 13 farms reported investments in irrigation equipment, this item alone accounted for more than one half of the total value of machinery and equipment. Irrigation equipment is very expensive and though badly needed in the area, it can only be afforded by the very rich land-holders. The same thing happens with the trucks and tractors. Only

very few large farmers reported them but their value per farm amounted to about one fifth of the total.

The value of dairy equipment constituted a very small part of the total. Other miscellaneous items made practically all of the total equipment. The majority of the farmers investigated reported having other equipment which consisted mainly of ox carts, plows, harrows, harness, chains and other miscellaneous tools such as hoes and "machetes". Ox carts are very

TABLE 12. INVESTED CAPITAL
240 farms, Southwestern Puerto Rico, 1942-43

	Per cent of total farms reporting	Average value per farm (all farms)	Per cent of total value
Operator's house	77.9	559	2.2
Dairy barns	19.6	53	0.2
Milk house	7.9	11	0.1
Equipment sheds	18.3	31	0.1
Houses for "agregados"	70.8	262	1.0
Other buildings	36.2	438	1.7
Total buildings		1,354	5.3
Aqueduct and watering places	50.8	251	1.0
Land	100.0	19,504	75.9
Total real estate		21,109	82.2
Livestock	94.6	2,147	8.4
Machinery	26.7	1,803	7.0
Equipment	88.3	599	2.3
Supplies	11.7	11	0.1
Other	0.1	6	*
Total		25,675	100.0

* Less than 0.1 per cent.

essential for the transportation of sugar cane from the field to railroad lines or to the places where it is picked up by trucks.

Use of the Land

Of the total acreage of the farms studied, 135 cuerdas, or 89 per cent, were classified as arable (table 14). The net area under cultivation amounted to a total of 62 cuerdas per farm, representing 40 per cent of the total land area.

The area in pasture, including aftermath, seeded pasture, clear per-

TABLE 13. INVESTMENT IN MACHINERY AND EQUIPMENT
240 farms, Southwestern Puerto Rico, 1942–43

Item	Farms reporting	Total Investment: Per farm reporting	Total Investment: All farms: Amount	Total Investment: All farms: Per cent of total
		$	$	
Machinery				
Trucks	14	2,001	117	4.9
Tractors	16	4,962	331	13.8
Irrigation equipment	13	23,602	1,278	53.2
Other*			77	3.2
Total			1,803	75.1
Equipment				
Dairy	51	56	12	0.5
Other	211	667	587	24.4
Total			599	24.9
Grand total			2,402	100.0

* Automobiles not included.

TABLE 14. USE OF THE LAND
240 farms, Southwestern Puerto Rico, 1942–43

Item	Cuerdas per farm	Per cent of total	Net cuerdas per farm (year basis)	Per cent of total
Total area cropped	74		56	
Minus:				
Intercropped	10		4	
Doublecropped	2			
Net area cropped	62	40	52	34
Aftermath			6	4
Seeded pasture	11	8	12	8
Clear permanent pasture	56	36	58	38
Wooded pasture	11	8	12	8
Woodland	3	2	3	2
Waste land	5	3	5	3
Buildings, roads and fences	5	3	5	3
Total	153	100	153	100
Area of arable land	135	89		

manent pasture and wooded pasture, amounted to 78 cuerdas per farm. This was 52 per cent of the total. Clear permanent pasture alone oc-

cupied an average of 56 cuerdas and represented 36 per cent of the total farm area. The rest of the land was in woods, waste, buildings, roads and fences.

The continuous growing season which is typical of the tropics makes possible in Puerto Rico the utilization of the same area of cropland for more than one crop during the year. In Southwestern Puerto Rico, in spite of the fact that there is a relatively long dry season and that the major enterprise is sugar cane which is a year crop, intercropping and

TABLE 15. DISTRIBUTION OF AVAILABLE PASTURE
240 farms, Southwestern Puerto Rico, 1942–43

Item	Farms reporting	Average per farm	Per cen of total
		cuerdas	
Harvested pasture			
Intercropped, net equivalent	1	*	—
Alone	27	0.2	0.2
Total		0.2	0.2
Seeded pasture			
Intercropped, net equivalent	1	†	—
Alone	78	12.5	15.6
Total		12.5	15.6
Permanent pasture			
Intercropped, net equivalent†	12	0.7	0.8
Aftermath, net equivalent	206	2.9	3.7
Wooded pasture, net equivalent	82	5.8	7.2
Alone	195	58.1	72.5
Total		67.5	84.2
Total available pasture	231	80.2	100.0
Area pastured per animal unit‡		2.9	

* Less than 0.05 cuerdas.

† In cocoanut groves.

‡ An average of 27.4 animal units per farm were pastured.

doublecropping are practiced to some extent. The land which has been used for cotton or tobacco is usually planted immediately after it has been harvested to other minor crops such as corn, sweet potatoes, beans, etc. Also combinations of crops are generally planted together. A very common practice is to intercrop corn and beans and corn or beans in tobacco, cotton, or sugar cane. The extent to which these farming practices were carried on in the farms studied is shown in table 14, with 10 and 2 cuerdas of intercropped and doublecropped land respectively.

Because of the fact that intercropping and doublecropping practices

are followed and that the use of the same cuerda of land may change during the year, we attempted in table 14 to describe the use of the land on a net year basis. For instance, a cuerda of land which was in corn six months and the rest of the year studied was left as aftermath was counted as one half net cuerda in crop and one half cuerda in aftermath. The same procedure was followed with the different plots of land in each farm. The following were the results obtained:

The net area cropped was only 52 cuerdas per farm, constituting 34 per cent of the total. It represented a reduction of 10 cuerdas per farm as compared to the net area under cultivation as calculated by the previous general method. The ten cuerdas, on the average, were distributed as follows: 6 were left as aftermath; two were whifted to clear permanent pasture; one was abandoned as wooded pasture and the remaining one was planted in seeded pasture. This means that part of the land in crops was shifted to other uses within the year studied. The importance of this fact is of special interest when estimating the total available pasture during the year so as to arrive at a more exact figure on the carrying capacity of pastures (table 15).

Distribution of Available Pasture

The average acreage of available pasture per farm studied amounted to 80.2 cuerdas (table 15).

The term available pasture is used to mean all the pasture available on the farm including harvested, seeded, and permanent pasture. The acreage is expressed on a net year basis. In the case of intercropped pasture (whether harvested, seeded or permanent) as well as in the aftermath, the total net-year-acreage available was given half weight in calculating the total available pasture for the farm. In other words, two year-acres of intercropped pasture or of aftermath were considered to be equivalent to one net acre of available pasture. The net equivalent available wooded pasture was calculated in the same way with the only difference that its equivalence was asked of the farmers themselves. It was done in this way because the condition of the wooded pastures as to its usefulness for grazing livestock is something that varies considerably on each farm.

Permanent pasture constituted 84 per cent of the total available pasture. Seeded pasture ranked second in acreage with a total of 16 per cent. The amount of harvested pasture present was practically insignificant. We mean by seeded pasture that which is seeded, cultivated and grazed but never harvested; so as to differentiate it from the harvested pasture, which is seeded, cultivated, and harvested, but never grazed.

As will be shown later in table 19, an average net total of 27.4 animal

units were pastured per farm studied. Therefore, the carrying capacity of the available pasture amounted on the average to 2.9 acres per unit. This figure compares favorably with studies made in other areas of the Island.

Crops Grown

A wide variety of crops were grown in these farms in 1942–43 (table 16). Sugar cane was the crop with the largest acreage. An average of 42 cuerdas were grown which accounted for nearly six tenths of the total

TABLE 16. CROPS GROWN

240 farms, Southwestern Puerto Rico, 1942–43

Crop	Cuerdas grown per farm				Per cent of total
	Net	Inter-cropped	Double-cropped	Total	
Sugar cane	41.8	0.5	*	42.2	57.4
Corn	8.6	0.8	3.0	12.4	17.0
Cotton	4.9	*	—	5.0	6.8
Cowpeas	0.7	0.1	3.2	4.0	5.5
Dry beans	0.8	0.1	0.6	1.5	2.0
Cocoanuts	1.4	—	—	1.4	1.9
Pigeon peas	0.8	0.3	0.2	1.3	1.8
Sweet potatoes	0.7	0.1	0.2	1.0	1.4
Tobacco	0.3	0.1	—	0.4	0.5
Cassava	0.3	0.1	*	0.4	0.5
Pineapples	0.2	—	—	0.2	0.2
Harvested pasture	0.2	*	*	0.2	0.2
Other	0.9	0.1	2.5	3.5	4.8
Total	61.6	2.2	9.7	73.5	100.0
Harvested	56.1	0.9	8.0	65.0	88.5

* Less than 0.1 cuerda.

acreage in crops. Following sugar cane in importance, as measured by acreage planted, is corn with an average of 12 acres which represent a little less than one-fifth of the total. Cotton and cowpeas were next, averaging 7 and 6 per cent respectively. Other crops grown were dry beans, cocoanuts, pigeon peas, sweet potatoes, tobacco, cassava, pineapples and harvested pastures. None of these crops amounted on the average to more than 2 cuerdas per farm.

A total of 74 cuerdas of crops were grown per farm, out of which 65 cuerdas or 88 per cent of the total were harvested during 1942–43. An average of 56 cuerdas out of the 65 harvested were net, and only 8 cuerdas were intercropped. Double crops were of minor importance.

To summarize the crops grown on the farms studied during 1942–43, table 17 has been prepared.

An average of 74 cuerdas in crops per farm were grown. Of this 65 cuerdas or 88 per cent of the total were harvested. The remaining 9 cuerdas or 12 per cent were crops standing or crop losses. Inter and double-cropping practices were followed but to a lesser extent. Of the two practices, that of intercropping is more common as indicated by the fact

TABLE 17. SUMMARY OF CROPS GROWN
240 farms, Southwestern Puerto Rico, 1942–43

Item	Average per farm	Per cent of total
	cuerdas	
Area harvested		
Net	56	76
Doublecropped	1	1
Intercropped	8	11
Total	65	88
Standing crops and others*		
Net	6	8
Doublecropped	1	2
Intercropped	2	2
Total	9	12
Totals:		
Net	62	84
Doublecropped	2	3
Intercropped	10	13
Total area in crops	74	100

* Included 2 cuerdas of crop losses.

that 13 per cent of the total crops grown on each farm, on the average, were intercropped. On the other hand, only 3 per cent were doublecropped.

Crop Yields

The yields of crops grown on these farms were relatively satisfactory for most of the crops, if compared with the production per cuerda of the same crops in Puerto Rico as a whole. Yet, most of these yields, especially those of the minor crops, are much lower than those obtained on farms previously studied in other sections of the Island. These relatively lower yields may be partly explained because of the fact that the year of the

study, 1942–43, was a war year and the amount of fertilizer applied was necessarily reduced to war-time restrictions. Furthermore, it should be remembered that the area under study is one of the driest sections of the Island (table 18).

Sugar cane yields averaged 23.4 tons of cane and 2.99 tons of sugar per cuerda. The sucrose content, though not the tonnage, compares favorably with other areas.

The yields per cuerda of corn, 7.25 cwt., was relatively good, though much lower than those obtained in experimental trials.

Cotton yields, 4.52 cwt. per cuerda, were lower on the average, than those obtained by the Northwestern growers.

TABLE 18. CROP YIELDS

240 farms, Southwestern Puerto Rico, 1942–43

Crop	Unit	Yield per cuerda		
		Alone	Inter-cropped	Total
Sugar cane	Tons-cane	23.40	—	23.40
Sugar cane	Tons-sugar	2.99	—	2.99
Corn	Cwt.	7.96	4.94	7.25
Cotton	Cwt.	4.52	—	4.52
Cowpeas	Cwt.	1.95	0.88	1.11
Dry beans	Cwt.	1.58	1.02	1.36
Cocoanuts	Thousands	0.97	—	0.97
Pigeon peas	Cwt.	3.17	2.00	3.01
Sweet potatoes	Cwt.	19.42	11.06	18.03
Tobacco	Cwt.	4.08	—	4.08
Cassava	Cwt.	23.40	36.86	24.47
Pineapples	Cwt.	132.55	—	132.55

Tobacco produced 4.08 cwt. per cuerda, which is far lower than the yields obtained in the tobacco area. The type of tobacco grown should be taken into consideration in measuring the significance of yields. In this area, the tobacco grown is mostly for chewing purposes, which is necessarily a lower yielder.

Pineapples produced 132.6 cwt. per cuerda. This relatively good yield may be partly accounted for by the fact that the soil where this crop is grown in the area is very well adapted.

Cocoanuts produced around one thousand nuts per cuerda. This yield is unsatisfactory as compared to the yields obtained in other cocoanut area of the Island.

The yields of the other crops grown, such as pigeon peas, cowpeas, sweet potatoes, dry beans, cassava and others are likewise considered unsatisfactory.

No comparison is here made with normal yields in the area because reliable information was not available.

Livestock

The average number per farm of the most important animals kept on the farms studied is shown in table 19. Averages were rounded up to the nearest figure.

TABLE 19. AVERAGE NUMBER PER FARM OF THE MOST IMPORTANT ANIMALS

240 farms, Southwestern Puerto Rico, 1942–43

Type	Average number (all farms
Cows	11
Heifers	4
Calves	7
Bulls	1
Oxen	7
Horses	1
Mares	1
Goats	1
Sows	1
Small pigs	1
Hens and roosters	19
Chickens	15
Turkeys	1

The farms studied reported having, on the average, a total of 11 cows, 4 heifers, 7 calves and 1 bull. The workstock kept was mostly oxen which amounted to an average of 7 per farm. In addition, each farm had one horse and one mare. Most of the farmers kept goats but, on the average, only one goat was reported per farm. The greatest majority of the farmers reported having also swine and poultry livestock. On the average, each farm had one sow, one small pig, 19 hens, 15 chickens and one turkey.

In terms of animals units,[6] dairy cattle was the most important group of livestock on the farms studied. It averaged 18.1 units per farm and accounted for about two-thirds of the total units of livestock present (table 20).

[6] A measure of the average number of animals kept on a farm during a year, based on the amount of feed consumed and value of manure produced. A mature cow, 1 bull, 1 ox, 1 horse or mare, 1 mule, 2 head of young stock, 5 sows or hogs or 10 pigs, 7 goats or sheep. 50 turkeys, 100 hens or roosters and 300 chickens are each considered as one animal unit.

TABLE 20. UNITS AND VALUE OF LIVESTOCK, BY TYPES
240 farms, Southwestern Puerto Rico, 1942–43

Type	Animal Units		Value		
	Per farm	Per cent of total	Per head	Per farm	Per cent of total
			$	$	
Dairy livestock					
Cows	10.91*	—	84	919	42.8
Heifers	2.07	—	38	159	7.4
Calves	3.57	—	12	86	4.0
Sires	0.37	—	125	47	2.2
Bulls	1.19	—	35	83	3.9
Total	18.11	64.7		1,294	60.3
Work-stock					
Oxen	7.39†	—	95	677	31.5
Horses	0.55	—	66	37	1.7
Mares	0.67	—	44	30	1.4
Colts	0.07	—	26	4	0.2
Mules	0.40	—	114	45	2.1
Total	9.08	32.5		793	36.9
Goats and sheep	0.16	0.6	6	6	0.3
Total grazing livestock	27.35	97.8		2.093	97.5
Poultry livestock					
Hens and roosters	0.19	—	1	22	1.1
Chickens	0.05	—	‡	7	0.3
Turkeys	0.02	—	3	3	0.1
Total	0.26	0.9		32	1.5
Swine					
Sows and boars	0.22	—	13	15	0.7
Pigs	0.11	—	4	4	0.2
Total	0.33	1.2		19	0.9
Other	0.03	0.1		3	0.1
Grand total	27.97	100.0		2,147	100.0

* Includes 0.03 year-average cow-units pastured temporarily on the farm, but not considered for the investment in cows.

† Includes 0.24 year-average oxen-units pastured temporarily on the farm, but not considered for the investment in oxes.

‡ Less than $0.50.

Workstock was second in importance and averaged practically the remaining third of the total. Oxen are the most important kind of draft animal on these farms. They are used for plowing and fitting the fields but mostly for hauling the sugar cane out of the farm. Goats and sheep are other grazing animals found on a large number of farms but its relative importance is very insignificant. The total grazing livestock averaged 27.4 animal units per farm of 98 per cent of the total. It practically made all of the livestock present. Swine, like poultry and other kinds of livestock were of minor importance and altogether did not amount to one animal unit per farm. Each farm reported having, on the average, a total of 28 animal units.

The average value per farm of all the livestock on the farms studied amounted to $2,147. Dairy cattle, of which cows were the most important, made three fifths of the total investment. Dairy cows alone accounted for 43 per cent. Practically the remaining two fifths of the total value was represented by the workstock present. The average value of oxen, which is the most important kind of animal power, comprised almost one third of the total value. Measured also in terms of investment, other livestock present on the farms was considered to be rather insignificant.

The quality of livestock on the farms studied in Southwestern Puerto Rico is not very satisfactory as may be seen by the average value per head of stock. For instance, the average value of dairy cows was $84 per head which undoubtedly is by far below the value of a good dairy cow in Puerto Rico. Even oxen rate very low if compared with the workstock of the big cane plantations. In conclusion, very few of the dairy animals are purebred. Very little selection or improvement has been practiced or attempted. Pastures are poor and feeding is deficient. These facts suggest that some effort should be directed along the line of selection and management to improve the quality of actual stock and increase its productive capacity.

Expenses and Receipts

Farm Cash Expenses. The total general farm cash expenses averaged $4,540 per farm. Hired labor accounted for $3,166, machinery and equipment for $371, fertilizer and insecticides for $306, taxes for $297, livestock feed for $46, building and building repairs for $31, rented pasture for $8, and other miscellaneous expenses for the remaining $315 (table 21).

Labor was the outstanding item of expense on these farms. It accounted for seven-tenths of the total farm cash expenses. An average of $2,595 per farm was spent in hired day labor alone, which represented 57 per cent of the general farm cash expenses. Only 18 per cent of the farmers reported expenses on manager or overseer with an average of $221 for all the

TABLE 21. FARM CASH EXPENSES

240 farms, Southwestern Puerto Rico, 1942–43

Item	Per cent of all farms reporting	Average per farm (all farms)	Per cent of total
		$	
Hired labor			
Daily labor, total*	97	2,595	57.2
Manager or overseer	18	221	4.9
Weekly labor†	31	185	4.1
Labor insurance	58	154	3.3
Board	13	11	0.2
Total		3,166	69.7
Machinery and equipment			
Irrigation pumps, operation	5	114	2.5
Trucks:			
purchases	1	12	0.2
operation	7	62	1.4
Tractors:			
purchases	2	19	0.4
operation	7	49	1.1
Milk wagons:			
purchases	1	5	0.1
operation	7	23	0.5
Auto: farm share	15	26	0.6
Equipment:			
purchases	35	19	0.4
repairs	53	42	1.0
Total		371	8.2
Fertilizer and insecticides			
Fertilizer:			
sugar cane	59	295	6.5
other crops	5	4	0.1
Insecticides	35	7	0.1
Total		306	6.7
Taxes	90	297	6.5
Livestock feed:			
concentrates	21	39	0.9
other	9	7	0.2
Total		46	1.1

TABLE 21—*Continued*

Item	Per cent of all farms reporting	Average per farm (all farms)	Per cent of total
		$	
Buildings:			
new	2	10	0.2
repairs	15	21	0.5
Total		31	0.7
Rented pasture	10	8	0.2
Other expenses			
Equipment hired	72	183	4.0
Work animals hired	47	48	1.0
Fences:			
new	5	4	0.1
repairs	65	26	0.6
Seed purchased:			
sugar cane	8	6	0.1
other	45	9	0.2
Milking materials	8	8	0.2
Ropes and twine	78	6	0.1
Marketing farm produce	25	5	0.1
Drugs and disinfectants	45	4	0.1
Horse and ox shoeing	37	4	0.1
Other	31	12	0.3
Total		315	6.9
Grand total		4,540	100.0

* The average total number of wages per farm reporting amounted to $2,213, out of which $1,605 were for sugar cane.

† The average total number of weeks per farm reporting amounted to 152, out of which 60 were for sugar cane.

farms, constituting around 5 per cent of the farm cash expenses. Only the larger farms can afford to incur this expense. Thirty-one per cent of the farmers reported weekly labor. This item of expense amounted to $185 on the average for all farms and made a little over 4 per cent of the total farm cash expenses. The expenditure for labor insurance was reported in 58 per cent of the farms. It amounted to $154 per farm, on the average, or to over 3 per cent of all cash expenses. Board to laborers is a rather insignificant expenditure but is important from the point of view of the few farmers who incurred that type of expense. Mostly smaller farmers continue this practice and are mainly those whose major enterprise is other

than sugar cane. This can be described as a "cultural hang-over" which has been disappearing little by little with the gradual appearance of our present system of commercial farming.

Machinery and equipment ranked second to labor in importance among the general farm cash expenses, with an average of 8 per cent of the total. Of this the most important single expenditure was that of the operation of irrigation pumps. Although only 5 per cent of the farmers reported this expenditure, it amounted to an average of $114 per farm for all farms, and made 2.5 per cent of all cash expenditures. The other single item of machinery and equipment expenses are of minor consideration.

Fertilizer and insecticides expenses followed in importance, accounting for 6.7 per cent of all farm cash expenses. Most of the fertilizer was applied to sugar cane which alone made for 6.5 per cent of the total farm cash expenses. Very few farmers reported buying fertilizer for other crops. The insecticides purchased were mostly Paris Green, wheat flour, lead arsenate, and hydrated lime. These were purchased mostly by the farmers growing cotton and/or tobacco.

Among all other items of expenditure it is important to point out that of rented pasture, not for the amount that it represents, but for its significance considering the great scarcity of pasture in the area during the prolonged dry season. Only 10 per cent of the farms studied reported this expenditure which amounted to the very insignificant amount of $8 per farm during the year. The bigger land holders are the only ones who can afford to rent pasture. However, smaller farmers seem to manage themselves well enough to feed their livestock, probably by grazing it on free pastures provided by surrounding big land-holders or by feeding cane tops during the harvesting months. Surprisingly, in spite of the alleged seriousness of this problem of pastures, no attempt has been made so far by either the farmers or the agricultural agencies of the Island to explore the possibilities of solving this problem with practices such as growing hay pastures or maintaining silos for the season. Apparently the problem has not been serious enough, from the economic standpoint, to stimulate the farmers or the agencies to work for its definite solution.

Crop Sales. Crop sales amounted to $5,507 per farm studied (table 22). Sugar cane is the outstanding enterprise. It constituted the most important source of income as indicated by the fact that it accounted for nearly nine-tenths of the total crop sales and averaged $4,768 per farm. The price paid to farmers per ton of sugar cane delivered was $5.47. This price includes only the average amount of money received by the farmer from the sugar mill per ton of sugar cane delivered. It does not include the deduction which, according to the grinding contract, is made by the

sugar mill for the processing of the sugar cane; nor does it include A.A.A. and rebated transportation payments made to the growers.

No other individual crop, aside from sugar cane, stood out as particularly important, on a commercial scale, for all the farms. Corn and cotton were second in importance, averaging each around $260 per farm and representing 5 per cent each of the total sales of crops. The receipts from tobacco, which ranked third, contributed $110 per farm, or 2 per cent of the total crop sales.

The average value per farm of the sales of most of the crops was very low. For instance, sales of cocoanuts, sweet potatoes, pineapples, cowpeas,

TABLE 22. CROP SALES

240 farms, Southwestern Puerto Rico, 1942–43

Crop	Unit	Amount sold per farm	Price per unit	Sales	
				Per farm	Per cent of total
			$	$	
Sugar	Tons	872.4	5.47	4,768	88.6
Corn	Cwt.	72.5	3.60	261	4.7
Cotton	Cwt.	22.3	11.57	258	4.7
Tobacco	Cwt.	1.4	81.48	110	2.0
Cocoanuts	Thousands	1.4	20.61	28	0.5
Sweet potatoes	Cwt.	9.6	1.76	17	0.3
Pineapples	Cwt.	10.1	1.54	16	0.3
Cowpeas	Cwt.	1.7	6.59	11	0.2
Pigeon peas	Cwt.	1.3	6.23	8	0.1
Dry beans	Cwt.	0.9	8.43	8	0.1
Cassava	Cwt.	2.3	1.54	3	0.1
Other	—	—	—	19	0.4
Total				5,507	100.0

pigeon peas, dry beans, cassava and other crops, made only 2 per cent of the total receipts from sales of crops. They may have constituted important source of income for a few individual farms, but not for all farms as a whole. Most of these minor crops are grown for home use, and only a few farms sell part of their production, especially those harvesting considerable quantities above their consumption needs.

Prices received by the farmers studied in 1942–43 were neither low nor too high. They can be better described as slightly high, in general. Tobacco prices seem to be exceptionally high, with an average price reported of $81.48 per hundredweight. It should be remembered, though, that this is chewing tobacco which is processed at the farm. The price

reported is that received by the farmer at the farm for the processed product.

Livestock Products. The total value of all livestock products on the farms studied averaged $845 per farm. Sales represented three-fourths of their total and almost one-fifth was used by the operator's family. The remaining part was given away to "agregados" and others (table 23).

Milk was the most important livestock product. Its sales averaged 6,722 quarts per farm with a total value of $615. The family used an average of 1,381 quarts and a total of 32 quarts per farm were given away. Total milk production on these farms averaged 8,639 quarts and amounted to $798 per farm.

TABLE 23. LIVESTOCK PRODUCTS

240 farms, Southwestern Puerto Rico, 1942–43

Product	Sold		Used by family		Given away		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		$		$		$		$
			Average per farm					
Milk, quarts	6,722	615	1,381	132	536	51	8,639	798
Eggs, dozens	29	12	62	27	9	4	100	43
Other		3		1		*		4
Total		630		160		55		845
Per cent		75		19		6		100

* Less than $0.50.

Eggs were the only other important livestock product. An average of 100 dozen were produced per farm, out of which 29 were sold, 62 used by the family and the rest were given away. The total average value of egg sales per farm amounted to $12; those used by the family to $27 and an average value of $4 was given away. The total value of eggs produced per farm amounted to $43 per farm, on the average.

Farm Privileges. The farm privileges include the value of products from the farm used for home consumption and those given away, plus the rental value of the operator's dwelling. On the farms studied they amounted to an average of $456 per farm (table 24).

Livestock products, which averaged $215 per farm and represented almost one-half of the total, accounted for the major proportion of the farm privileges. The yearly rental value of the operator's dwelling with $118 per farm was second in importance, representing a little over one-fourth of the total value of farm privileges. Crops privileges averaged

$60 or 14 per cent of the total, livestock $31 or 7 per cent, and wood averaged $20 accounting for only 4 per cent of all farm privileges. The value

TABLE 24. FARM PRIVILEGES
240 farms, Southwestern Puerto Rico, 1942–43

Item	Average value per farm	Per cent of total
	$	
Livestock products*	215	47
Rent value of dwelling	118	26
Crops*	60	14
Livestock	31	7
Wood	20	4
Charcoal	6	1
Other	6	1
Total	456	100

* Includes livestock products and crops given away.

TABLE 25. MISCELLANEOUS RECEIPTS
240 farms, Southwestern Puerto Rico, 1942–43

	Per cent of all farms reporting	Average per farm (all farms)	Per cent of total
		$	
Benefit payments:			
Sugar	78	1,482	84.9
Other	69	30	1.7
Sugar cane transportation rebates	67	123	7.1
Machinery and equipment hired	9	51	2.9
Custom grazing	6	20	1.1
Labor off farm	9	13	0.7
Work animals hired	11	10	0.6
Charcoal sold	5	5	0.3
Lumber and wood sold	4	4	0.2
Rent of farm buildings	6	4	0.2
Seed sold	3	1	0.1
Other	8	3	0.2
Total		1,746	100.0

of charcoal and other farm privileges represented insignificant amounts, each one accounting for only one per cent of the total.

Miscellaneous Receipts. Besides the receipts from crop sales and livestock and livestock products sold, the farmers of the Lajas Valley studied had some additional income from other miscellaneous sources connected

with the farm business. The total for these miscellaneous receipts amounted to an average of $1,746 per farm (table 25). Most of the miscellaneous receipts came directly from sugar cane. The benefit payments made by the Agricultural Adjustment Administration were by far the outstanding item among the miscellaneous receipts. These payments amounted to an average of $1,482 per farm or nearly 85 per cent of the total. If to this amount are added the payments made to sugar cane growers by the sugar mill for sugar cane transportation rebates, which amounted to $123 on the average and which constituted 7 per cent of the total, then the miscellaneous receipts derived from the sugar cane enterprise represented alone over nine-tenths of the total miscellaneous receipts.

Of all the other miscellaneous items of receipts only those of machinery and equipment hired, soil conservation payments and custom grazing are worth mentioning. Although only 9 per cent of the farmers—the larger ones—reported hiring machinery and equipment, this item accounted for nearly 3 per cent of all miscellaneous receipts. Soil conservation payments made to farmers as compensation for the adoption of certain farm practices, accounted for about 2 per cent of the total. Custom grazing, that is, renting pasture, to outsiders, accounted for the insignificant amount of one per cent of the total miscellaneous receipts. All other items together, such as labor off farm, work animals hired, sales of charcoal, lumber and wood, rent of farm buildings, sales of seed and other amounted together on the average to $40 per farm and represented only 2.6 per cent of the total miscellaneous receipts.

Summary of Expenses and Returns. A brief summary of the general aspects of the farm organization and an insight into the financial returns of the farms studied is presented in table 26.

The average total receipts amounted to $8,212 per farm. A little over two-thirds came from crop sales, 8 per cent from livestock products sold, 3 per cent from livestock sold, 21 per cent from miscellaneous receipts and only 1 per cent came from a net increase in the inventory of the farm during the year. This net increase in inventory is also a part of the total receipts.

It is definitely established here that Southwestern Puerto Rico is not mainly a livestock area as is the impression of many people in the Island. It is primarily a sugar cane region.

The total farm expenses averaged $4,676 per farm. The general farm cash expenses accounted for the greater bulk of the total expenses, representing 98 per cent of them. Livestock bought during the year accounted for one per cent. The value of the unpaid family labor is also considered as an expense in the farm and it made only one per cent of the total farm expenditures.

The average total receipts exceeded the average total expenses on these

TABLE 26. SUMMARY OF EXPENSES AND RETURNS
240 farms, Southwestern Puerto Rico, 1942–43

Item	Total	
	Average per farm	Per cent of total
Receipts:		
Crop sales	$5,507	67
Livestock products sold	630	8
Livestock sold	273	3
Miscellaneous receipts	1,746	21
Net increase in inventory	56	1
Total receipts	$8,212	100
Expenses:		
Farm cash expenses	$4,540	98
Livestock bought	60	1
Unpaid family labor	74	1
Unpaid animal and machine work	2	
Total expenses	$4,676	100
Farm income	$3,536	
Interest on capital	1,540	
Labor income	$1,996	
Farm privileges	456	
Labor earnings	$2,452	
Value of operator's time	$453	
Return on capital	$3,083	
Capital invested	$25,675	
Per cent return on capital	12.0	
Capital turnover	3.1	
Net farm cash income	$3,556	
Return on labor	$5,692	
Man equivalent	7.7	
Return on labor per man	$738	

farms by $3,536. This balance represents the farm income, or the amount which the farmer received for his year's work, and the use of the capital invested. In order to put all farms on a comparable basis, regardless of capital investment, 6 per cent interest on the average capital invested was

deducted from the farm income to obtain the labor income. Therefore, labor income represents what the farmer received for a year's labor and management. In addition, the operator usually lives in the farm house and uses crops, livestock, and other products of the farm in his home. These last items are not considered in the determination of labor income.

The average total labor income per farm was $1,996. This means that the average total receipts of these farms were enough to pay the total farm expenses and to cover the interest on the average capital invested, and that the farmer received $1,996 for his year's work. The labor earnings of these farms, which are obtained by adding the $456 of farm privileges to the labor income, amounted to $2,452. Labor earnings is a very reliable measure of profitableness in a farm; however, its use is limited by the fact that it is very difficult to estimate with great accuracy the privileges of the farm. For this reason, labor income is many times preferred as a measure of farm profits.

The farm income minus the value of the operator's time, as estimated by the farmer himself, gives the return on capital. The farm income represents, as already explained, the income from capital and operator's labor. The average value of the operator's time for these farms was estimated as $453. This amount, subtracted from the total average farm income ($3,536) gives the return on capital, which averaged $3,083.

The return on capital, expressed as a percentage of the average capital invested ($25,675) gives the per cent return on capital. These farms had a per cent return on capital of 12 per cent. The per cent return on capital is an important measure of success from the standpoint of the person who contributes the capital. Where land is a limiting factor, as in Puerto Rico, because of its scarcity, or because of its high value, the per cent return on capital is of particular importance as well.

The capital turnover measures the time in years that it takes the farm receipts to equal the capital invested. Dividing the average capital (25,675) by the average total receipts (8,212) we found the capital turnover of these farms, which was 3.1 years.

If we add the farm cash receipts and from them subtract the sum of all cash expenses, we get the net farm cash income. For the farms studied, the net farm cash income was $3,556. This represents the amount on which the farmer can draw to meet his family cash expenses, and to pay his debts and the interest on any mortgage with which the farm may be encumbered. It is obvious that with the net cash income they obtained the farmers in general were in very good shape in the year studied.

The labor earnings plus the value of the unpaid family labor plus the cash labor expenses gives the return on labor. For the farms studied it averaged $5,692 per farm. This measure of return is of more significance

if it is expressed in terms of the men employed on the farm; that is, return on labor per man equivalent. It is not only of interest from the economic point of view, but to some extent from the social point of view as well. The reason is that it is a rough indication of the amount of money upon which each man employed on the farm, on the average, can rely for his or his family's living. Therefore, it is consequently a rough indication of their average standard of living. With an average man equivalent of 7.7 men per farm, these farms provided a $738 return on labor per man in the year 1942–43. This amount is considered by other farms studied in other sections of the Island.

FACTORS AFFECTING FARM EARNINGS

The analysis of the factors influencing farm earnings is one of the main objectives of the farm management study undertaken in the Lajas Valley area. It has been found that returns from farming vary considerably from farm to farm, within a given group. It is therefore important to find the reasons for these variations.

The labor income, as has been already stated, is preferred to others as a measure for the profitableness of a farm. The earnings of a farm are generally expressed in terms of labor income. However, a high labor income may not always be an entirely dependable index of proficiency in farming. Earnings may have been very high under the most favorable conditions and, conversely, they may have been too low to be profitable, even for the best farms, when conditions have been remarkably unfavorable. The ability of a farm to pay better than other farms of similar characteristics and under similar conditions which make the aggregate of the region, may be a pretty good indication of its relative efficiency, although not of its general success as a business enterprise. Therefore, comparisons have to be established to find out why, under a given set of conditions, some farms are more successful than others.

The farmers investigated in the Lajas Valley have different interests in farming. The smaller in size (and this group constituted the great majority) are more concerned with what they get from the farms for their own time. The remaining few but larger farmers, on the contrary, are more interested in what they obtain as returns for the use of the capital invested. For this reason, other measures of profitableness besides labor income and labor earnings are used wherever possible, to measure the variation in success on these farms; namely, return on capital, per cent return on capital and capital turnover.

Differences in earnings between individual farms, or between representative groups of farms, may be explained by their comparative rating in certain factors, as of size, intensity of land use, labor efficiency, rates of

production, combination of enterprises, farm mechanization, and other upon which the profits of farming generally depend. The most renumerative business set-up is the one which excels in more of the important factors, or which best combines a number of them to a greater advantage.

An attempt has been made to discuss in this section some of the factors which affected the financial returns of the farms studied in Southwestern Puerto Rico, for the crop year 1942–43. In order to establish the existing relationships, the farms have been divided into groups according to their standing in the individual factors considered.

Relation of Size of Business to Farm Earnings and Other Factors

A farm enterprise needs sufficient size of business in order to be profitable. As a rule, the larger farms make the better profits because of their advantage over small farms of being able to use more efficiently the factors of production and marketing. However, this is true within certain limits since there are certain circumstances under which this relationship does not work. Unfavorable years, for instance, may cause the most serious drawbacks to profits in farming. When the weather conditions have been very poor, or prices very low, it is very likely that the farms which developed the greatest activities have the largest losses. Furthermore, beyond a certain top limit of size, labor is less efficiently used and therefore in situations of very expensive labor, large farms cannot compete advantageously. In appraising the effects on earnings of the factors determining size of business, these considerations have to be kept in mind.

Several measures of size of business were related to earnings and other factors; namely, total capital invested, total cuerdas in farm, cuerdas in sugar cane, tons of sugar cane harvested, and man equivalent. The main reason for using more than one size factor was to observe consistencies or variations in the relationships found. The results found are presented in the pages to follow.

Total Capital Invested

Capital invested is a very good measure of the size of the farms in the area. Its relationship to farm earnings and other factors is shown in tables 27 to 36 presented below.

Other Size Factors. The relationship of total capital invested to other size factors is demonstrated in table 27.

The total cuerdas in farm as well as the net cuerdas harvested increased definitely with increases in the capital invested. The same relationship was observed as to the cuerdas and the tons of sugar cane harvested, however, the differences in tons of sugar cane produced can be described as substantially high. On the contrary, although the acreage in tobacco, cotton and corn was also found to increase in direct relationship with the

capital invested, the increases were not as significant. The number of men employed in the farms studied, as measured by man equivalent, increased directly with capital. The investment in machinery and equipment showed very significant increases with increases in farm capital, especially in the largest group of farms.

TABLE 27. RELATION OF TOTAL CAPITAL INVESTED TO OTHER SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Cuerdas in tobacco, cotton and corn	Man equivalent	Investment in machinery and equipment
Range	Average								
$	$								$
Less than 1,500	1,046	24	10	6	2.9	54	4.4	1.4	32
1,500– 2,499	1,911	47	13	8	5.5	93	2.4	1.8	39
2,500– 4,999	3,582	38	23	13	7.8	120	5.4	2.4	82
5,000– 9,999	6,989	44	46	25	13.6	243	11.6	3.3	300
10,000–19,999	14,283	40	102	49	24.4	448	28.6	5.8	488
20,000–39,999	28,552	25	174	83	48.3	845	32.1	8.8	879
40,000 and over	196,286	22	1,109	330	252.0	6,791	56.0	47.6	23,453

TABLE 28. RELATION OF TOTAL CAPITAL INVESTED TO INTENSITY OF LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Per cent total harvested land in tobacco, cotton and corn	Equipment investment per cuerda harvested
Range	Average							
$	$							$
Less than 1,500	1,046	24	4.3	89	72	46	48	5
1,500– 2,499	1,911	47	3.6	93	66	67	23	5
2,500– 4,999	3,582	38	3.6	89	63	60	32	6
5,000– 9,999	6,989	44	3.7	93	59	53	35	12
10,000–19,999	14,283	40	3.7	91	53	49	44	10
20,000–39,999	28,552	25	3.7	92	52	58	33	11
40,000 and over	196,286	22	2.5	87	34	76	16	71

To summarize, total capital invested was directly related to other size factors studied, although in varying degrees of significance.

Intensity of Land Use and Other Factors. The total investment of capital was also related to the intensity with which the land was used and various other factors. It is attempted in table 28 to describe the relationships found.

As stated in a previous section of this report, the intensity of land use in each farm studied was determined after completing the land classification of the area. For the purpose of the study of relationships the average land class of each group of farms was calculated. This is probably not the best procedure to follow since the average land class is a very generalized concept; however, it serves the purpose of indicating to some extent the intensity of land use in each group of farms.

Although a very straight relationship was not found between capital invested and economic land class, it is definitely demonstrated that the largest farms are located on the best lands and that, conversely, the smallest farms are situated on the poorest lands. The per cent of arable land on the farms studied showed practically no variation with increases in capital. A smaller percentage of the arable land is cultivated on the

TABLE 29. RELATION OF TOTAL CAPITAL INVESTED TO LIVESTOCK
240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Total animal units	Per cent grazing units	Per cent productive units	Per cent cow units is of productive units	Per cent investment in livestock	Average value per productive unit
Range	Average							
$	$							$
Less than 1,500	1,046	24	3.0	86	64	53	18	59
1,500– 2,499	1,911	47	3.2	89	75	54	11	65
2,500– 4,999	3,582	38	7.0	90	66	56	13	62
5,000– 9,999	6,989	44	10.1	94	65	59	11	74
10,000–19,999	14,283	40	17.6	95	58	57	10	77
20,000–39,999	28,552	25	30.2	99	63	66	8	72
40,000 and over	196,286	22	196.3	99	63	63	8	72

larger farms. The larger farms showed also higher percentages of the net area harvested planted to sugar cane. On the contrary, the percentages planted to other less important crops in the area, such as tobacco, cotton and corn, decreased with increases in the size of the farm, as measured by total capital invested. This fact shows very convincingly that the degree of specialization increased as the size of the farm business increased and that, on the other hand, diversification was greater on smaller farms. This higher specialization permitted these farms to mechanize to a larger extent as is shown in this table in which a direct relationship was observed between the investment in machinery and equipment per net cuerda harvested and farm capital. The most significant increase is that which occurred between the last two groups of farms, that is, from $11 to $71 per cuerda.

Livestock. The relationship of the total capital invested to the livestock kept on the farm is shown in table 29.

The total animal units kept on the farm were found to increase with increases in size as measured by total farm capital. The per cent constituted by the grazing livestock was also found to be in direct relationship with capital investments. However, the per cent of the total livestock classified as productive did not show any significant variations. By productive livestock it is meant all the livestock of the farm excluding only the work stock. So, the relative number of work stock as well as that of productive livestock on the farms studied remained rather constant, regardless of size. The proportion of productive animal units made by dairy-cows varied in direct relationship with capital. In other words, the farms with larger capital investments had a higher proportion of dairy-cow units. A straight relationship between the per cent investment

TABLE 30. RELATION OF TOTAL CAPITAL INVESTED TO USE OF PASTURE LAND

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Cuerdas in available pasture				Cuerdas in clear permanent pasture	
Range	Average		Total	Per grazing livestock unit	Per cent of total cuerdas in farm	Per cent of total arable land	Total	Per cent of available pasture
$	$							
Less than 1,500....	1,046	24	3	1.2	30	34	3	100
1,500– 2,499.....	1,911	47	4	1.4	29	32	4	100
2,500– 4,999.....	3,582	38	8	1.3	36	41	7	88
5,000– 9,999.....	6,989	44	19	2.0	41	45	16	86
10,000–19,999.....	14,283	40	42	2.5	41	46	32	76
20,000–39,999.....	28,552	25	81	2.7	46	50	73	91
40,000 and over....	196,286	22	642	3.3	58	66	540	84

in livestock and farm capital was not observed. However, there exists a tendency for it to decrease with increases in capital investment. The average value per productive animal unit on the farm was in direct relationship with the total capital invested. This indicates the fact that the larger sized farms had better quality livestock than the smaller farms. It is obvious that they could afford to buy better animals.

Use of Pasture Land. We attempted to discover any relationship that may exist between total capital invested and pastures and use of pasture lands. Findings are shown in table 30.

The total number of cuerdas in available pasture, increased as the farm capital increased. The larger farms reported having more cuerdas in available pasture per grazing livestock unit. The larger sized farms also reported having a higher proportion of the total cuerdas in the farm, as well as a higher percentage of the total arable land, devoted to pastures.

The amount of permanent pasture alone was larger for the farms with larger capital investments. The per cent that it constituted of the total available pasture, however, showed a tendency to decrease with increases in size. This is very interesting, since it indicates that the larger farms have improved their pastures to some extent by having very probably a higher proportion of their total available pasture in seeded and harvested pastures.

Irrigation. The relation of total capital invested to irrigation in the area is something of much interest to observe. Table 31 presents the relationships found.

It is definitely demonstrated here that irrigation is practiced by the very few largest farms in the area. The smaller farms reported having no

TABLE 31. RELATION OF TOTAL CAPITAL INVESTED TO IRRIGATION
240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Investment in irrigation equipment				Cuerdas of sugar cane irrigated		
Range	Average		Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
	$		$	$					
Less than 1,500..	1,046	24	0	0	0	0	0.0	0.0	0.0
1,500– 2,499....	1,911	47	0	0	0	0	0.0	0.0	0.0
2,500– 4,999....	3,582	38	0	0	0	0	0.0	0.0	0.0
5,000– 9,999....	6,989	44	0	0	0	0	0.2*	0.5	1.7
10,000–19,999....	14,283	40	74	3	53	1	1.4	1.5	5.7
20,000–39,999....	28,552	25	0	0	0	0	0.0	0.0	0.0
40,000 and over..	196,286	22	13,811	55	94	7	146.6	15.2	58.2

* Irrigated with outside equipment

investment at all in irrigation equipment. Some of the farms in the group ranging in capital from $5,000 to $10,000 reported some sugar cane lands irrigated, but it was done with outside equipment. A few farms in the group, ranging from $10,000 to $20,000 in capital investment, were the first to report irrigation equipment. Practically all the irrigation equipment of the area studied belongs to those farmers who reported a capital investment of $40,000 or over. Consequently, nearly all the sugar cane lands irrigated were the property of these farmers, too.

Rates of Production and Labor Efficiency. Definite relationships were found between the rates of production and labor efficiency as measured by several different factors, and size of farm as measured by capital invested (table 32).

The larger farms had higher rates of production as shown by a higher

tonnage of sugar cane per cuerda and more quarts of milk produced per cow unit. As to the crop index (excluding sugar cane), the smaller farms showed a tendency to have higher yields. The crop index, as calculated, included only the crops which on the average are considered of secondary importance in the area. The larger farms specialized more in sugar cane, as shown before, and paid very little attention to these minor crops. The main reason why they planted a few cuerdas of these crops was to comply with the requirements of the Agricultural Adjustment Administration in order to qualify for sugar cane benefit payments. Consequently, the yields obtained by these larger farms were on the average lower.

TABLE 32. RELATION OF TOTAL CAPITAL INVESTED TO RATES OF PRODUCTION AND LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Crop index (excluding cane)	Tons of cane per cuerda	Quarts of milk per cow unit	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Tons of cane per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average										
$	$								$	$	$
Less than 1,500	1,046	24	105	19	708	4.4	2.0	37	723	489	518
1,500– 2,499	1,911	47	109	17	707	4.6	3.1	53	1,078	501	597
2,500– 4,999	3,582	38	115	15	763	5.4	3.3	50	1,501	542	635
5,000– 9,999	6,989	44	100	18	847	7.8	4.2	75	2,143	721	962
10,000–19,999	14,283	40	96	18	816	8.5	4.2	77	2,456	740	990
20,000–39,999	28,552	25	125	17	621	9.4	5.5	96	3,255	741	1,103
40,000 and over	196,286	22	92	27	820	6.9	5.3	143	4,124	783	1,238

The fact that they obtained more tons of sugar cane to the acre is easily explained. As demonstrated before, these farmers had the better lands and were the only ones who enjoyed the privilege of irrigating most of their cane lands. Furthermore, they applied to advantage more units of production per cuerda, as will be later shown.

In relation to the higher production of milk per cow, it happened somewhat similarly. These farms had not only more and better pastures but also better animals, and, very surely, they fed them better too.

The efficiency in the use of labor was definitely higher on the farms with larger capital investments. The larger farms reported more net cuerdas in crops harvested, and more cuerdas in sugar cane harvested per man. However, the largest group of farms, above $40,000 in capital invested, were below the maximum of efficiency as measured by these factors, showing a definite decline beyond certain limits. The larger farms, with

higher yields and a larger acreage in cane per man, produced more tons of sugar cane per man

The capital invested per man, which also indicates to some extent the efficiency in the use of capital, increased consistently with increases in size. Finally, the return on labor and the gross income per man were larger for the larger sized farms.

There is no doubt about the fact that the larger farms studied had higher rates of production both in crops and animals. They also used more efficiently the labor employed on the farm, but apparently up to a certain limit, beyond which it shows a tendency to decline.

Farm Expenses. Farm expenses were found to be directly related to size of farms, as measured by total capital invested (table 33).

TABLE 33. RELATION OF TOTAL CAPITAL INVESTED TO FARM EXPENSES

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Farm cash expenses			Hired labor expenses	
Range	Average		Total	Per total cuerda harvested	Per net cuerda harvested	Total	Per cent of total cash expenses
$	$		$	$	$	$	
Less than 1,500....	1,046	24	320	35	51	153	48
1,500– 2,499.....	1,911	47	465	45	56	243	52
2,500– 4,999.....	3,582	38	661	39	51	375	57
5,000– 9,999..	6,989	44	1,507	45	59	827	55
10,000–19,999.....	14,283	40	2,770	43	56	1,741	63
20,000–39,999.....	28,552	25	4,987	51	60	3,204	64
40,000 and over....	196,286	22	33,322	94	101	24,750	74

Obviously the total farm cash expenses increased with increases in farm capital. What is more significant is that the farm cash expenses per total cuerda harvested and per net cuerda harvested showed marked tendencies to increase in the same direction. The larger farms spent not only more money for hired labor but also this item of expense accounted for a larger percentage of the total farm cash expenditures. The apparent conclusion that could be drawn from the above facts is that the larger farms applied more units of production per cuerda, and that a larger proportion of the labor force on the smaller farms is accounted for by the unpaid labor available.

Farm Receipts. In table 34 it is attempted to present the relation of total capital invested to farm receipts.

The total farm gross income was, as is logical, larger for the larger sized farms, as measured by total capital invested. The per cent of the gross income accounted for by crop sales showed a tendency to increase with

increases in size; but the tendency is more marked in the case of the per cent of the income derived from sugar cane. Sugar cane acreage and tonnage, as previously shown, increased consistently with increases in size. The relative importance of the income from tobacco, cotton and corn tended to diminish as the size of the farms increased. This finding agrees with the previous fact shown that the acreage planted to these crops was also of less relative importance in the larger farms. Although no clear straight relationship was observed between the per cent of the income derived from livestock and livestock products with capital invested, the tendency is for the larger farms to have a larger percentage.

It is worth mentioning here that the per cent crop sales is of the total value of crops harvested increased directly with increases in farm capital.

TABLE 34. RELATION OF TOTAL CAPITAL INVESTED TO FARM RECEIPTS

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Total farm gross income	Per cent income from crop sales	Per cent crop sales is of total crops value	Per cent income from cane	Per cent income from tobacco, cotton and corn	Per cent income from livestock and products
Range	Average							
$	$		$					
Less than 1,500..	1,046	24	748	59	90	62	14	6
1,500– 2,499....	1,911	47	1,058	60	92	73	9	8
2,500– 4,999....	3,582	38	1,516	59	91	64	12	11
5,000– 9,999....	6,989	44	3,138	61	96	63	16	9
10,000–19,999....	14,283	40	5,778	65	97	63	19	8
20,000–39,999....	28,552	25	9,679	63	98	69	11	9
40,000 and over..	196,286	22	58,910	67	99	81	3	12

This shows that the smaller farmers consumed at the farm a larger share of the crops harvested. The larger farmers are not only more specialized in sugar cane growing, the crop of which is entirely sold, but also they sell, on the average, most of the crops grown.

Farm Earnings. In general, farm earnings as measured by different factors, increased with increases in the size of the farm, as measured by total capital invested (table 35).

The return on the capital invested was directly related to size, but no relationship was observed with the per cent return on capital. However, the farms ranging from $5,000 to $10,000 in total farm investments, had the highest per cent return on capital. Beyond this point it diminishes to a level for the largest farm slightly above that of the smallest ones. The capital turnover increased consistently with increases in the size of farm. A significant direct relationship was also found between size of

farm and return on labor, net farm cash income, labor income and labor earnings. Size of farms is, definitely, very closely associated with the profitableness and success of the farms of the Lajas Valley Area.

Farm Mortgage Indebtedness and Other Factors. Other miscellaneous factors, among which farm mortgage indebtedness was included, were also related with total capital invested (table 36).

TABLE 35. RELATION OF TOTAL CAPITAL INVESTED TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Return on capital	Per cent return on capital	Capital turn-over	Return on labor	Net farm cash income	Labor income	Labor earnings
Range	Average								
$	$		$			$	$	$	$
Less than 1,500.	1,046	24	106	10.2	1.40	708	368	276	502
1,500– 2,499...	1,911	47	220	11.5	1.80	888	517	357	586
2,500– 4,999...	3,582	38	329	9.2	2.36	1,293	711	437	787
5,000– 9,999...	6,989	44	1,128	16.1	2.23	2,352	1,408	1,049	1,453
10,000–19,999...	14,283	40	2,292	16.0	2.48	4,304	2,677	1,859	2,442
20,000–39,999...	28,552	25	3,729	13.1	2.95	6,504	4,041	2,739	3,278
40,000 and over..	196.286	22	21.827	11.1	3.33	37,276	22,224	11,367	12,519

TABLE 36. RELATION OF TOTAL CAPITAL INVESTED TO FARM MORTGAGE INDEBTEDNESS AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Total capital invested		Number of farms	Age of operator	Farm popu-lation	Distance to nearest paved road (kms.)	Farm mortgage indebtedness		
Range	Average					Total	Per total cuerda in farm	Per cent of total capital
$	$					$	$	
Less than 1,500.	1,046	24	54	11	1.2	15	2	1
1,500– 2,499..	1,911	47	50	12	0.9	37	3	2
2,500– 4,999..	3,582	38	51	14	1.3	37	2	1
5,000– 9,999..	6,989	44	49	14	0.7	304	7	4
10,000–19,999..	14,283	40	47	23	1.0	1,242	12	9
20,000–39,999..	28,552	25	44	20	0.7	2,748	16	10
40,000 and over.	196,286	22	51	102	0.5	6,952	6	4

The size of the farm was found to have no relationship with the age of the operator. The farm population, however, showed to be in direct relationship with size. This indicates the same fact pointed out in a previous section of this report. It was found also that, although no straight relationship was observed, there was a tendency which indicates that the larger farms are located closer to paved roads than the smaller ones.

The farms with larger capital had, on the average, larger mortgage

indebtednesses, as expressed in absolute figures. However, when expressed in terms of total cuerdas in the farm and as a per cent of the total capital invested, a direct relationship was found to exist up to the group of farms below $40,000 in total capital investments. The largest group of farms showed a significant decline which is a clear indication of their more solid economic solvency.

Total Cuerdas in Farm

The second measure of size of the farms studied which was related to farm earnings and other factors, was total cuerdas in farm. The relationships found are presented in tables 37 to 44.

Other Size Factors. In table 37 the relationships of total cuerdas in farm to other size factors are shown.

TABLE 37. RELATION OF TOTAL CUERDAS IN FARM TO OTHER SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Total capital invested	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Cuerdas in tobacco, cotton and corn	Man equivalent	Investment in machinery and equipment
Range	Average								
			$						$
Less than 10.	7	34	1,606	5	3.1	56	1.4	1.4	43
10– 19.....	14	48	2,502	10	6.5	117	4.0	1.9	76
20– 39.....	27	41	4,449	16	9.5	164	5.8	2.5	157
40– 59.....	49	27	7,952	27	15.7	267	11.0	3.8	251
60– 99.....	75	26	12,888	44	27.0	576	18.0	5.5	371
100–199.....	136	31	21,858	73	42.8	729	28.6	7.6	911
200 and over.	822	33	138,709	244	172.3	4,556	60.0	34.3	15,764

The same relationships found in the case of total capital invested were observed in this case too. As the size of the farms studied increased, measured by the total cuerdas in farm, the total capital invested, the net cuerdas harvested, the acreage in sugar cane and the tons of cane harvested, the acreage in tobacco, cotton and corn, the number of men employed on the farm as well as the investment in machinery and equipment increased consistently. No inconsistencies or variations could be observed.

Intensity of Land Use and Other Factors. The relationship found between total cuerdas in farm and economic land class was not as clear as that observed when the size of the farm was measured in terms of capital invested. The variations of economic land class with increases in size, as measured by total cuerdas in farm, are not considered to be very significant. However, in both cases, the largest farmers showed the lowest economic land class, which means that they own the better lands (table 38).

The per cent of arable land showed variations with size which, as in the case of capital invested, were considered to be insignificant. In the same way, the proportion of the land used for sugar cane increased with increases in size, as well as the investment in machinery and equipment per net cuerda cultivated. The per cent of the total cuerdas cultivated which was planted to tobacco, cotton and corn showed no downward trend with size increases, as was in the case of capital invested. Both the lowest and the largest groups of farms had a lowest percentages of the land devoted to these secondary crops. The farms in the middle sized groups showed very small variations.

Livestock. No inconsistencies were observed between the relationships of size to livestock when size was measured by either total capital invested

TABLE 38. RELATION OF TOTAL CUERDAS IN FARM TO INTENSITY OF LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Per cent total harvested land in tobacco, cotton and corn	Equipment investment per cuerda harvested
Range	Average							
								$
Less than 10	7	34	3.4	90	79	65	22	9
10– 19	14	48	3.8	93	74	67	31	8
20– 39	27	41	3.8	89	65	61	31	10
40– 59	49	27	3.6	93	60	58	32	9
60– 99	75	26	3.5	92	64	61	31	8
100–199	136	31	3.8	93	58	59	33	12
200 and over	822	33	3.3	87	34	71	22	65

or total cuerdas in farm. In table 39 the relationships of total cuerdas in farm to livestock are presented.

A direct close association was found between total cuerdas in farm and total animal units, per cent grazing livestock units, and per cent dairy cow units is of productive animal units. The per cent that the productive livestock of the farm constituted of the total animal units remained rather constant. A tendency, though not a direct relationship, was observed for the larger farms to have a smaller percentage of its capital invested in livestock.

Use of Pasture Lands. In table 40 it is attempted to show the relationships that existed between total cuerdas in farm and use of pasture land.

As in the case of total capital invested, total cuerdas in farm was in direct relation to total cuerdas in available pasture, to the cuerdas in available pasture per grazing livestock unit, to the proportion of the farm

in pasture and to the per cent that the cuerdas in available pasture constituted of the total arable land. Similarly, it was also found that the total number of cuerdas in clear permanent pasture increased with size, and that the proportion it constituted of the total available pasture, conversely, tended to decrease as size of farms decreased. No inconsistent

TABLE 39. RELATION OF TOTAL CUERDAS IN FARM TO LIVESTOCK
240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Total animal units	Per cent grazing units	Per cent productive units	Per cent cow units is of productive units	Per cent investment in livestock
Range	Average						
Less than 10	7	34	3.5	86	69	50	15
10– 19	14	48	3.8	87	74	54	12
20– 39	27	41	6.2	93	60	59	10
40– 59	49	27	10.5	93	59	56	11
60– 99	75	26	12.5	95	60	59	7
100–199	139	31	24.5	97	60	60	9
200 and over	822	33	145.2	99	64	63	8

TABLE 40. RELATION OF TOTAL CUERDAS IN FARM TO USE OF PASTURE LAND
240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Cuerdas in available pasture				Cuerdas in clear permanent pasture	
Range	Average		Total	Per cent grazing livestock unit	Per cent of total cuerdas in farm	Per cent of total arable land	Total	Per cent of available pasture
Less than 10	7	34	2	0.5	22	25	2	100
10– 19	14	48	4	1.1	26	28	4	100
20– 39	27	41	9	1.5	33	38	8	89
40– 59	49	27	17	1.8	35	38	16	94
60– 99	75	26	29	2.4	38	41	21	72
100–199	136	31	54	2.3	40	43	44	81
200 and over	822	33	478	3.3	58	67	404	85

relations to use of pasture land were found when either one of the two measures of size were used.

Rates of Production and Labor Efficiency. Total cuerdas in farm was in direct association with rates of production and labor efficiency (table 41).

As a measure of size, total cuerdas in farm showed the same relation to rates of production as total capital invested. Crop index (excluding sugar cane) tended to be larger for the smaller farms. The tons of sugar cane produced per cuerda showed increases with increases in size. The only

difference found in the relationships studied which contrasted with that observed in capital invested was the quarts of milk produced per cow-unit. Capital invested showed to be directly associated while total cuerdas in farm showed no apparent relationship.

Labor efficiency was found also to increase with increases in the total cuerdas in farm. This was true within certain limits of size beyond which it started to decline. The highest efficiency, as measured by net cuerdas harvested and cuerdas in sugar cane harvested per man, was found to exist in the group of farms ranging from 100 to 199 cuerdas in size. The tons of sugar cane produced per man did not show a consistent direct relationship; however, there was a marked tendency to increase as the total cuerdas in farm increased. The capital invested per man showed the same direct close association with size. The farms that had the largest

TABLE 41. RELATION OF TOTAL CUERDAS IN FARM TO RATES OF PRODUCTION AND LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Crop index (excluding cane)	Tons of cane per cuerda	Quarts of milk per cow unit	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Tons of cane per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average										
									$	$	$
Less than 10	7	34	139	18	809	3.5	2.2	41	1,157	480	540
10– 19.....	14	48	89	18	1,017	5.1	3.4	61	1,305	538	706
20– 39.....	27	41	96	17	774	6.3	3.8	66	1,801	658	811
40– 59.....	49	27	122	17	780	7.2	4.2	71	2,119	653	834
60– 99.....	75	26	96	21	754	8.1	4.9	105	2,347	822	1,127
100–199.....	136	31	108	17	629	9.6	5.6	96	2,880	758	1,067
200 and over.	822	33	100	26	809	7.1	5.0	133	4,046	765	1,204

return on labor were those having between 60 to 99 total cuerdas in size. The highest gross income per man was reported by the largest farms.

Farm Expenses. A direct relationship between total cuerdas in farm and farm expenses was observed in the farms studied (table 42).

The total farm expenses increased with increases in size, as measured by the total cuerdas in farm. This same relationship was found in the case of capital invested. Tendencies were also observed for the farm expenses per total cuerda harvested and per net cuerda harvested to increase as the total cuerdas in farm increased. Similarly, the total expenses in hired labor were larger for the larger farms, and it constituted a larger percentage of the total farm cash expenses.

Farm Receipts. The total farm gross income was found to increase consistently with increases in the total cuerdas in farm (table 43). This relationship was identical with the one observed with capital invested.

In the same way, the size of farm, as measured by total acreage, was in direct association with the per cent income from crop sales, the per cent income from sugar cane and with the per cent that the crop sales is of the total value of crops harvested. In the case of the per cent income from tobacco, cotton and corn, the relationships found varied somewhat. The smaller as well as the larger farms reported the smaller percentages.

TABLE 42. RELATION OF TOTAL CUERDAS IN FARM TO FARM EXPENSES

240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Farm cash expenses			Expenses in hired labor	
Range	Average		Total	Per total cuerda harvested	Per net cuerda harvested	Total	Per cent of total cash expenses
			$	$	$	$	
Less than 10	7	34	274	42	57	108	39
10– 19	14	48	674	52	69	319	47
20– 39	27	41	848	45	55	485	57
40– 59	49	27	1,540	45	57	961	62
60– 99	75	26	3,107	54	70	1,910	61
100–199	136	31	4,059	46	56	2,609	64
200 and over	822	33	23,178	86	95	17,109	74

TABLE 43. RELATION OF TOTAL CUERDAS IN FARM TO FARM RECEIPTS

240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Total farm gross income	Per cent income from crop sales	Per cent crop sales is of total crops value	Per cent income from cane	Per cent income from tobacco, cotton and corn	Per cent income from livestock and products
Range	Average							
			$					
Less than 10	7	34	750	50	88	62	6	13
10– 19	14	48	1,352	57	93	72	6	13
20– 39	27	41	2,003	64	94	68	17	6
40– 59	49	27	3,129	66	96	68	17	6
60– 99	75	26	6,187	64	97	76	9	5
100–199	136	31	8,101	66	98	71	13	7
200 and over	822	33	41,293	66	99	77	5	12

The middle sized ones reported the larger. The reverse happened in regard to the per cent income from livestock and livestock products. The extreme sized farms had the highest percentages of their income from this source, while the middle sized farms reported the lower percentages.

Farm Earnings. Farm earnings, as in the case of capital invested, showed to be larger for the larger sized farms, as measured by total acreage in farm (table 44).

The return on capital was directly related to total cuerdas in farm. The per cent return on capital increased up to the group of farms ranging between 60 to 99 cuerdas. Above this acreage in size, the per cent return on capital declined consistently. The capital turnover showed a tendency to increase as the total cuerdas in farm increased; however, the relationship found was not as consistent as the one observed when size was measured by total capital invested. Return on labor, labor income and labor earnings were closely associated with size as measured by total farm acreage. They increased consistently as the size increased. This corroborates once more the great influence that size of farm business had on the financial success of the farms studied in the Lajas Valley Area in the year 1942–43.

TABLE 44. RELATION OF TOTAL CUERDAS IN FARM TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Total cuerdas in farm		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Return on labor	Labor income	Labor earnings
Range	Average							
			$			$	$	$
Less than 10.	7	34	147	9.1	2.14	667	256	490
10– 19.....	14	48	302	12.1	1.85	1,031	415	666
20– 39.....	27	41	678	15.2	2.22	1,625	730	1,046
40– 59.....	49	27	969	12.2	2.54	2,450	866	1,356
60– 99.....	75	26	2,479	19.2	2.08	4,513	2,085	2,520
100–199.....	136	31	3,174	14.5	2.70	5,757	2,452	3,043
200 and over.	822	33	15,266	11.0	3.36	26,225	8,089	9,107

Cuerdas in Sugar Cane Harvested

Cuerdas in sugar cane harvested is another measure of size which was related to farm earnings and other factors in addition to the two previously discussed; namely, total capital invested and total cuerdas in farm. The results of the relationships studied are presented in tables 45 to 55 which follow. As previously shown in this report, only 186 farms of the 240 studied in the Lajas Valley had sugar cane planted in 1942–43. The relationships were established with cuerdas in sugar cane harvested; therefore, the information regarding the 54 farms which did not plant sugar cane was not included. These 54 farms, on the average, were found to be larger in size than the first two groups of farms reporting fewer cuerdas in sugar cane harvested.

Other Size Factors. Table 45 shows the relationship of cuerdas in sugar cane harvested to other size factors. Because of the fact that sugar cane is the major enterprise in the farms of the area, it is considered to be a good

measure of size of business. As in the case of the two previous size factors studied, cuerdas in sugar cane harvested is directly associated with all other size measures selected. Total capital invested, total cuerdas in farm, net cuerdas harvested, tons of sugar cane harvested, cuerdas in tobacco, cotton and corn, man equivalent, and investment in machinery and equipment, all increased as the cuerdas in sugar cane increased.

TABLE 45. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO OTHER SIZE FACTORS

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Total capital invested	Total cuerdas in farm	Net cuerdas harvested	Tons of cane harvested	Cuerdas in tobacco, cotton and corn	Man equivalent	Investment in machinery and equipment
Range	Average								
			$						$
Less than 5.0	3.0	35	3,289	26	10	47	7.3	2.0	64
5.0– 9.9	7.6	47	4,372	26	12	134	3.5	2.3	128
10.0–19.9	13.5	36	7,658	44	27	215	13.7	3.5	229
20.0–49.9	31.7	31	13,226	126	50	573	10.5	5.4	515
50.0–99.9	64.1	21	26,871	143	89	1,203	19.9	9.2	1,063
100 and over	354.3	16	245,706	1,271	416	9,417	40.1	61.9	31,729

TABLE 46. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO INTENSITY OF LAND USE AND OTHER FACTORS

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Per cent total harvested land in tobacco, cotton and corn	Equipment investment per cuerda harvested
Range	Average							
								$
Less than 5.0	3.0	35	4.0	86	46	29	55	6
5.0– 9.9	7.6	47	3.5	86	51	65	24	11
10.0–19.9	13.5	36	3.2	93	67	50	44	8
20.0–49.9	31.7	31	3.1	74	54	63	18	10
50.0–99.9	64.1	21	2.6	93	66	72	20	12
100.0 and over	354.3	16	1.9	90	36	85	9	76

Intensity of Land Use and Other Factors. In table 46, cuerdas in sugar cane harvested was also related to intensity of land use and other factors.

It is definitely shown here, once more, that the best lands were in the hands of the larger farmers, as shown by the consistent decline of the economic land class with increases in size, as measured by cuerdas in sugar cane harvested. The per cent of arable land showed no relationship with size, and it varied very little as to the average per cent which

it constituted of the total farm acreage. The per cent of the arable land which was cultivated, contrary to the tendencies of decreasing with size increases which was observed before, did not show any significant relationship with cuerdas in sugar cane harvested. However, the largest farms had always the smallest percentage. The proportion of the net cuerdas harvested which was in sugar cane, showed again the tendency of increasing with size increases. The proportion of the total cuerdas harvested which was in tobacco, cotton and corn, as observed before, tended to decrease as the size of the farm increased. The investment in machinery and equipment per net cuerda harvested, tended to increase with increases in size.

Livestock. As the size of the farms studied increased, the total animal units on the farm showed consistent increases too (table 47).

TABLE 47. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO LIVESTOCK

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Total animal units	Per cent grazing units	Per cent productive units	Per cent cow units is of productive units	Per cent investment in livestock	Average value per productive unit
Range	Average							
								$
Less than 5.0.....	3.0	35	6.3	92	70	54	14	70
5.0– 9.9.....	7.6	47	6.6	92	72	60	10	60
10.0–19.9.....	13.5	36	10.0	96	62	66	11	84
20.0–49.9.....	31.7	31	19.6	97	67	60	11	62
50.0–99.9.....	64.1	21	21.9	97	52	57	6	72
100.0 and over.....	354.3	16	220.1	99	60	64	7	68

The grazing livestock of the farms showed also to be consistent in its relationship with size. It increased as the cuerdas in sugar cane harvested increased. The population of the livestock which was productive showed again no significant variation with size and furthermore, the relative amounts did not vary too much either. Cuerdas in sugar cane harvested and the relative amounts of cow-units on the farm showed but a slight tendency, if any, to be related with each other. Perhaps there exists a very slight tendency to increase with size increases, but it cannot be considered significant. In the case of the relative importance of the investments in livestock measured in terms of the total investment, it showed a marked tendency to decrease as size increased. The quality of the productive livestock, as measured by its average value per unit, was found to show no significant relationship with cuerdas in sugar cane harvested.

Use of Pasture Land. Table 48 is presented to show the relation of cuerdas in sugar cane harvested to use of pasture land.

The total number of cuerdas in available and clear permanent pasture increased with size increases, as measured by cuerdas in sugar cane harvested. The cuerdas in available pasture per grazing livestock unit did not show any significant relationship with this measure of size, as was the case with the capital invested and total farm acreage. The same happened with the per cent that the available pasture constituted of both the total cuerdas in farm and of the total arable land. The extreme sized farms, though, showed the highest percentages. In this respect, cuerdas in sugar cane harvested differed from the other measures of size. The per cent that the clear permanent pasture was of the total available pastures showed again the tendency to decline with increases in size.

TABLE 48. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO USE OF PASTURE LAND

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested			Cuerdas in available pasture				Cuerdas in clear permanent pasture	
Range	Average	Number of farms	Total	Per grazing livestock unit	Per cent of total cuerdas in farm	Per cent of total arable land	Total	Per cent of available pasture
Less than 5.0.....	3.0	35	14	2.4	53	62	11	79
5.0– 9.9.....	7.6	47	10	1.7	38	44	10	100
10.0–19.9.....	13.5	36	13	1.4	30	32	12	92
20.0–49.9.....	31.7	31	42	2.2	34	45	39	93
50.0–99.9.....	64.1	21	46	2.2	32	34	42	91
100 and over.....	354.3	16	741	2.2	58	65	631	85

Irrigation. Irrigation practices were carried on mostly in the larger farms studied. In table 49, where size of farm is measured by cuerdas in sugar cane harvested, it is observed that the only group of farms which practiced no irrigation at all was the smallest one, that is, those reporting less than 5.0 cuerdas in cane. All the other groups practiced irrigation, but to different extents. The first group of farms which reported irrigation equipment was that ranging between 20 to 50 cuerdas in sugar cane harvested.

A very clear direct relationship was observed which indicated that the larger the farms the larger the amount invested in irrigation equipment, and the larger the acreage irrigated. Irrigation equipment, as pointed out previously, is very expensive and only rich farmers could afford to have it. The smaller farms that reported irrigating part of their canes did it with either borrowed or hired outside facilities.

Rates of Production. Rates of production have never shown to be in

close association with size. However, in the farms studied, a direct relationship was generally observed. Of course, the higher rates of production observed were very probably due to other factors such as better lands, better farm practices, better pastures and better livestock, which were found to be intimately associated with size. In table 50 it is shown how

TABLE 49. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO IRRIGATION

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Investment in irrigation equipment				Cuerdas of sugar cane irrigated		
Range	Average		Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
Less than 5.0	3.0	35	0	0	0	0.0	0.0	0.0	0.0
5.0– 9.9	7.6	47	0	0	0	0.0	0.2*	0.9	2.8
10.0–19.9	13.5	36	0	0	0	0.0	0.4*	1.0	3.1
20.0–49.9	31.7	31	15	1	15	0.1	1.0	1.1	3.2
50.0–99.9	64.1	21	252	4	56	0.9	4.5	3.4	7.0
100.0 and over	354.3	16	18,815	53	96	7.7	196.3	17.1	55.4

* Irrigated with outside equipment.

TABLE 50. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO RATES OF PRODUCTION

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Crop index (excluding cane)	Tons of cane per cuerda	Tons of sugar per cuerda	Per cent sucrose content of cane	Quarts of milk per cow unit
Range	Average						
Less than 5.0	3.0	35	134	16	1.9	12.56	908
5.0– 9.9	7.6	47	104	18	2.3	13.08	764
10.0–19.9	13.5	36	104	16	2.1	13.00	712
20.0–49.9	31.7	31	108	18	2.3	12.94	573
50.0–99.9	64.1	21	115	19	2.4	12.98	595
100.0 and over	354.3	16	80	27	3.4	12.68	815

size, as measured by cuerdas in sugar cane harvested kept a close association with rates of production.

Crop index (excluding sugar cane) indicated the same tendency to decline in the larger farms. On the other hand, both tons of sugar cane per cuerda and tons of sugar produced per cuerda increased as the size of the farms increased. Conversely, the sucrose content of the sugar cane harvested in the smaller farms showed to be higher than for the larger

farms. This is very probably explained by the fact that the smaller farms grew the sugar cane under drier conditions. On the smaller farms, sugar cane is generally planted in steeper land, and, furthermore, these farms very seldom practice irrigation. Of course, this finding is something that deserves special and further study.

It was also expected here to find the production of milk per cow unit to increase with size increases. However, the reverse tendency was observed. The largest sized farms were the only ones which showed an increase in milk production per cow above the preceding group, thus breaking the relationship. Apparently, there is an inconsistency here which may be explained by the fact that the farms with the larger sugar cane acreages did not report having either the higher quality livestock nor the higher carrying capacity pastures.

TABLE 51. RELATION OF CUERDAS OF SUGAR CANE HARVESTED TO LABOR EFFICIENCY

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Tons of cane per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average							
						$	$	$
Less than 5.0	3.0	35	5.2	1.5	24	1,678	512	592
5.0– 9.9	7.6	47	5.0	3.2	57	1,866	521	688
10.0–19.9	13.5	36	7.7	3.8	61	2,174	687	887
20.0–49.9	31.7	31	9.2	5.9	106	2,440	779	1,103
50.0–99.9	64.1	21	9.6	7.0	131	2,919	924	1,261
100.0 and over	354.3	16	6.7	5.7	152	3,967	792	1,243

Labor Efficiency. The efficiency in the use of labor has been found, so far, to be directly related with size, up to certain limits, beyond which it has been found to decrease. It is attempted in table 51 to present the relationship of labor efficiency with cuerdas in sugar cane harvested during the year of study, 1942–43.

Both the tons of sugar cane per man and the capital invested per man increased consistently with increases in the sugar cane acreage. However, in the case of the net cuerdas harvested per man, the cuerdas in sugar cane harvested per man, the return on labor per man and the gross income per man, consistent increases were found up to the group of farms reporting sugar cane acreages ranging between 50 to 100 cuerdas. This group had the highest efficiency in the use of labor. The next and largest group in size showed to use labor less efficiently. The same finding is once more corroborated.

Farm Expenses. Total farm cash expenses were, logically, larger for the larger farms (table 52). The same relationship was observed between the total farm cash expenses per total cuerda harvested and size, as measured by cuerdas in sugar cane harvested. Size was also found to be directly related to the proportion that the total hired expenses represented of the total farm expenses. Increases were not consistent but the tendency was clearly marked.

As to the hired labor expenses in sugar cane, both per cuerda and per ton of cane harvested, a direct relationship was found showing general increases with increases in size. This indicates definitely that the larger farms applied more units of production per cuerda in cane than the smaller ones. The per cent that the hired labor expenses in sugar cane constituted

TABLE 52. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO FARM EXPENSES

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Farm cash expenses			Hired labor expense in sugar cane			Fertilizer cost per cuerda of cane
Range	Average		Total	Per total cuerda harvested	Per cent hired labor	Per cuerda of cane	Per ton of cane	Per cent of total hired labor	
			$	$		$	$	$	
Less than 5.0.....	3.0	35	409	31	49	21	1.38	32	7
5.0– 9.9.....	7.6	47	775	54	52	37	2.08	70	7
10.0–19.9.....	13.5	36	1,394	45	65	38	2.40	57	7
20.0–49.9.....	31.7	31	3,106	54	59	42	2.34	73	8
50.0–99.9.....	64.1	21	5,922	59	67	49	2.59	78	5
100.0 and over....	354.3	16	44,206	102	74	67	2.52	72	9

of the total hired labor expenses showed a clear tendency to increase as the cuerdas in sugar cane harvested increased. Although a slight tendency for the total fertilizer expenses per cuerda of cane harvested to increase with size was observed, the variation can be described as rather insignificant.

Farm Receipts. Total farm gross income increased with increases in cuerdas in sugar cane harvested (table 53). It is very natural to expect this increase in farm receipts with increases in size. What is really significant is that both the per cent income from crops sales and the per cent that crop sales is of the total value of crops harvested increased with increases in size. The per cent that the total receipts from sugar constituted of the farm gross income showed again the same tendency to increase with size. The per cent income from tobacco, cotton and corn indicated the same tendency observed before to decrease with increases in size, measured this time by cuerdas in sugar cane harvested.

Livestock and livestock products constituted a less important source of income for the larger farms. However, the relationship was broken by the largest farms, which showed a marked increase to a higher level but never as high as that of the first two groups of smaller farms.

Farm Earnings. Size and farm earnings proved once more to be intimately related in Southwestern Puerto Rico. Return on labor, labor

TABLE 53. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO FARM RECEIPTS

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Total farm gross income	Per cent income from crop sales	Per cent crop sales is of total crops value	Per cent income from cane	Per cent income from tobacco, cotton and corn	Per cent income from livestock and products
Range	Average							
			$					
Less than 5.0	3.0	35	1,160	52	89	33	27	16
5.0– 9.9	7.6	47	1,612	55	93	68	6	12
10.0–19.9	13.5	36	3,124	64	96	55	24	10
20.0–49.9	31.7	31	5,976	62	97	78	7	6
50.0–99.9	64.1	21	11,610	68	98	83	7	3
100.0 and over	354.3	16	76,998	68	99	86	1	10

TABLE 54. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO FARM EARNINGS

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Return on labor	Net farm cash income	Labor income	Labor earnings
Range	Average								
			$			$	$	$	$
Less than 5 0	3.0	35	306	9.3	2.84	1,004	606	379	706
5.0– 9.9	7.6	47	389	8.9	2.71	1,220	667	405	723
10.0–19.9	13.5	36	1,184	15.5	2.45	2,421	1,483	1,112	1,460
20.0–49.9	31.7	31	2,194	16.6	2.21	4,223	2,657	1,793	2,312
50.0–99.9	64.1	21	5,018	18.7	2.31	8,502	5,388	3,975	4,502
100.0 and over	354.3	16	27,932	11.4	3.19	49,050	30,676	14,906	16,168

income, and labor earnings showed consistent increases with increases in size, as measured by cuerdas in sugar cane harvested (table 54).

The return on capital showed a close direct association with size. The per cent return on capital, however, had again a top limit in the group of farms which ranged from 50 to 100 cuerdas in sugar cane. This group of farms showed, on the average, around 19 per cent return on capital. The next and largest group showed a substantial decline to 11 per cent. Contrary to the previous relationships observed, the capital turnover was larger for the smaller farms with a definite tendency to decrease with

size increases. An exception is noticed in the largest farms which jumped up from 2.31 to 3.19 years. This apparent inconsistency was only present in this case, that is, when cuerdas in sugar cane was used as a measure of size. It may be concluded that the larger the acreage in sugar cane the less number of years needed for the gross receipts to equalize the capital investment. This was true within certain limits, in our case, up to 100 cuerdas in sugar cane.

Farm Mortgage Indebtedness. Cuerdas in sugar cane harvested, as a measure of size, was also related to farm mortgage indebtedness, and the results found are presented in table 55.

TABLE 55. RELATION OF CUERDAS IN SUGAR CANE HARVESTED TO FARM MORTGAGE INDEBTEDNESS AND OTHER FACTORS

186 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in sugar cane harvested		Number of farms	Age of operator	Farm population	Distance to nearest paved road (kms.)	Farm mortgage indebtedness		
Range	Average					Total	Per total cuerdas in farm	Per cent of total capital
						$	$	
Less than 5.0	3.0	35	51	13	1.4	293	11	9
5.0– 9.9	7.6	47	50	13	0.9	215	8	5
10.0–19.9	13.5	36	45	12	1.1	222	5	3
20.0–49.9	31.7	31	46	36	0.8	1,127	9	9
50.0–99.9	64.1	21	47	26	0.2	2,396	17	9
100.0 and over	354.3	16	52	95	0.5	8,161	6	3

The age of the operator and size of farm showed again no relationship to each other. The same as before, larger farms were found to support a larger farm population, on the average. In general they were also located at shorter distances from paved roads, as is indicated in table 55. This factor is of special significance since the hauling and marketing of farm products is facilitated, and consequently its cost is reduced.

The mortgage indebtedness of the farms increased as size increased, but no relationship was observed when the mortgage burden of the farms was expressed per cuerda in farm or as a per cent of the total capital invested. The only point of interest shown again is that the largest sized farms had the least mortgage burden per cuerda, and, together with the group of farms ranging between 10 to 20 cuerdas in cane, also showed to have the least percentage of its capital mortgaged. It should be kept in mind that the economic solidity of the larger farmers, in general, is unquestionable.

Tons of Sugar Cane Harvested

Tons of sugar cane harvested, as well as the cuerdas in sugar cane was also related to farm earnings, and other factors. This factor, used here as a measure of size, is also influenced by rates of production, which have been found to be closely related to size. For this reason it is considered to be a good measure of size of business in the area studied. As in the case of cuerdas in sugar cane harvested, the information regarding the 54 farms which did not grow sugar cane in 1942–43 was not included in tables 56 to 60 presented below. These farms were found to be larger in size than the first three groups of farms with fewer tons of sugar cane produced.

Other Size Factors. In table 56 the relation of tons of sugar cane harvested to other size factors is presented.

TABLE 56. RELATION OF TONS OF SUGAR CANE HARVESTED TO OTHER SIZE FACTORS

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane harvested		Number of farms	Total capital invested	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of sugar produced	Man equivalent	Investment in machinery and equipment
Range	Average								
			$						$
Less than 75..	46	39	3,221	26	11	3.7	5.7	2.0	70
75–149.....	118	36	3,919	25	14	8.3	15.4	2.3	104
150–299.....	198	39	6,887	41	21	12.8	25.4	3.1	202
300–599.....	425	24	12,796	77	44	24.2	55.3	4.7	415
600–1199.....	850	21	22,695	199	83	49.5	110.3	7.7	1,264
1200 and over..	6,207	27	154,922	793	274	236.5	789.3	40.8	18,949

Tons of sugar cane harvested showed a direct close association with other size factors. Total capital invested, total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, tons of sugar produced and man equivalent, all were found to increase consistently with increases in size.

Intensity of Land Use. Economic land class was found to be inversely related to tons of sugar cane harvested as shown in table 57. The better lands in the hands of the larger sized farmers accounts for a great part of the higher tonnage of sugar cane produced.

The larger farms had approximately the same per cent of land arable, but they had cultivated a lower per cent of it as compared to the smaller farms. A very clear tendency for the larger farms to have higher percentage of the net cuerdas in crop in sugar cane was very definitely ob-

served again. Larger farms had also larger investments in machinery and equipment per net cuerda harvested. They were also found to irrigate, by far, a larger proportion of the land in cane. The proportion of total animal units which was work-stock was also found to be somewhat larger for the larger farms, as measured in this occasion by tons of sugar cane harvested.

TABLE 57. RELATION OF TONS OF SUGAR CANE HARVESTED TO INTENSITY OF LAND USE AND OTHER FACTORS

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane harvested		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Equipment investment per cuerda harvested	Per cent cuerdas in cane irrigated	Per cent work-stock is of total animal units
Range	Average								
							$		
Less than 75	46	39	4.1	87	47	35	7	0.0	32
75– 149	118	36	3.3	91	61	60	8	0.0	36
150– 299	198	39	3.3	90	57	60	10	3.8	31
300– 599	425	24	3.2	91	63	55	9	6.4	38
600–1199	850	21	3.0	77	55	59	15	2.4	37
1200 and over	6,207	27	2.0	90	38	86	69	50.3	40

TABLE 58. RELATION OF TONS OF SUGAR CANE HARVESTED TO RATES OF PRODUCTION AND LABOR EFFICIENCY

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane harvested		Number of farms	Tons of cane per cuerda	Tons of sugar per cuerda	Per cent sucrose content of cane	Tons of cane per man	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Gross income per man
Range	Average									
									$	$
Less than 75	46	39	12	1.5	12.48	23	5.3	1.9	1,614	551
75– 149	118	36	14	1.9	12.97	52	6.0	3.6	1,719	689
150– 299	198	39	15	2.0	12.85	63	6.7	4.1	2,198	774
300– 599	425	24	18	2.3	13.02	91	9.4	5.2	2,737	1,147
600–1199	850	21	17	2.2	12.98	110	10.8	6.4	2,946	1,177
1200 and over	6,207	27	26	3.3	12.72	152	6.7	5.8	3,797	1,250

Rates of Production and Labor Efficiency. The larger farms showed to have better rates of production than the smaller ones (table 58). For instance, the tons of sugar cane as well as of sugar produced per cuerda increased consistently with size increases. The sucrose content of the cane produced, however, showed no relationship with tons of sugar cane harvested. Perhaps there is a slight tendency for the sucrose content to increase with size, but it does not seem to be very significant.

Generally speaking, the labor efficiency of the farms of the area was found to be higher for the larger ones and vice versa. Definite consistent

increases with size were observed in the tons of sugar cane per man, the capital invested per man, and the gross income per man. It is also true that net cuerdas harvested per man and cuerdas in sugar cane harvested per man showed a direct relationship with size. This association however, is conditioned by certain top limits in size, in this case, by the very largest group of farms. The farms having the highest efficiency in the use of labor, as measured by these two factors, were those ranging from 600 to 1200 tons of sugar cane harvested. The next and largest group of farms, showed a substantial decline in labor efficiency. Once more this relationship is corroborated.

Farm Expenses and Receipts. It is the objective of table 59 to show the relationships found between tons of sugar cane harvested and farm expenses and receipts.

TABLE 59. RELATION OF TONS OF SUGAR CANE HARVESTED TO FARM EXPENSES AND RECEIPTS

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane harvested		Number of farms	Hired labor expenses in sugar cane			Fertilizer costs per cuerda of cane	Total cane receipts per cuerda	Per cent income from cane	Total farm gross income
Range	Average		Per cent of total hired labor	Per cuerda of cane	Per ton of cane				
				$	$	$	$		$
Less than 75	46	39	39	22	1.83	5	100	34	1,098
75– 149	118	36	66	30	2.09	6	117	62	1,572
150– 299	198	39	67	38	2.45	6	124	65	2,427
300– 599	425	24	63	37	2.14	7	143	64	5,363
600–1199	850	21	71	43	2.49	8	139	76	9,068
1200 and over	6,207	27	73	66	2.53	8	186	86	50,987

The larger farms were found to use more hired labor per cuerda of cane harvested. The per cent of the total hired labor expenses which these larger farms used on sugar cane was also found to be larger than for the smaller farms. As is hereby demonstrated, the larger farmers applied more units of production per cuerda of cane harvested. They intensified in the sugar cane enterprise. However, when the hired labor expenses in sugar cane were expressed per ton of sugar cane harvested, no apparent good relationship was observed, except a tendency to increase with increases in sugar cane tonnage.

The higher yields per cuerda of the larger farms were apparently enough to compensate for the larger hired expenses per cuerda of sugar cane in which they incurred. These higher yields are partly accounted for by the heavier amounts of fertilizer per cuerda which these larger farms applied, as shown in table 59. As the tons of sugar cane harvested increased, the total fertilizer expenses per cuerda of cane harvested increased also.

The total farm gross income, obviously, increased as size increased. The per cent of the gross income which was constituted by the total receipts from sugar cane, was in direct relationship with size. They both increased together. The same relationship was observed between total receipts from sugar cane per cuerda of cane harvested and size. In spite of higher labor expenses, the gross output per cuerda of cane was definitely higher for the larger farms.

Farm Earnings. It is attempted in table 60 to indicate the relationships found between tons of sugar cane harvested, as a measure of size, and farm earnings.

Once more the return on capital was found to be greater for the larger farms. However, the per cent return on capital did not show any relationship. It was found that it tended to increase up to the group of farms

TABLE 60. RELATION OF TONS OF SUGAR CANE HARVESTED TO FARM EARNINGS

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane harvested		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Net farm cash income	Labor income	Labor earnings
Range	Average							
			$			$	$	$
Less than 75...	46	39	252	7.8	2.93	563	337	655
75– 149.....	118	36	395	10.1	2.49	746	452	784
150– 299.....	198	39	686	10.0	2.84	940	626	964
300– 599.....	425	24	2,432	19.0	2.39	2,810	2,102	2,591
600–1199.....	850	21	3,473	15.3	2.50	4,013	2,628	3,279
1200 and over..	6,207	27	18,883	12.2	3.04	20,559	10,755	11,621

which had a total production of sugar cane ranging from 300 to 600 tons. Beyond this size, it went down substantially, corroborating once more the previous relationships found. Capital turnover showed no relationship with sugar cane tonnage; however, the farms having the largest cane tonnage had the largest capital turnover. That is, it takes 3.04 years for the gross receipts which they had in 1942–43 to equalize the capital invested.

The net farm cash income as well as the labor income and the labor earnings were found again to be closely and directly associated with size. They showed consistent increases as the tons of sugar cane harvested increased.

Man Equivalent

The number of men employed in a farm during the year is a good measure of its size. In the absence of a better measure of total volume of productive work accomplished by labor, man equivalent may be used as a measure to size of business. For this reason it was also included here for discussion

and its relationships with farm earnings and other factors are presented in tables 61 to 67.

Other Size Factors. As in the case of other size measures studied, there was a direct relationship between man equivalent and other size factors.

TABLE 61. RELATION OF MAN EQUIVALENT TO OTHER SIZE FACTORS
240 farms, Southwestern Puerto Rico, 1942–43

Man equivalent		Number of farms	Total capital invested	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Cuerdas in tobacco, cotton and corn	Investment in machinery and equipment
Range	Average								
			$						$
Less than 1.5...	1.0	32	1,775	11	5	3.0	46	2.1	38
1.5–1.9.....	1.7	36	2,894	16	10	6.5	101	3.9	52
2.0–2.9.....	2.4	53	3,879	26	14	7.4	129	6.3	109
3.0–4.9.....	3.9	50	9,946	70	30	12.6	220	18.0	337
5.0–9.9.....	7.0	41	22,963	167	66	32.5	565	34.6	687
10.0 and over...	41.1	28	155,589	857	286	223.6	5,832	44.7	18,662

TABLE 62. RELATION OF MAN EQUIVALENT TO INTENSITY OF LAND USE AND OTHER FACTORS
240 farms, Southwestern Puerto Rico, 1942–43

Man equivalent		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Per cent total harvested land in tobacco, cotton and corn	Equipment investment per cuerda harvested
Range	Average							
								$
Less than 1.5.....	1.0	32	3.6	91	55	56	29	7
1.5–1.9.....	1.7	36	3.5	92	66	66	30	5
2.0–2.9.....	2.4	53	3.9	89	60	54	36	8
3.0–4.9.....	3.9	50	4.3	93	46	43	43	11
5.0–9.9.....	7.0	41	3.4	89	44	49	41	10
10.0 and over.....	41.1	28	2.3	88	38	78	15	65

With an increase of man equivalent there was an increase in total capital invested, total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, tons of sugar cane harvested, cuerdas in tobacco, cotton and corn, and investment in machinery and equipment.

Intensity of Land Use and Other Factors. Man equivalent did not show a very close relationship with economic land class. A tendency was observed for the larger farms to show a lower economic land class which means that they tend to have the better lands. It was also shown again that the largest farms had definitely the better lands (table 62).

The per cent of arable land did not vary too much for both smaller and larger farms. This same relationship had been observed before. The larger farms indicated a tendency to have a lower per cent of the arable land cultivated; however, a larger percentage of the net area cultivated was planted in sugar cane. The per cent of the total cuerdas harvested represented by tobacco, cotton and corn was found to be smaller, on the average, for the larger farms. Farms with a larger man equivalent were found to have larger investment in machinery and equipment per net cuerda harvested.

Livestock. The larger farms, on the basis of man equivalent, had more total animal units (table 63).

TABLE 63. RELATION OF MAN EQUIVALENT TO LIVESTOCK
240 farms, Southwestern Puerto Rico, 1942–43

Man equivalent		Number of farms	Total animal units	Per cent grazing units	Per cent productive units	Per cent cow units is of productive units	Per cent investment in livestock	Average value per productive units
Range	Average							
								$
Less than 1.5...	1.0	32	3.6	86	71	51	14	65
1.5–1.9.....	1.7	36	4.2	89	70	57	10	72
2.0–2.9.....	2.4	53	6.4	91	67	57	11	62
3.0–4.9.....	3.9	50	15.3	96	65	60	13	81
5.0–9.9.....	7.0	41	29.7	97	68	61	11	80
10.0 and over...	41.1	28	147.2	99	61	63	7	68

The proportion of grazing livestock on the farms studied was larger for the larger farms. Very little variation, however, was found in the farms studied as to the per cent of the livestock accounted for by productive animals. The proportion that dairy cows constituted of all the productive livestock in the farms showed also very little variation with man equivalent. Perhaps a slight tendency to increase with size was observed. Livestock investments in general were relatively smaller for the larger farms. Although a slight tendency was observed for the average value per productive animal unit to increase with size, as measured by man equivalent, its significance is rather negligible.

Use of Pasture Land. As in the case of other size factors studied, the total number of cuerdas in available pasture as well as those in clear permanent pasture were found to increase with size, measured on the basis of man equivalent (table 64).

The total number of cuerdas in available pasture per grazing livestock unit were found to increase with increases in size. The larger farms reported also having a larger per cent of the total farm acreage in available

pasture. A tendency was also observed for the larger farms to have a higher proportion of their total arable land in available pasture. The relative importance of the clear permanent pasture, measured in terms of the total available pasture, tended to decrease as size increased.

Irrigation. In table 65 the relation of man equivalent to irrigation is presented.

TABLE 64. RELATION OF MAN EQUIVALENT TO USE OF PASTURE LAND
240 farms, Southwestern Puerto Rico, 1942–43

Man equivalent		Number of farms	Cuerdas in available pasture				Cuerdas in clear permanent pasture	
Range	Average		Total	Per grazing livestock unit	Per cent of total cuerdas in farm	Per cent of total arable land	Total	Per cent of available pasture
Less than 1.5	1.0	32	5	1.5	43	47	4	95
1.5–1.9	1.7	36	5	1.3	31	33	3	68
2.0–2.9	2.4	53	10	1.7	39	44	8	77
3.0–4.9	3.9	50	35	2.4	51	54	28	78
5.0–9.9	7.0	41	84	2.9	51	57	69	82
10.0 and over	41.1	28	470	3.2	55	63	403	81

TABLE 65. RELATION OF MAN EQUIVALENT TO IRRIGATION
240 farms, Southwestern Puerto Rico, 1942–43

Man equivalent		Number of farms	Investment in irrigation equipment				Cuerdas in sugar cane irrigated		
Range	Average		Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
Less than 1.5	1.0	32	0	0	0	0.0	0.0	0.0	0.0
1.5–1.9	1.7	36	0	0	0	0.0	0.0	0.0	0.0
2.0–2.9	2.4	53	0	0	0	0.0	0.2*	0.8	2.5
3.0–4.9	3.9	50	10	1	53	0.1	0.2	0.3	1.4
5.0–9.9	7.0	41	61	2	53	0.3	1.1	0.8	3.5
10.0 and over	41.1	28	10,851	48	94	7.0	115.2	15.3	51.5

* Irrigated with outside equipment.

The same as in the previous measures of size of business, the farmers employing larger amounts of labor during the year studied also had larger investments in irrigation equipment and, consequently, irrigated a larger proportion of their lands. The smaller farms had no investments at all and, if some of them reported having practiced some irrigation, it was with the aid of hired or borrowed equipment. Practically all the irrigation in

the area is done by the farmers employing over 10 or more men during the year.

Rates of Production and Labor Efficiency. Man equivalent was also related to rates of production and labor efficiency. The results are presented in table 66.

The same tendency for the larger farms to have a lower crops index (excluding sugar cane) was found. As to the tons of sugar cane per cuerda, they were found again to increase with increases in size. The quarts of milk produced per cow unit did not show any significant relationship with size, as measured by man equivalent.

Labor efficiency, in general, was found to be directly associated with man equivalent, but it also indicated the same tendency of decreasing beyond certain limits of size. The efficiency in the use of labor, when measured by

TABLE 66. RELATION OF MAN EQUIVALENT TO RATES OF PRODUCTION AND LABOR EFFICIENCY

Relation of man equivalent to rates of production and labor efficiency

Man equivalent		Number of farms	Crop index (excluding cane)	Tons of cane per cuerda	Quarts of milk per cow unit	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Tons of cane per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average										
									$	$	$
Less than 1.5....	1.0	32	120	15	727	5.3	3.0	45	1,759	566	652
1.5–1.9.....	1.7	36	98	16	897	5.7	3.8	59	1,694	563	678
2.0–2.9.....	2.4	53	103	17	779	5.8	3.1	53	1,611	533	655
3.0–4.9.....	3.9	50	113	17	904	7.6	3.2	56	2,552	647	903
5.0–9.9.....	7.0	41	103	17	720	9.5	4.7	81	3,304	786	1,116
10.0 and over....	41.1	28	96	26	792	7.0	5.4	142	3,788	778	1,210

cuerdas in sugar cane harvested per man, tons of sugar per man, capital invested per man, and gross income per man, showed general consistent increases with size increases. However, when measured in terms of net cuerdas harvested per man, it increased consistently up to the group of farms ranging from 5 to 10 men employed. When it was measured in terms of return on labor per man, labor efficiency showed practically consistent increases up to the same group of farms. The farms employing ten or more men during the year had a decline in labor efficiency.

Farm Earnings. Size, measured this time by man equivalent, and labor earnings were found once more to be directly associated (table 67).

The return on capital showed definite increases with increases in size. No straight relationship, however, was found between the per cent return on capital and man equivalent. A tendency to increase up to the farms ranging from 5 to 10 men in man equivalent, was observed. This group

of farms had the highest per cent return on capital of 14.6. The largest group of farms showed a substantial decline. A tendency for the total receipts of the larger farms to take more years to equalize the total capital invested was also found. The larger farms tended to have, therefore, a larger capital turnover, but the differences are rather insignificant.

The return on labor, the labor income and the labor earnings of the farms studied were intimately associated with size. Their relationship with man equivalent indicated consistent increases as the size of the farms increased.

Summary of Relation of Size of Business to Farm Earnings and Other Factors

In the previous pages several measures of size of business were related to farm earnings and other factors. The size factors, in the order in which they were presented, were: total capital invested; total cuerdas in farm;

TABLE 67. RELATION OF MAN EQUIVALENT TO FARM EARNINGS
240 farms, Southwestern Puerto Rico, 1942–43

Man equivalent		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Return on labor	Labor income	Labor earnings
Range	Average		$			$	$	$
Less than 1.5	1.0	32	159	8.9	2.70	571	229	462
1.5–1.9	1.7	36	292	10.1	2.50	962	393	661
2.0–2.9	2.4	53	367	9.5	2.46	1,284	442	786
3.0–4.9	3.9	50	1,228	12.3	2.83	2,521	1,039	1,469
5.0–9.9	7.0	41	3,348	14.6	2.96	5,465	2,497	3,122
10.0 and over	41.1	28	18,085	11.6	3.13	31,968	9,994	10,959

cuerdas in sugar cane harvested; tons of sugar cane harvested; and man equivalent. All these factors of size of business presented the same general aspects in their relation to farm earnings and other factors. In spite of the apparent repetition of facts, they all were included for discussion so as to observe significant consistencies or variations in the relationships found. An attempt is made below to summarize briefly in a general way the principal relationships which were found to exist between the size of the farms studied, their earnings and other aspects of their organization and functioning.

The results of the analysis made demonstrated that:

1. Larger farms were found to be larger in all the aspects of size studied.
2. Larger farms were found to have always the better lands, to have relatively less of their arable land cultivated, to be more specialized in sugar cane cultivation, and to be mechanized to a higher extent.
3. Large and small farms had about the same proportion of productive

and draft animals, but larger farms were found to have relatively more grazing livestock than smaller farms. Larger farms tended also to have relatively more cow-units. The quality of the productive livestock kept tended to be better for the larger farms. In general, smaller farms were found to have a larger percentage of their capital invested in livestock.

4. Larger farms had more of their lands in pasture and also more pasture per grazing livestock unit. Larger farms were found to have less of their pastures in clear permanent pastures, indicating that they had a larger proportion of seeded and harvested improved pastures.
5. Most of the irrigation equipment was found in the larger farms which, consequently, were the same ones that did practically all the irrigation carried on in the farms studied.
6. Larger farms, because of the facts that they had the better lands, that they irrigated most of their sugar cane lands, and that they applied larger amounts of units of production per cuerda of cane, obtained higher yields of sugar cane per cuerda. However, they showed to obtain lower yields per cuerda of the minor crops harvested. As to production per cow, a tendency for the larger farms to have larger yields was observed. These farms had not only more and better pastures, but also higher quality livestock.
7. Efficiency in the use of labor was found to increase with the size of farm up to a certain limit of size, beyond which it showed substantial decreases. In general, the farms with the highest labor efficiency were those ranging between $20,000 to $40,000 in total capital invested, those having between 100 to 200 total cuerdas in size, those harversting between 50 to 100 cuerdas of sugar cane and producing between 600 to 1,200 tons of cane, and those employing between 5 to 10 men during the year. In no case, were these the largest farms studied. Definitely the largest farms proved to use labor less efficiently than these farms.
8. The larger farms applied more units of production per cuerda and hired a larger proportion of the total labor employed. Smaller farms utilized more unpaid labor.
9. The larger farms derived more of their total gross income from crop sales, especially from sugar cane. They were also found to sell more of their crops harvested. The per cent income from secondary crops tended to be larger for the smaller farms. A slight tendency was also found for the larger farms to derive a larger part of their gross receipts from the sales of livestock and livestock products.
10. Size of farms was found to be definitely directly associated with farm

earnings. Net farm cash income, labor income and labor earnings showed consistent increases with increases in size. The total return on capital was found to be larger for the farms of larger size. However, the per cent return on capital was larger for the farms ranging between $5,000 to $10,000 in total capital invested, having between 60 to 100 total cuerdas in farms, harvesting between 50 to 100 cuerdas in sugar cane, producing between 300 to 600 tons of cane, and employing from 5 to 10 men during the year. As in the case of labor efficiency, none of these groups happened to be the largest. Therefore, the per cent return on the capital invested increased with size up to certain limits beyond which it showed significant declines. The capital turnover, that is, the number of years that it takes for the farm gross receipts to equalize the total capital invested, was found to be larger for the larger farms, indicating therefore that the smaller farms had more gross receipts per unit of capital invested. It may be concluded that the largest farms proved definitely to use the capital less efficiently than the smaller ones.

11. Size of farm and age of operator proved to have no relationship at all. The total population was logically found to be larger for the larger farms. The larger farms were found to be located at shorter distances from paved roads, thus, facilitating and lowering the costs of hauling and marketing farm produce.
12. In regard to the burden of mortgage indebtedness, it was found that the largest farms had a heavier total burden expressed in terms of per total cuerda in farm or as a per cent of the total farm capital, which tended to decrease with size. The most significant decline was that shown by the largest farms, indicating definitely their best economic solvency.

Relation of Intensity of Land Use to Farm Earnings and Other Factors

The intensity with which the land is used has been found to be intimately related to financial returns in farming. Of course, this aspect of farming is dependent on physical, economic, social and even on psychological factors. Many times it is subjected to political considerations and to a series of other controllable and uncontrollable factors. In addition, the ability of the farm operator to use the resources available is something that influences to a great extent the intensity with which his lands are used and, consequently, the degree of financial success he may achieve in his business.

The above section was entirely devoted to the discussion of the land classification which was made of the area studied, based on the intensity of land use. The pages to follow will be devoted to presenting the relation of

intensity of land use, as measured by five different factors, to farm earnings, and other factors of organization and operation of the farms studied. The five factors selected are: economic land class; per cent net cuerdas harvested is of total arable land; per cent cuerdas in plant-cane is of cuerdas in cane harvested; per cent area in available pasture is of total arable land, and cuerdas in available pasture per grazing livestock unit. Tables 68 to 93 presented below summarize the relationships found.

Economic Land Class

Various Size Factors. In table 68 the relation of economic land class to various size factors is presented.

Farms falling in land classes 1 and 2 were positively larger than all other farms, as measured by total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, tons of sugar cane harvested, man equivalent,

TABLE 68. RELATION OF ECONOMIC LAND CLASS TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Man equivalent	Total capital invested	Investment in machinery and equipment
Range	Average								
1–2	1.3	40	523	180	149.5	4,013	26.6	101,100	12,677
3	3.0	116	57	30	20.0	326	3.9	9,732	400
4–5	4.8	41	163	42	6.2	136	4.8	16,800	324
6–7	6.3	43	55	24	9.1	127	3.3	6,981	224

total capital invested and investment in machinery and equipment. Considering all farms, marked tendencies for size to decrease with increases in the economic land class were observed. Tons of sugar cane harvested and investment in machinery and equipment were found to be inversely and consistently related with economic land class. That is, the farms with lands classified as better had consistently larger total production of sugar cane and larger investments in machinery and equipment. Of course, with more and better lands in sugar cane, a higher tonnage is naturally expected.

Land Use and Other Factors. The per cent of the total farm area which was arable did not show significant differences with variations in economic land class (table 69).

The per cent of the total arable land in the farms studied which was cultivated showed no relationship at all with economic land class. Very marked tendencies, however, were observed for the farms with the better lands to have done less intercropping and double-cropping practices, as

shown by the fact that higher percentages of their total area harvested were classified as net. This is explained by the fact that they also were found to have higher percentages of their net area harvested made by sugar cane, which is a year crop. Furthermore, they also had relatively less area planted in tobacco, cotton and corn. Very definitely it is demonstrated that a higher percentage of the cane on the farms with the better lands was found to be plant-cane. This practice of renewing every year between one-fourth and one-third of the total area in cane is desirable from the point of

TABLE 69. RELATION OF ECONOMIC LAND CLASS TO LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Per cent land arable	Per cent of arable land harvested	Per cent total area harvested net	Per cent net harvested land in cane	Per cent cuerdas in plant cane is of total cane	Per cent total harvested land in tobacco, cotton and corn	Equipment investment per cuerda harvested
Range	Average								
									$
1–2	1.3	40	90	38	95	83	27	11	70
3	3.0	116	92	57	84	67	8	24	13
4–5	4.8	41	81	32	66	15	13	61	8
6–7	6.3	43	88	50	83	38	6	53	9

TABLE 70. RELATION OF ECONOMIC LAND CLASS TO LIVESTOCK

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Total animal units	Per cent grazing units	Per cent productive units	Per cent cow units is of productive units	Per cent investment in livestock	Average value per productive unit
Range	Average							
								$
1–2	1.3	40	90.4	99	60	63	7	68
3	3.0	116	11.4	95	59	60	10	73
4–5	4.8	41	32.4	98	76	62	14	74
6–7	6.3	43	10.3	94	54	57	13	89

view of higher yields. The farms with the better lands, from the economic standpoint, were necessarily found to be mechanized to higher extents than those having the poorer lands.

Livestock. The per cent of the total farm capital which was constituted by livestock was found to be larger for the farms with the poorer lands, from the economic point of view (table 70). The group of farms having an economic land class of 4 and 5 had the highest percentages. These farms are located on lands which, economically, are best suited for livestock raising. The farms with the best lands had a larger total number of animal units than those having poorer lands. The latter had relatively somewhat

more productive livestock and, on the average, their value per unit was found to be higher, thus indicating that they had better animals.

Very little variation was found in the per cent that the grazing livestock was of the total animal units. Perhaps a slight tendency, if any, for the farms with the better lands to have relatively more grazing animals was observed.

Use of Pasture Land. As in the case of livestock, the farms with the best lands had the largest acreage of both available and clear permanent pasture (table 71). The farms falling in land classes 4 and 5 followed. Therefore, no consistent relationships were observed between economic land class and pastures.

The farms with the best lands had the largest number of cuerdas in available pasture per grazing livestock unit, also followed by the farms in land classes 4 and 5. The latter, however, led in the per cent of the total farm

TABLE 71. RELATION OF ECONOMIC LAND CLASS TO USE OF PASTURE LAND

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Cuerdas in available pasture				Cuerdas in clear permanent pasture	
Range	Average		Total	Per grazing livestock unit	Per cent of total cuerdas in farm	Per cent of total arable land	Total	Per cent of available pasture
1–2	1.3	40	294	3.3	56	62	251	85
3	3.0	116	22	2.0	39	42	20	91
4–5	4.8	41	94	3.0	58	71	71	76
6–7	6.3	43	24	2.5	44	50	21	88

acreage which was in available pasture and in the per cent that it represented of the total arable land. This indicated a very slight tendency for the farms with the poorer lands, in general, to have relatively more land in pastures.

Irrigation. Irrigation was mostly practiced by the farms with the better lands, as shown in table 72.

Practically all the irrigation equipment was owned by the farmers operating in land classes 1 and 2. This is a very logical finding. These lands, due to the fact that they are of the highest productive quality, can economically support higher inputs per cuerda. As stated previously, irrigation equipment is of a very expensive nature. The farms falling in land classes 4 to 7 did not report investments in irrigation equipment of any kind.

Rates of Production. Rates of production, except for the secondary crops and the cows, were found to indicate tendencies of being higher for the farms falling in the best land classes (table 73).

The crop index, which includes the secondary crop only, tended to be higher for the farms located on poorer land classes. The quarts of milk produced per cow unit were also found to show the same tendency. As shown before, these farms had higher quality productive livestock. The farms located in the better land classes were found to have higher yields of sugar cane and sugar per cuerda. Previously it was demonstrated that these farms, besides having better lands, had a larger proportion of plant-

TABLE 72. RELATION OF ECONOMIC LAND CLASS TO IRRIGATION

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Investment in irrigation equipment				Cuerdas of sugar cane irrigated		
Range	Average		Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
1–2	1.3	40	7,658	51	93	7.6	82.0	17.4	54.9
3	3.0	116	4	*	53	†	0.1	0.2	0.4
4–5	4.8	41	0	0	0	0.0	0.0	0.0	0.0
6–7	6.3	43	0	0	0	0.0	0.0	0.0	0.0

* Less than $0.50.

† Less than 0.05 per cent.

TABLE 73. RELATION OF ECONOMIC LAND CLASS TO RATES OF PRODUCTION

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Crop index (excluding sugar cane)	Tons of cane per cuerda	Tons of sugar produced per cuerda	Per cent sucrose content of cane	Quarts of milk produced per cow unit
Range	Average						
1–2	1.3	40	94	27	3.4	12.73	789
3	3.0	116	110	16	2.1	12.85	832
4–5	4.8	41	102	22	2.8	12.78	725
6–7	6.3	43	108	14	1.8	13.00	960

cane, practiced irrigation, and, as will be shown later, applied more inputs per unit of production. The higher yields obtained, therefore, are explained.

Although no apparent relationship was found between economic land class and the sucrose content of cane, a slight tendency to increase in the farms with poorer lands was observed. This same tendency was previously noticed between size of business and sucrose content. The explanation given before applies here too.

Labor Efficiency. The efficiency with which labor was used on the farms

studied showed definitely to be related with economic land class (table 74).

Labor efficiency, when measured in terms of net cuerdas harvested per man did not show relationship with economic land class. When it was measured in terms of cuerdas in sugar cane harvested per man, tons of sugar cane per man and capital invested per man, very definite tendencies of being higher for the farms in better land classes were observed. The gross income per man, as a measure of labor efficiency showed consistent decreases as the economic land class increased. In other words, labor efficiency was higher .

TABLE 74. RELATION OF ECONOMIC LAND CLASS TO LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Tons of cane per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average							
						$	$	$
1–2	1.3	40	6.8	5.6	151	3,808	831	1,266
3	3.0	116	7.7	5.2	84	2,506	658	922
4–5	4.8	41	8.8	1.3	29	3,514	541	834
6–7	6.3	43	7.2	2.7	38	2,101	571	758

TABLE 75. RELATION OF ECONOMIC LAND CLASS TO FARM EXPENSES

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Total farm cash expenses			Hired labor expenses in sugar cane			Fertilizer costs per cuerda of cane
			Per total cuerda harvested	Per net cuerda harvested	Per cent hired labor	Per cuerda of cane	Per ton of cane	Per cent of total hired labor	
Range	Average								
			$	$		$	$		$
1–2	1.3	40	98	103	74	67	2.50	73	8
3	3.0	116	53	62	60	39	2.39	69	8
4–5	4.8	41	31	48	62	69	3.16	34	7
6–7	6.3	43	38	45	58	29	2.04	41	7

for the farms falling in better land classes than for those located in poorer lands.

Farm Expenses. The farms falling in the lower land classes, that is, those located in the better lands, were found to apply more units of production, as measured by the total farm cash expenses, both per cuerda in the farm and per cuerda harvested (table 75). Hired labor was found to be an item of expense more important for the farms falling in the better land classes, as measured by the per cent that it constituted of the total farm cash expenses.

A tendency for the hired labor expenses in sugar cane per cuerda of cane harvested to decrease as the economic land class increased was observed. This same tendency was shown again between the per cent that the hired labor expenses in sugar cane represented of the total hired labor expenses and economic land class. It was found to be larger for the farms in the better lands. No relationship was found, however, to exist between economic land class and the hired labor expenses in sugar cane per ton of cane harvested.

The expenses in fertilizer per cuerda of cane harvested were found to be lower for the farms with the poorer lands, as measured by economic land class. Apparently, the better lands were fertilized more heavily, indicating again the ability of these lands to stand, economically, larger inputs.

Farm Receipts. The farms in the lower or better land classes had higher gross receipts (table 76).

TABLE 76. RELATION OF ECONOMIC LAND CLASS TO FARM RECEIPTS
240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Farm gross income	Per cent income from crop sales	Per cent crop sales is of total crop value	Per cent income from cane	Per cent income from tobacco, cotton and corn	Per cent income from livestock and products
Range	Average							
			$					
1–2	1.3	40	33,618	68	99	85	3	9
3	3.0	116	3,579	61	96	72	9	9
4–5	4.8	41	3,986	51	94	27	28	3
6–7	6.3	43	2,520	60	95	41	30	2

Crop sales and economic land class showed no apparent relationship to each other. It was found that the farms in the better land classes sold more of the crops harvested than the farms in the poorer land classes. The latter consumed more of the crops grown or gave larger parts away.

The income from sugar cane was found to decrease with increases in the economic land class. That is, sugar cane is a more important source of income for the farms with the better lands. On the contrary, the per cent of the total gross receipts on these farms which was accounted for by tobacco, cotton and corn, was lower than for the farms on the poorer lands. This means that the latter relied to a larger extent on the secondary crops of the area as a source of income. The income derived from the sales of livestock and livestock products was found to be more important for the farms in the better economic land classes. This source of income, as well as sugar cane, was found to be of relatively more importance in the farms with the better lands.

Farm Earnings. Economic land class and farm earnings were found to be very closely and directly associated (table 77). This is demonstrated by the fact that the return on labor, the net farm cash income, the labor income and the labor earnings of the farms studied showed in general consistent decreases as the quality of the land, measured by economic land class, decreased. In other words, the farms in the better lands proved definitely to be financially more successful than those located in poorer lands.

From the point of view of return on capital it was found that the farms in the better land classes has the highest returns. When the return on capital was expressed as a per cent of the total capital invested, it was found that the farms in land classes 1 and 2 had the highest percentage, and those falling in land classes 4 and 5 had the lowest. The farms in the poorest land classes had a per cent return on capital which compared favorably with that of the farms located in the best lands. No significant relationship was ob-

TABLE 77. RELATION OF ECONOMIC LAND CLASS TO FARM EARNINGS
240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Return on capital	Per cent return on capital	Capital turn-over	Return on labor	Net farm cash income	Labor income	Labor earn-ings
Range	Average		$			$	$	$	$
1–2	1.3	40	12,877	12.7	3.01	22,058	14,060	7,645	8,273
3	3.0	116	1,171	12.0	2.72	2,553	1,503	948	1,347
4–5	4.8	41	1,336	8.0	4.22	2,587	1,572	748	1,215
6–7	6.3	43	800	11.5	2.77	1,897	1,215	760	1,163

served between economic land class and capital turnover. The farms which showed to have the lowest capital turnover were those located in land classes 3 and 6 and 7. This demonstrated once more that the gross farm receipts per unit of capital invested were larger for the farms in the poorer lands. This is probably due to the relatively lower capital investments which these farms had.

Farm Mortgage Indebtedness and Other Factors. In table 78 the relation of economic land class to farm mortgage indebtedness and other factors is presented.

No relationship was found to exist between age of operator and economic land class. The population on the farms with better lands was found to be larger than for those located on poorer lands. Definitely, better lands can support larger populations. The farms in the better land classes were consistently located at shorter distances from paved roads. This is, undoubtedly, a great advantage both from the economic and social standpoints.

Although no significant relationship was found between economic land class and farm mortgage indebtedness, the farms located in the extreme land classes had the lowest farm mortgage burden when expressed as a per cent of the total farm capital. This is due to the fact that the farmers in the best lands had, on the average, a greater economic solidity, and those on the poorer land classes are not only very suspicious of long-term credit but also present great risks to this type of agency.

Per Cent Net Cuerdas Harvested Is of Total Arable Land

The per cent that the net cuerdas harvested represents of the total arable land in the farms studied was related to farm earnings and other factors. The results are presented in tables 79 to 85. This factor measures to a certain extent the intensity with which the arable lands in the area studied are

TABLE 78. RELATION OF ECONOMIC LAND CLASS TO FARM MORTGAGE INDEBTEDNESS AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Economic land class		Number of farms	Age of operator	Farm population	Distance to nearest paved road (kms.)	Farm mortgage indebtedness		
Range	Average					Total	Per total cuerda in farm	Per cent of total capital
						$	$	
1–2	1.3	40	48	46	0.5	3,744	7	4
3	3.0	116	49	16	0.9	597	10	6
4–5	4.8	41	51	32	1.0	1,383	8	8
6–7	6.3	43	49	15	1.2	289	5	4

utilized for crop-growing. Of course, the utilization of the land in pasture is excluded from consideration here.

Various Size Factors. In table 79, the relationship of per cent net cuerdas harvested is of total arable land to various size factors is presented.

No consistent relationships between the per cent that the net cuerdas harvested represented of the total arable land and size were observed. It was observed, however, that the group of farms which harvested less than 35 per cent of their total arable land were consistently the largest in size as measured by total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, tons of sugar cane harvested, man equivalent, total capital invested, and investment in machinery and equipment. On the other hand, the smallest farms, as measured by the above same factors, had consistently the largest percentages except when size was measured by tons of sugar cane produced. It is also worth mentioning that the farms in the group which ranged between 50 and 64 per cent, showed marked tendencies

to be rather small in size. In spite of this apparent inconsistency, a clear tendency was observed for the smaller farms to utilize more of their arable lands in crop-growing.

Land Use and Other Factors. A very definite inverse relationship was found to exist between the per cent of the total arable land which was har-

TABLE 79. RELATION OF PER CENT NET CUERDAS HARVESTED IS OF TOTAL LAND TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent net cuerdas harvested is of total arable land		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Man equivalent	Total capital invested	Investment in machinery and equipment
Range	Average								
								$	$
Less than 35	23	38	486	96	64.5	1,944	15.9	65,621	10,435
35–49	42	37	222	81	52.9	1,219	12.1	43,603	2,286
50–64	58	39	67	35	18.8	308	4.2	10,431	574
65–79	73	45	85	59	44.0	961	6.9	20,122	1,186
80–94	86	48	57	43	25.8	494	4.7	11,708	386
95 and over	98	33	25	22	17.8	347	3.1	5,476	30

TABLE 80. RELATION OF PER CENT NET CUERDAS HARVESTED IS OF TOTAL ARABLE LAND TO LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent net cuerdas harvested is of total arable land		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Per cent total harvested land in tobacco, cotton and corn	Equipment investment per cuerda harvested
Range	Average							
								$
Less than 35	23	38	4.2	88	86	67	25	109
35–49	42	37	4.2	86	88	65	30	28
50–64	58	39	3.7	92	74	54	38	16
65–79	73	45	3.5	95	91	75	17	20
80–94	86	48	3.3	89	86	59	28	9
95 and over	98	33	2.9	92	90	81	19	1

vested and the economic land class (table 80). It was found that the farms with the better lands showed consistently to utilize more of their arable lands in crops. This shows that, apparently, the better lands are put into crops while the poorer ones are left to other uses. Definitely, this is a very wise farming practice, considering the general economy of the area under study.

The extent to which the arable land in the farms studied was cultivated, did not show to be related with either the per cent land arable, the amount of doublecropping and intercropping done as measured by the per cent the net area harvested is of the total area harvested, the per cent of the net area harvested which was in cane, nor with the per cent of the total area harvested which was represented by cuerdas in tobacco, cotton and corn. It was found, however, that the farms which cultivated more of their total arable land were mechanized to a lower extent than those which cultivated less of their arable land. It should be remembered here that, in general, they also were found to be the smaller in size.

Livestock. In table 81 it is attempted to present the relationships found between the extent to which the arable lands in the farms studied were cropped and the livestock kept on those farms.

TABLE 81. RELATION OF PER CENT NET CUERDAS HARVESTED IS OF TOTAL ARABLE LAND TO LIVESTOCK

240 farms, Southwestern Puerto Rico, 1942-43

Per cent net cuerdas harvested is of total arable land		Number of farms	Total animal units	Per cent grazing units	Per cent productive units	Per cent cow units is of productive units	Per cent investment in livestock	Average value per productive unit
Range	Average							
								$
Less than 35	23	38	82.3	99	65	62	9	73
35-49	42	37	50.0	99	71	64	9	70
50-64	58	39	14.5	94	55	52	11	65
65-79	73	45	13.9	96	45	56	6	66
80-94	86	48	10.0	96	54	62	8	90
95 and over	98	33	1.9	83	74	48	2	66

The total animal units kept on the farms as well as the per cent which was grazing livestock showed a decline with increases in the per cent of the arable land which was cropped. In other words, the farms which grew relatively more crops had less animals and, furthermore, less of the grazing type. Obviously, less land was available to take care of the livestock enterprise.

No relationship was found to exist between the proportion of arable land cropped and the per cent of the livestock kept that was of the productive type. The average value per productive animal unit, which indicates to some extent its quality, also showed no relationship. The relative importance of dairy cows tended to decrease as the farms used more of their arable lands in crops. In general, the per cent of the total farm capital which was accounted for by the livestock kept on the farm, decreased as more arable land was cultivated. To summarize, the more arable land cropped, the less the importance of the livestock enterprise on the farms studied.

Use of Pasture Land. Since the livestock enterprise is of relatively less importance on the farms which had more of their arable land in crops, it was very reasonable to find that the total number of cuerdas in available pasture as well as in clear permanent pasture decreased as the farms had relatively more arable land in crops (table 82).

The number of cuerdas in available pasture per grazing livestock unit in the farm was found, logically, to be larger for the farms with a lower percentage of their arable lands cultivated. Inverse consistent relationships were also found between the per cent net cuerdas harvested is of total arable land and the per cent that the available pasture represented of both the total cuerdas in farm and the total arable land. That is, they decreased consistently as more of the arable land was cropped. The farms with higher percentages of their arable land cultivated were also found to have more

TABLE 82. RELATION OF PER CENT NET CUERDAS HARVESTED IS OF TOTAL ARABLE LAND TO USE OF PASTURE LAND

240 farms, Southwestern Puerto Rico, 1942–43

Per cent net cuerdas harvested is of total arable land		Number of farms	Cuerdas in available pasture				Cuerdas in clear permanent pasture	
Range	Average		Total	Per grazing livestock unit	Per cent of total cuerdas in farm	Per cent of total arable land	Total	Per cent of available pasture
Less than 35	23	38	321	3.9	66	75	264	82
35–49	42	37	116	2.4	52	61	102	88
50–64	58	39	27	2.0	41	44	24	89
65–79	73	45	24	1.8	28	30	21	88
80–94	86	48	12	1.2	21	24	11	92
95 and over	98	33	1	0.9	6	6	1	100

of their total available pasture accounted for by clear permanent pasture. This shows that, conversely, they had less improved seeded and harvested pastures.

Irrigation. Most of the irrigation found to be practiced in the farms studied was done by the farms which had lower percentages of their total arable land cultivated (table 83).

A very marked tendency for the farmers with more of their arable land cultivated to own more of the irrigation equipment was observed. Consequently, they also carried on irrigation practices to a larger extent. As was previously shown these farms were also found to be larger in size.

Rates of Production and Labor Efficiency. In table 84 the relationship of per cent net cuerdas harvested is of total arable land to rates of production and labor efficiency is presented.

The yields of the secondary crops of the area, as measured by the crop

index (excluding sugar cane) showed a tendency to be larger for the farms which cultivated higher percentages of their arable lands. The yields of sugar cane per cuerda measured in tons, on the contrary, were found to be larger for the farms which had less of their arable land in crops. As to the

TABLE 83. RELATION OF PER CENT NET CUERDAS HARVESTED IS OF TOTAL ARABLE LAND TO IRRIGATION

240 farms, Southwestern Puerto Rico, 1942–43

Per cent net cuerdas harvested is of total arable land		Number of farms	Investment in irrigation equipment				Cuerdas of sugar cane irrigated		
Range	Average		Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
Less than 35	23	38	6,929	107	132	10.6	52.3	12.3	81.1
35–49	42	37	695	13	33	1.6	20.8	10.8	39.3
50–64	58	39	64	3	53	0.6	1.2	2.0	6.4
65–79	73	45	328	7	33	1.6	10.1	12.5	22.9
80–94	86	48	12	1	24	0.1	0.5	1.0	1.9
95 and over	98	33	0	0	0	0.0	0.3*	1.3	1.7

* Irrigated with outside equipment.

TABLE 84. RELATION OF PER CENT NET CUERDAS HARVESTED IS OF TOTAL ARABLE LAND TO RATES OF PRODUCTION AND LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Per cent net cuerdas harvested is of total arable land		Number of farms	Crop index (excluding cane)	Tons of cane per cuerda	Quarts of milk per cow unit	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Tons of cane per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average										
									$	$	$
Less than 35	23	38	89	30	876	6.1	4.1	123	4,139	680	1,174
35–49	42	37	105	23	705	6.7	4.4	101	3,618	719	1,053
50–64	58	39	115	16	751	8.4	4.5	73	2,490	710	967
65–79	73	45	118	22	655	8.5	6.4	139	2,921	844	1,130
80–94	86	48	94	19	751	9.2	5.4	104	2,467	802	1,082
95 and over	98	33	116	19	822	7.2	5.8	112	1,775	743	983

production of milk per cow, it was found to have no significant relationship to the per cent of the arable land which was harvested.

No consistent changes in the labor efficiency were observed among the farms studied with changes in the per cent that the net cuerdas harvested represented of the total arable land. The only exception was in the case of capital invested per man. It was found to decrease consistently as the

proportion of the arable land cultivated increased. The net cuerdas harvested per man were found to increase up to the group of farms which reported having cropped between 80 to 90 per cent of their total arable land. The group of farms above the latter showed a decline. The same tendency of going up and then declining beyond a certain limit was also observed when labor efficiency was measured in terms of cuerdas in sugar cane harvested per man. The farms with the top efficiency were found to be those which cropped between 65 to 79 per cent of their total arable land. They were also found to have the highest sugar cane tonnage per man and the highest return on labor per man. The gross income per man showed insignificant variations; however, the farms with less than 35 per cent of their arable lands cropped had the highest gross income per man.

TABLE 85. RELATION OF PER CENT NET CUERDAS HARVESTED IS OF TOTAL ARABLE LAND TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent of net cuerdas harvested is of total arable land		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Return on labor	Labor income	Labor earnings
Range	Average							
						$	$	$
Less than 35	23	38	5,509	8.4	3.53	10,778	2,120	2,753
35–49	42	37	5,072	11.6	3.44	8,664	3,146	3,751
50–64	58	39	1,349	12.9	2.57	2,975	1,173	1,705
65–79	73	45	3,236	16.1	2.58	5,814	2,481	2,927
80–94	86	48	2,196	18.8	2.28	3,807	1,845	2,175
95 and over	98	33	1,195	21.8	1.81	2,291	1,097	1,288

The relationships found here are perhaps mostly due to the influence of size of business. As shown previously, the farms with the higher percentages of their arable lands harvested were found to show tendencies of being larger in size. Consequently, the relationships observed here compare very favorably with those found between size of business and labor efficiency and rates of production.

Farm Earnings. Per cent net cuerdas harvested is of total arable land and farm earnings were related and the results presented in table 85.

The return on capital showed tendencies to decrease with increases in the per cent of the land arable which was cropped. The relationship found was not very consistent. However, when the return on capital was expressed as a per cent of the total capital invested, a direct and very close association was found with the per cent that the net acreage harvested constituted of the total arable land. These two factors proved to be very closely associated. That is, the more arable land cultivated, the higher the per cent

return on capital. Similarly, the capital turnover was also found to decrease consistently. In other words, it takes less number of years on the farms with more of their arable land cropped for their gross receipts to equalize the total farm capital. Evidently, from the capital investment standpoint, it was economically advisable to cultivate larger proportions of the total arable land.

Labor income did not show to be too much associated with the per cent that the net cuerdas harvested is of the total arable land. The farms which cropped between 35 to 49 per cent of their total arable acreage had the highest labor income and labor earnings. In general, labor income, labor earnings and return on labor tended to be lower for the farms which had higher percentages of their arable land cultivated.

TABLE 86. RELATION OF PER CENT CUERDAS IN PLANT-CANE IS OF CUERDAS IN CANE HARVESTED TO VARIOUS FACTORS OF FARM ORGANIZATION

186 farms, Southwestern Puerto Rico, 1942–43

Per cent cuerdas in plant-cane is of cuerdas in cane harvested		Number of farms	Cuerdas in cane harvested	Tons of cane harvested	Tons of sugar produced	Animal units	Per cent work-stock is of total animal units	Economic land class
Range	Average							
0	0	126	18.5	314	41.1	12.7	36	3.5
Less than 15	10	18	91.7	2,018	259.7	35.7	43	2.3
15–29	20	22	102.2	2,443	307.4	55.8	33	3.3
30 and over	45	20	135.6	3,989	505.1	100.3	43	2.4

Per Cent Cuerdas in Plant-Cane Is of Cuerdas in Cane Harvested

As was indicated before, the practice of renewing every year part of the cane by planting new cane is desirable from the point of view of yields. The extent to which a farmer carries on this practice may be an indication, besides other things, of the intensity with which he cultivates his sugar cane lands. In tables 86 to 88 presented below, it is attempted to show the relation of per cent cuerdas in plant-cane is of cuerdas in cane harvested to various factors of farm organization and functioning and to farm earnings. Only 186 farms found to grow sugar cane were included.

Various Factors of Farm Organization. The per cent that the cuerdas in new or plant-cane represented of the total cuerdas in cane harvested was related to various factors of farm organization. The results are presented in table 86.

The size of the farm business, as measured by cuerdas in sugar cane harvested, tons of sugar cane harvested, tons of sugar produced and animal

units, was found to increase consistently with increases in the per cent of the sugar cane harvested which was plant-cane. This means that the larger the farm, the more plant-cane they harvested. The larger the extent to which this practice is carried on, the larger the expenditures, as will be shown later. Therefore, this practice can better be afforded by the larger farmers who, generally, have a more solid economic position.

The extent to which this practice was carried on had nothing to do with the amount of work-stock available on the farms studied. This is shown by the fact that no relationship was found to exist between the extent to which this practice was carried on and the per cent of the total animal units accounted for by work-stock animals.

A very clear tendency was observed which indicated that the economic land class was lower as the practice of harvesting more plant-cane was intensified. In other words, the better the lands the more intensively this

TABLE 87. RELATION OF PER CENT CUERDAS IN PLANT-CANE IS OF CUERDAS IN CANE HARVESTED TO VARIOUS FARM EXPENSES

186 farms, Southwestern Puerto Rico, 1942–43

Per cent cuerdas in plant-cane is of cuerdas in cane harvested		Number of farms	Total expenses in hired labor	Per cent hired labor expenses in cane	Hired labor expenses in cane per cuerda	Hired labor expenses in cane per ton	Fertilizer costs per cuerda of cane
Range	Average						
			$		$	$	$
0	0	126	1,110	65	39	2.29	7
Less than 15	10	18	6,067	79	52	2.36	8
15–29	20	22	8,174	74	59	2.47	8
30 and over	45	20	14,803	72	78	2.65	8

practice was followed. Naturally, the better lands can stand, economically, more inputs per cuerda.

Various Farm Expenses. Table 87 shows the relation of per cent cuerdas in plant-cane is of cuerdas in cane harvested to various farm expenses.

The total expenses in hired labor were found to increase consistently with increases in the relative importance of the plant-cane harvested. No significant relationship was observed, however, between the per cent that the hired labor expenses in sugar cane represented of the total hired labor expenses, and the extent to which the practice of harvesting more plant-cane was intensified. Perhaps, a very slight tendency of being directly related was noticed, but the variations found cannot be considered significant. Both the hired labor expenses in sugar cane per cuerda and per ton of cane produced were found to increase with increases in the per cent of the total sugar cane acreage harvested which was plant-cane. This shows definitely that this practice is very closely associated with larger inputs per cuerda.

Although the fertilizer expenses per cuerda of cane harvested tended to increase, the differences found cannot be described as significant.

Rates of Production and Farm Earnings. Sugar cane yields were definitely found to increase with increases in the per cent of the total cane acreage harvested which was plant-cane (table 88).

The tons of sugar cane as well as of sugar produced per cuerda were found to increase consistently as the relative importance of the plant-cane harvested increased. As to the per cent sucrose content of cane, a very marked tendency to decrease was observed. It is perhaps advisable that further research on this observation should be undertaken.

Apparently the value of the additional tonnage of sugar cane which resulted from the practice of having higher proportions of the cane renewed, were not sufficiently high, beyond certain limits, to compensate economi-

TABLE 88. RELATION OF PER CENT CUERDAS IN PLANT-CANE IS OF CUERDAS IN CANE HARVESTED TO RATES OF PRODUCTION AND FARM EARNINGS

186 farms, Southwestern Puerto Rico, 1942–43

Per cent cuerdas in plant-cane is of cuerdas in cane harvested		Number of farms	Tons of cane per cuerda	Tons of sugar per cuerda	Per cent sucrose content of cane	Net farm cash income	Labor income	Labor earnings
Range	Average							
						$	$	$
0	0	126	17	2.2	13.10	1,726	1,125	1,526
Less than 15	10	18	22	2.8	12.87	8,718	6,376	6,975
15–29	20	22	24	3.0	12.58	8,328	4,790	5,442
30 and over	45	20	29	3.7	12.66	11,734	4,397	4,934

cally for the added costs of the larger inputs applied. The net farm cash income increased almost consistently with intensification of this practice; however, labor income and labor earnings did not show this same relationship. The lowest labor income and labor earnings were reported by the farms which did not follow this farm practice. The highest were reported by the group of farms which had up to 15 per cent of the cane harvested in plant-cane. Beyond this point substantial decreases in both labor income and labor earnings were recorded.

To conclude, the farm practice of increasing plant-cane acreage is apparently desirable from the point of view of yields, but its intensification is definitely limited to certain extents by economic considerations. Therefore, it is advisable that it be carefully followed.

Cuerdas in Available Pasture Per Grazing Livestock Unit

The number of cuerdas of pasture available for each unit of grazing livestock in the farms studied is, to a large extent, a measure of the intensity

with which the pasture lands were utilized in Southwestern Puerto Rico. It is also, though not exactly, an indication of the carrying capacity of the pastures of the area. In the tables 89 to 93 below, it is attempted to show how it is related to farm earnings and other factors of farm organization and operation.

TABLE 89. RELATION OF CUERDAS IN AVAILABLE PASTURE PER GRAZING LIVESTOCK UNIT TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in available pasture per grazing livestock unit		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Man equivalent	Total capital invested
Range	Average						
							$
Less than 1.0	0.7	77	31	24	17.1	3.5	7,187
1.0–1.9	1.7	60	121	57	40.0	7.8	26,388
2.0–2.9	2.4	52	140	62	34.1	7.0	20,973
3.0–3.9	3.5	29	223	59	35.7	8.0	34,479
4.0 and over	4.8	22	598	151	110.2	23.5	87,941

TABLE 90. RELATION OF CUERDAS IN AVAILABLE PASTURE PER GRAZING LIVESTOCK UNIT TO LAND USE

240 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in available pasture per grazing livestock unit		Number of farms	Economic land class	Per cent land arable	Per cent net area harvested is of total arable land	Cuerdas in sugar cane harvested	
						Per cent of total arable land	Per cent of net cuerdas harvested
Range	Average						
Less than 1.0	0.7	77	3.3	94	80	58	73
1.0–1.9	1.7	60	3.5	85	55	39	70
2.0–2.9	2.4	52	3.9	81	54	30	55
3.0–3.9	3.5	29	3.7	90	30	18	60
4.0 and over	4.8	22	4.2	93	27	20	73

Various Size Factors. It was definitely found that the larger the size of the farm business the larger the area they had in available pasture per grazing livestock unit kept on the farm (table 89).

The total farm acreage, the net cuerdas harvested, the cuerdas in sugar cane harvested, the number of men employed during the year, and the total capital invested, in general, increased consistently with increases in the number of cuerdas in available pasture per grazing livestock unit.

Land Use. The economic land class was found to increase consistently as the acreage of pasture available per grazing livestock unit increased (table 90). That is, the farms with the better lands were found to have less

pasture available per grazing animal unit than the farms located in the poorer lands. Very probably, the farmers found through experience that more profitable results could be obtained by cultivating better lands more intensively rather than leaving them in pasture for livestock raising.

The per cent of the farm acreage which was arable did not show any relationship with cuerdas in available pasture per grazing livestock unit. However, the proportion of that arable land which was cultivated showed a relation which indicated a marked tendency of decreasing with increases in the amount of pasture per grazing animal unit. Apparently this reason may explain the larger amount of arable land left in pasture and consequently the larger amount of pasture available per grazing livestock unit.

The per cent of the total arable land which was used in sugar cane was inversely related to the cuerdas in available pasture per grazing livestock

TABLE 91. RELATION OF CUERDAS IN AVAILABLE PASTURE PER GRAZING LIVESTOCK UNIT TO LIVESTOCK

240 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in available pasture per grazing livestock unit		Number of farms	Total animal units	Per cent grazing units	Per cent productive units	Per cent cow units is of productive units	Per cent investment in livestock	Average value per Productive unit
Range	Average							
								$
Less than 1.0	0.7	77	7.9	94	57	61	10	90
1.0–1.9	1.7	60	30.3	97	69	61	9	64
2.0–2.9	2.4	52	23.6	97	66	62	9	71
3.0–3.9	3.5	29	42.3	99	75	60	11	84
4.0 and over	4.8	22	83.5	99	50	65	6	64

unit. In other words, they decreased as the area in available pasture per grazing livestock unit increased. However, the per cent that the cuerdas in sugar cane harvested represented of the net cuerdas harvested showed no relationship with the amount of pasture available per grazing animal unit.

Livestock. Although the total animal units in the farms studied were found to increase as the amount of pasture available per grazing livestock unit increased, the per cent which was constituted by grazing livestock showed but a very slight tendency, if any, to increase. Practically no variation was found (table 91). The per cent of the total farm livestock which was classified as productive was not related to the cuerdas in available pasture per grazing livestock unit. Furthermore, the proportion of the productive animal units which was constituted by dairy cows showed also to have no relation. Just a very slight tendency for the per cent of the total farm capital accounted for by livestock to decrease as the area in pasture available per grazing animal unit increased, was observed. The same de-

creasing tendency was observed in the case of the average value per productive animal unit.

Use of Pasture Land. In table 92, the relation of cuerdas in available pasture per grazing livestock unit to use of pasture land is presented.

Both the total cuerdas in available pasture and in clear permanent pasture were found to show consistent increases with increases in the cuerdas in

TABLE 92. RELATION OF CUERDAS IN AVAILABLE PASTURE PER GRAZING LIVESTOCK UNIT TO USE OF PASTURE LAND

240 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in available pasture per grazing livestock unit		Number of farms	Cuerdas in available pasture			Cuerdas in clear permanent pasture	
Range	Average		Total	Per cent of total cuerdas in farm	Per cent of total arable land	Total	Per cent of available pasture.
Less than 1.0	0.7	77	6	18	19	4	67
1.0–1.9	1.7	60	49	40	47	44	90
2.0–2.9	2.4	52	54	39	47	49	91
3.0–3.9	3.5	29	148	66	74	122	82
4.0 and over	4.8	22	399	67	72	325	81

TABLE 93. RELATION OF CUERDAS IN AVAILABLE PASTURE PER GRAZING LIVESTOCK UNIT TO RATES OF PRODUCTION, LABOR EFFICIENCY AND FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Cuerdas in available pasture per grazing livestock unit		Number of farms	Quarts of milk per cow unit	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Gross income per man	Capital turnover	Labor income	Labor earnings
Range	Average									
						$	$		$	$
Less than 1.0	0.7	77	822	6.7	4.9	2,058	1,016	2.03	1,244	1,530
1.0–1.9	1.7	60	677	7.2	5.1	3,367	1,009	3.34	1,763	2,275
2.0–2.9	2.4	52	717	8.8	4.9	3,000	1,082	2.77	2,362	2,894
3.0–3.9	3.5	29	1,044	7.4	4.5	4,319	1,198	3.60	3,020	3,559
4.0 and over	4.8	22	756	6.4	4.7	3,741	1,186	3.16	3,052	3,659

available pasture per grazing livestock unit. However, the per cent of the total available pasture represented by the clear permanent pasture showed no indication of being related. On the other hand, the per cent that the area in available pasture represented of both the total farm acreage and of the total arable land, showed marked and definite tendencies to increase as the area in available pasture per grazing livestock unit increased. With no relative change in the amount of grazing livestock, as shown before, and an

increase in the relative amount of pasture, the logical result was, therefore, a larger acreage of available pasture per grazing animal unit.

Rates of Production, Labor Efficiency, and Farm Earnings. The relation of cuerdas in available pasture per grazing livestock unit to rates of production, labor efficiency, and farm earnings is presented in table 93.

No apparent relationships were found to exist between quarts of milk produced per cow unit and the cuerdas in available pasture per grazing livestock unit.

The labor efficiency, when measured in terms of net cuerdas harvested per man, and of cuerdas in sugar cane harvested per man, showed no relationship at all. A tendency to increase, however, was observed when it was measured in terms of both capital invested and gross income per man.

The capital turnover was found to show definite tendencies of increasing with increases in the cuerdas in available pasture per grazing livestock unit. That is, it takes less years for the gross receipts, which the farms with the lower acreages of available pasture per grazing livestock unit obtained in the crop year 1942–43, to equalize the total farm capital. Both labor income and labor earnings showed consistent increases with increases in the number of cuerdas of pasture available per unit of grazing stock. The farms with more pasture per grazing livestock unit were found to be larger in size; and therefore, the reasons which accounted for the larger returns on the larger farm businesses apply here, too.

Summary of Relation of Intensity of Land Use to Farm Earnings and Other Factors

In the preceding pages, the different relationships of intensity of land use to farm earnings and other factors were presented. Among several measures, only four, which were considered to be of more significance, were selected; namely, economic land class, per cent net cuerdas harvested is of total arable land, per cent cuerdas in plant-cane is of cuerdas in cane harvested and cuerdas in available pasture per grazing livestock unit. Many different relationships were found out of which some were considered to be more significant. A general summary of the most important findings is herewith presented:

1. The farms falling in the better land classes and which cultivated them more intensively were found to be larger in size.
2. The farms in the better lands were found to use less of the total arable land in crops, but the intensity with which the land in crops was used was larger as shown by the fact that they had relatively more sugar cane, more plant-cane, less secondary crops, less productive animals, and more farm machinery.
3. The farms in the poorer land classes were found to have relatively

more lands in pasture. Consequently, the relative importance of the livestock enterprise was larger for these farms.

4. Irrigation practices were carried on mostly by the farms located in the better lands.
5. Sugar cane yields were found to be higher for the farms falling in the better lands; however, these located in poorer lands showed to have better yields in the secondary crops grown.
6. Labor efficiency was also observed to be higher for the farms which used their lands more intensively, that is, those located in the better lands. The farms cultivating between 65 to 79 per cent of the total arable land led in labor efficiency. Beyond this point it decreased substantially.
7. The farms in the better lands were found to apply more inputs per cuerda, as shown by higher farm cash expenses, larger amounts of hired labor, and higher amounts of fertilizer used.
8. Sugar cane was a more important source of income for the farms with the better lands.
9. The farms on the lands which were used more intensively proved definitely to be financially more successful than those located in poorer lands.
10. The practice of increasing plant-cane acreage proved to be desirable from the point of view of yields, but its intensification is definitely limited to certain extents by economic considerations. The highest returns were obtained by the farms which had up to 15 per cent of the cane harvested in plant-cane.
11. Intensity of land use was not found to be related to age of operator.
12. Farms in the better land classes were found to be supporting larger farm population.
13. The farms in the better lands were consistently located at shorter distances from paved roads.
14. The farms located in the extreme land classes were found to have the lowest farm mortgage burden. This is due to the fact that the farmers in the best lands had a greater economic solidity, and those in the poorer land classes are not only very suspicious of long-term credit but also present greater risks to this type of agency.

Relation of Rates of Production to Farm Earnings and Other Factors

Another important factor affecting farm profits is rates of production. The general principle is that higher rates of production, within limits, bring higher returns. The reason is that it costs more per acre or per productive animal to obtain higher yields or production but not per unit of

output. Within the limits of farmers' practices, costs increase at slower rates than returns.

There are definite limits to yields. It should be kept in mind that farmers are dealing with living things and that weather conditions are beyond their control. Besides these physical limitations, there are also definite economic limitations. As an example is the principle of diminishing returns. As increasing amounts of one factor of production are added to a fixed quantity of other factors, the amount of product increases at a decreasing rate. Also profits increase at a decreasing rate until a point may be reached beyond which it is uneconomical to apply added quantities of a factor of production. Changes in the price of the product may cause this optimum point to fluctuate. It is also true that in agriculture, as well as in other industries, an item of cost cannot be increased without increasing some of the others.

Good land and good animals are very important in increasing yields; but the farmers' individual problem is to get the best proportion of the factors of production with which they are working such as price of product, price of land, productivity of the land, quality of the animals, cost of labor, price of feed, price of fertilizer, price of other cost items, the amount of money at his disposal, etc. He should also correct adverse conditions limiting yields by relatively cheap methods.

Tons of Sugar Cane per Cuerda

In tables 94 to 99 presented below, it is attempted to present the relation of tons of sugar cane per cuerda to farm earnings and various other factors. The fact that sugar cane was the leading crop in the area and that it was cultivated in the great majority of the farms studied makes of this factor an excellent measure of the rates of production of crops in the area studied. For the purpose of studying relationships only the information on the 186 farms which planted sugar cane during the crop year studied was included.

Various Size Factors. Tons of sugar cane produced per cuerda was found to be directly associated with size of business (table 94).

The size of the farms studied, as measured by total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, tons of sugar cane harvested, tons of sugar cane produced, man equivalent and total capital invested, increased consistently as the yield of sugar cane per cuerda increased.

Land Use and Other Factors. The farms with the higher yields of sugar cane per cuerda were found to be located in the better land classes (table 95). A very definite direct relationship was found between the two factors. That is, the farms with the better lands had the better yields.

No association was observed, however, between the per cent land arable and sugar cane yields. The proportion of the total arable land which was harvested showed, on the contrary, a marked tendency to decrease as the yields of cane increased. The farms with the higher sugar cane yields had consistently larger percentages of the net cuerdas harvested in sugar cane. In other words, they were specialized to a higher extent on sugar cane

TABLE 94. RELATION OF TONS OF SUGAR CANE PER CUERDA TO VARIOUS SIZE FACTORS

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane per cuerda		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Tons of sugar produced	Man equivalent	Total capital invested
Range	Average								
									$
10 and less	8	24	62	36	16.0	131	15.9	3.6	8,975
11–15	13	47	68	38	25.6	344	45.0	4.1	10,213
16–20	17	66	141	46	31.9	549	70.3	5.8	19,968
21–25	23	29	143	60	42.5	983	124.9	8.5	27,283
26 and over	31	20	638	229	201.1	6,265	798.3	37.4	134,870

TABLE 95. RELATION OF TONS OF SUGAR CANE PER CUERDA TO INTENSITY OF LAND USE AND OTHER FACTORS

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane per cuerda		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Per cent cuerdas in plant cane is of total cane	Per cent investment in machinery and equipment
Range	Average							
10 and less	8	24	4.0	92	63	44	10	5
11–15	13	47	3.6	93	59	68	6	3
16–20	17	66	3.3	84	38	70	16	4
21–25	23	29	2.8	90	46	71	21	3
26 and over	31	20	2.0	89	40	88	28	17

growing. These farms also showed definite tendencies of having relatively larger acreages of plant-cane. The farms with higher yields of sugar cane, in addition, were found to be mechanized to a larger extent. Therefore, better lands, more plant-cane and probably better cultivation practices aided by more and better machinery contributed largely to the higher yields.

Irrigation. In table 96 below, it is demonstrated that the farms with higher yields of sugar cane per cuerda practiced irrigation to a larger extent than those which had lower yields of cane.

The investment in irrigation equipment, as well as the acreage of sugar cane irrigated was found to be larger, both expressed in absolute and relative amounts, for the farms with higher yields of sugar cane per cuerda. This fact is an additional reason which accounted for the higher yields of cane obtained.

TABLE 96. RELATION OF TONS OF SUGAR CANE PER CUERDA TO IRRIGATION

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane per cuerda		Number of farms	Investment in irrigation equipment				Cuerdas of sugar cane irrigated		
Range	Average		Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
10 and less	8	24	20	1	53	0.2	0.4	0.6	2.3
11–15	13	47	0	0	0	0.0	0.0	0.0	0.0
16–20	17	66	115	4	28	0.6	4.2	3.5	13.0
21–25	23	29	99	2	14	0.4	6.9	5.3	16.2
26 and over	31	20	14,792	74	105	11.0	140.4	24.7	69.8

TABLE 97. RELATION OF TONS OF SUGAR CANE PER CUERDA TO OTHER RATES OF PRODUCTION AND LABOR EFFICIENCY

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane per cuerda		Number of farms	Tons of sugar per cuerda	Per cent sucrose content of cane	Tons of cane per man	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Gross income per man
Range	Average								
								$	$
10 and less	8	24	1.0	12.09	36	9.9	4.4	2,465	733
11–15	13	47	1.8	13.06	84	9.2	6.3	2,500	929
16–20	17	66	2.2	12.81	95	7.9	5.5	3,443	1,071
21–25	23	29	2.9	12.70	115	7.0	5.0	3,192	1,197
26 and over	31	20	4.0	12.74	168	6.1	5.4	3,608	1,258

Other Rates of Production and Labor Efficiency. Thus tons of sugar produced per cuerda were found to increase consistently as the tons of sugar cane per cuerda increased (table 97). This was solely the effect of higher tonnage since no relationship was found between tons of sugar cane per cuerda and the per cent sucrose content of cane.

The labor efficiency, measured in terms of tons of sugar cane per man, capital invested per man and gross income per man, in general was found to increase consistently as the yields of sugar cane per cuerda increased. However, when it was expressed in terms of net cuerdas harvested per man,

consistent decreases were observed with increases in the tons of sugar cane per cuerda. The number of cuerdas in sugar cane harvested per man showed no relationship with sugar cane yields. In general it may be concluded that labor efficiency, measured in outputs per man, was higher for the farms with higher yields of sugar cane per cuerda.

Farm Expenses. The total expenses in hired labor were found to increase consistently with increases in the tons of sugar cane per cuerda (table 98). However, the per cent represented by hired labor expenses in sugar cane increased consistently up to the group of farms which had yields of cane ranging between 21 to 25 tons per cuerda. Beyond this point a substantial decrease was observed.

The hired labor expenses in sugar cane per cuerda of cane harvested were found to increase consistently as yield of cane per cuerda increased. When

TABLE 98. RELATION OF TONS OF SUGAR CANE PER CUERDA TO FARM EXPENSES

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane per cuerda		Number of farms	Total expenses in hired labor	Per cent hired labor expenses in cane	Hired labor expenses in cane per cuerda	Hired labor expenses in cane per ton	Fertilizer costs per cuerda of cane
Range	Average						
			$		$	$	$
10 and less	8	24	862	48	26	3.17	4
11–15	13	47	1,208	70	33	2.45	6
16–20	17	66	2,029	71	45	2.62	8
21–25	23	29	2,444	97	56	2.41	7
26 and over	31	20	20,688	60	76	2.45	10

they were expressed in terms of per unit of production the reverse relationship was observed. That is, the hired labor expenses in sugar cane per tone of cane harvested were found to indicate a definite marked tendency of decreasing with increases in yields of cane. In other words, it costs more per cuerda to obtain higher yields of sugar cane but not per ton produced. Fertilizer expenses per cuerda of cane harvested were also found to increase with increases in sugar cane yields. These larger applications of fertilizer and of other inputs, together with better lands, more plant-cane, more mechanization, and more irrigation, were mainly responsible for the higher tonnage of sugar cane per cuerda obtained.

Farm Earnings. The higher the tonnage of sugar cane per cuerda, the higher the farm earnings of the farms studied (table 99).

The return on capital of the farms studied showed consistent increases with increases in sugar cane yields. However, when it was expressed in terms of a per cent of the total farm capital the increases did not show to

be consistent. The per cent return on capital increased with sugar cane yields up to the group of farms which ranged between 21 to 25 tons of sugar cane per cuerda. Beyond this point a substantial decrease was observed for the group of farms which had yields above 25 tons of sugar cane per cuerda. The capital turnover tended to decrease as the yields of sugar cane increased.

Net farm cash income, labor income and labor earnings were intimately related with sugar cane yields. They showed consistent increase with increases in the tons of sugar cane produced per cuerda.

To summarize, farm earnings from the point of view of capital investment, were found to be limited by sugar cane yields up to certain extents beyond which it was uneconomical to continue increasing yields. On the other hand, from the standpoint of the operator's return there was, apparently, no limitation found within the extent of the sugar cane yields obtained by the farms studied.

TABLE 99. RELATION OF TONS OF SUGAR CANE PER CUERDA TO FARM EARNINGS

186 farms, Southwestern Puerto Rico, 1942–43

Tons of sugar cane per cuerda		Number of farms	Return on capital	Per cent return on capital	Capital turn over	Net farm cash income	Labor income	Labor earnings
Range	Average							
			$			$	$	$
10 and less	8	24	788	8.8	3.36	1,252	670	1,094
11–15	13	47	1,309	12.8	2.69	1,651	1,093	1,506
16–20	17	66	2,379	11.9	3.21	2,460	1,626	2,120
21–25	23	29	4,692	17.2	2.67	5,095	3,534	3,975
26 and over	31	20	15,922	11.8	2.87	18,725	8,632	9,198

Crop Index

A crop index was calculated to measure the yields per cuerda of crops other than sugar cane. The farms studied were grouped according to their crop index and its relationship to farm earnings and other factors was studied. The results found are presented below in tables 100 to 105.

Various Size Factors. No consistent relationship was observed between crop index (excluding sugar cane) and size of business (table 100).

It was observed, however, that the largest farms, as measured by total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, total animal units, man equivalent and total capital invested, had the lowest crop index. In general the other groups of farms studied were, on the average, of almost the same size.

Crop index, as calculated, measured only the yields of the secondary

crops in the area. As stated before, the largest farms were highly specialized in sugar cane growing and planted secondary crops mostly to qualify for the Agricultural Adjustment Administration payments. In many cases, these crops were abandoned right after government inspection. Consequently, yields were lower than those obtained by smaller farms which depended more on them as a source of direct income.

TABLE 100. RELATION OF CROP INDEX (EXCLUDING SUGAR CANE) TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Crop index (excluding sugar cane)		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Total animal units	Man equivalent	Total capital invested
Range	Average							
								$
Less than 50	27	35	498	135	113.7	88.1	22.3	83,889
50– 74	63	40	94	45	27.8	15.6	5.8	15,998
75– 99	86	50	79	40	20.8	15.0	4.4	13,754
100–124	111	33	90	44	24.2	16.4	5.5	13,524
125–149	136	31	151	47	25.6	29.5	6.3	22,261
150–174	159	22	67	39	26.5	12.0	5.0	16,836
175 and over	215	29	82	40	22.1	18.3	4.7	13,497

TABLE 101. RELATION OF CROP INDEX (EXCLUDING SUGAR CANE) TO LAND USE

240 farms, Southwestern Puerto Rico, 1942–43

Crop index (excluding sugar cane)		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent total area harvested net	Per cent net harvested land in cane	Per cent total harvested land in tobacco, cotton and corn
Range	Average							
Less than 50	27	35	2.9	87	31	94	84	11
50– 74	63	40	3.8	93	51	77	62	38
75– 99	86	50	4.0	84	61	84	52	36
100–124	111	33	3.7	93	53	83	55	32
125–149	136	31	3.7	91	34	84	54	35
150–174	159	22	3.8	93	62	86	68	22
175 and over	215	29	3.2	90	53	85	56	32

Land Use. In table 101 it was attempted to present the relationships between crop index (excluding sugar cane) and land use.

No consistent relationship was observed to exist between crop index and economic land class. However, the farms with the lowest crop index were found to be located in the better land classes. They cultivated the lowest percentage of the total arable land and practiced intercropping and doublecropping to the least extent. They were also found to have the

largest proportion of their net cuerdas in crops planted in sugar cane. On the contrary, they had relatively the smallest acreage in the secondary crops. The other groups of farms studied did not show much variation as to quality of the lands in which they were located and its use.

Farm expenses and Receipts. In general, no consistent relationship was observed between crop index (excluding sugar cane) and farm expenses and receipts (table 102).

The farms with the lowest crop index had the largest expenses per net cuerda harvested. They specialized more in sugar cane which requires larger expenditures per cuerda. The other farms did not show much variation between themselves. The per cent that expenses in hired labor represented of total farm cash expenses showed no relation with crop index.

TABLE 102. RELATION OF CROP INDEX (EXCLUDING SUGAR CANE) TO VARIOUS FARM EXPENSES AND RECEIPTS

240 farms, Southwestern Puerto Rico, 1942–43

Crop index (excluding sugar cane)		Number of farms	Farm cash expenses per net cuerda harvested	Per cent expenses in hired labor is of total cash expenses	Per cent income from crop sales	Per cent income from cane sales	Per cent income from tobacco, cotton and corn
Range	Average						
			$				
Less than 50	27	35	120	73	68	67	1
50– 74	63	40	64	69	67	58	9
75– 99	86	50	48	63	63	44	17
100–124	111	33	60	62	61	42	17
125–149	136	31	66	68	53	37	14
150–174	159	22	66	73	75	64	9
175 and over	215	29	59	65	62	42	15

The per cent that crop sales constituted of the farm gross receipts was not related to crop index. In fact, it did not show much variation, on the average, among the different groups of farms studied. A very clear tendency for the farms with the higher crop index to derive less of their gross income from sugar cane was observed. On the other hand, they depended to a larger extent on the income derived from tobacco, cotton and corn. A marked tendency corroborating this finding was observed.

Labor Efficiency. No relationship was found between crop index (excluding sugar cane) and labor efficiency (table 103).

When labor efficiency was measured in terms of net cuerdas harvested per man and cuerdas in sugar cane harvested per man, no relationship with crop index was found. Both the capital invested and the gross income per man showed no relationship with crop index. However, the group of farms with the lowest crop index had the highest labor efficiency, as meas-

ured by these two factors. The return on labor per man, indicated a tendency to increase with increases in the crop index. The relationship found, however, cannot be considered very significant.

Farm Earnings. Crop index (excluding sugar cane) was not found to be related to farm earnings (table 104).

TABLE 103. RELATION OF CROP INDEX (EXCLUDING SUGAR CANE) TO LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Crop index (excluding sugar cane)		Number of farms	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average						
					$	$	$
Less than 50	27	35	6.0	5.1	3,760	732	1,201
50– 74	63	40	7.8	4.8	2,768	766	1,024
75– 99	86	50	9.3	4.8	3,159	693	978
100–124	111	33	8.0	4.4	2,458	669	925
125–149	136	31	7.5	4.1	3,554	732	1,036
150–174	159	22	7.7	5.3	3,349	761	1,064
175 and over	215	29	8.5	4.7	2,895	876	1,163

TABLE 104. RELATION OF CROP INDEX (EXCLUDING SUGAR CANE) TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Crop index (excluding sugar cane)		Number of farms	Capital turnover	Return on labor	Net farm cash income	Labor income	Labor earnings
Range	Average						
				$	$	$	$
Less than 50	27	35	3.13	16,340	9,571	4,012	4,518
50– 74	63	40	2.70	4,430	2,838	1,851	2,283
75– 99	86	50	3.23	3,018	2,035	1,325	1,764
100–124	111	33	2.66	3,682	2,133	1,433	1,931
125–149	136	31	3.43	4,584	3,048	1,842	2,376
150–174	159	22	3.15	3,825	2,557	1,520	1,868
175 and over	215	29	2.49	4,084	2,855	2,088	2,495

When farm earnings were measured in terms of capital turnover, no relationship with crop index was found to exist. It was only observed that the group of farms with the lowest crop index had the highest capital turnover while those with the highest crop index had the lowest.

The return on labor, net farm cash income, labor income and labor earnings of the farms studied were not found to be related to crop index. The farms with the lowest crop index, however, had consistently the highest farm earnings as measured by these four factors. For the other groups of farms they did not vary too much.

Farm Mortgage Indebtedness and Other Factors. In table 105 the relationship of crop index (excluding sugar cane) to farm mortgage indebtedness and other factors is presented.

Crop index, age of operator and farm population were not found to be related. However, the population of the farms with the lowest crop index was found to be the largest. Although no relationship was found to exist between crop index and distance of farm to nearest paved road, it was observed that the farms near the extremes in crop index were located at shorter distances.

No relationship was also found between crop index (excluding sugar cane) and the mortgage burden of the farms studied. When the total

TABLE 105. RELATION OF CROP INDEX (EXCLUDING SUGAR CANE) TO FARM MORTGAGE INDEBTEDNESS AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Crop index (excluding sugar cane)		Number of farms	Age of operator	Farm population	Distance to nearest paved road (kms.)	Farm mortgage indebtedness		
Range	Average					Total	Per total cuerda in farm	Per cent of total capital
						$	$	$
Less than 50.	27	35	53	53	0.6	1,629	3	2
50– 74.....	63	40	46	17	0.8	1,509	16	9
75– 99.....	86	50	50	17	1.4	1,042	13	8
100–124.....	111	33	48	22	1.0	867	10	6
125–149.....	136	31	53	22	0.9	1,702	11	8
150–174.....	159	22	48	14	0.7	930	14	6
175 and over	215	29	44	17	0.9	579	7	4

farm mortgage indebtedness was expressed per total cuerda in farm or as a per cent of the total farm capital, it was found that the farms at the extremes of the crop index had the lowest farm mortgage burden. The relationships, however, were not consistent nor significant.

Summary of Relation of Rates of Production to Farm Earnings and Other Factors

Rates of production, as measured by tons of sugar cane produced per cuerda, were found to be very influential on the farm earnings of the farms studied in Southwestern Puerto Rico. The yields of the secondary crops, as measured by crop index (excluding sugar cane) proved to be no deciding factor on the profitableness of the farms surveyed. As shown before, sugar cane accounted for nearly nine-tenths of the total crop sales of the farms under study. It was also by far the most important crop grown in the area from the point of view of acreage. This fact explains why tons

of sugar cane per cuerda were found to be of such a great influence in determining the success of the farms in Southwestern Puerto Rico. Furthermore, it also explains why the rates of production of the secondary crops bore no relationship to farm earnings.

It is attempted below to summarize the most important relationships found to exist between tons of sugar cane per cuerda, farm earnings and other factors.

1. The larger sized farms had the better yields of sugar cane per cuerda.
2. The farms located in the better land classes were found to have the higher yields of sugar cane.
3. The farms with higher yields of sugar cane had relatively larger acreages of sugar cane and harvested higher percentages of plant-cane.
4. The farms with higher sugar cane yields were found to be mechanized to a larger extent, which indicates that very probably better cultivation practices were carried on by these farms.
5. Irrigation practices were found to be carried on to larger extents by the farms with the higher yields of cane.
6. Labor efficiency, when measured in terms of output per man, was higher for the farms with higher yields of sugar cane per cuerda.
7. It cost more per cuerda to produce higher yields of sugar cane but not per ton of cane produced. That is, the value of the inputs applied per cuerda were found to be higher for the farms with higher yields of sugar cane, but resulted lower when expressed in terms of per ton of cane produced.
8. Better lands, more plant-cane harvested, better cultivation resulting from higher mechanization, more irrigation practiced and higher inputs per cuerda including heavier applications of fertilizer, were mainly responsible for the higher yields of sugar cane obtained.
9. The higher the tonnage of sugar cane per cuerda, the higher the operator's returns were found to be. From the point of view of capital investment, however, farm earnings were found to be limited by sugar cane yields up to certain extents beyond which it proved to be uneconomical to continue increasing yields.

Relation of Labor Efficiency to Farm Earnings and Other Factors

The efficiency with which labor is used in a farm is very influential in its success or failure. Labor is the most important single cost in farming. Its importance has been and will continue increasing with passing time. Cost of living, in general, as well as the standard of living of laborers has been consistently increasing. It is, therefore, very logical to expect increasing pressure on the part of laborers from higher and higher wages. Farm laborers are no exception.

This increasing importance of labor cost in farming demands corresponding increases in the output per worker in agriculture. Farms must keep pace with this increased efficiency in the use of labor. Otherwise, if they cannot go with this trend, they will be forced out of business and others will have to do the job, if they can.

Working more efficiently does not mean working longer hours. On the contrary, it means more and better work done per man, higher output units per man, higher returns per man. Labor efficiency is very tied up to size of business. The larger the size within certain economic limits, the more efficient the farm labor can be used. Of no less importance also are other factors such as good labor distribution, use of well-established machinery, use of modern methods of communication and transportation, good farm layout and buildings arrangement, good planning and timing of the work to be done, and good labor management. Farms need to watch out for these factors carefully in order to achieve higher labor efficiency and, consequently have a more successful farm business.

Labor efficiency on a farm may be measured either in terms of cuerdas and number of animals cared for per man or in terms of the quantity produced per man. Usually, the first method is used and the latter, which involves rates of production, is discarded in view of the fact that it is easier to measure rates of production separately. In the case of the farms studied in Southwestern Puerto Rico, it was preferred to measure labor efficiency in terms of gross income per man. It was considered the fact that the study was covering an entire region which included different types of farm businesses. In the absence of such good measures as productive man work units per man or output units per man, it was believed that gross income per man would serve better the purpose of comparing, on equal basis, the different farms studied in the whole region.

Farm Gross Income per Man

The relation of gross income per man, as a measure of labor efficiency, to farm earnings and other factors of farm organization and functioning is presented in tables 106 to 111 which follow.

Various Size Factors. The relation of farm gross income per man to various size factors is shown in table 106.

As the gross income per man increased, size of business, as measured by total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, total animal units and total capital invested, increased consistently up to the group of farms which had gross income per man ranging from $1200 to $1400. The farms above, which had gross income per man of $1400 and over, were found to be smaller than the previously-mentioned farms. In other words, the farms with the highest labor efficiency were

not the largest in size. As indicated before, labor efficiency is very tied up with size of business. Within certain economic limits, labor efficiency and size of business are directly associated. However, beyond those limits, it may decrease with increases in size. This is the point which individual

TABLE 106. RELATION OF FARM GROSS INCOME PER MAN TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Gross income per man		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Total animal units	Man equivalent	Total capital invested
Range	Average							
$	$							$
Less than 400...	282	35	24	11	2.5	5.7	2.3	2,863
400– 599.....	516	42	27	13	5.3	7.0	2.4	4,060
600– 799.....	703	43	110	36	11.5	19.3	4.2	11,377
800– 999.....	913	41	118	52	26.9	23.2	6.4	18,412
1000–1199.....	1,051	25	203	82	65.0	51.7	3.7	43,832
1200–1399.....	1,271	22	517	175	150.4	70.1	26.4	95,127
1400 and over...	1,609	32	270	92	66.0	30.8	9.6	45,578

TABLE 107. RELATION OF FARM GROSS INCOME PER MAN TO LAND USE

240 farms, Southwestern Puerto Rico, 1942–43

Gross income per man		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent total area harvested net	Per cent net harvested land in cane	Per cent total harvested land in tobacco, cotton and corn
Range	Average							
$	$							
Less than 400..	282	35	4.5	88	53	69	22	65
400– 599.....	516	42	4.1	89	56	82	39	50
600– 799.....	703	43	3.8	77	42	78	32	50
800– 999.....	913	41	3.2	91	49	81	52	39
1000–1199.....	1,051	25	3.3	84	48	86	79	18
1200–1399.....	1,271	22	3.3	93	36	95	86	9
1400 and over..	1,609	32	2.7	90	38	89	72	17

farms or governmental agencies in charge of land tenure policies should watch carefully.

Land Use. Labor efficiency, as measured by gross income per man, was found to be higher for the farms which were located on better land classes (table 107). That is, the farms with the better land used labor more efficiently.

The proportion of the total farms acreage classified as arable showed no

relationship with labor efficiency. On the other side, it was found that the per cent of the total arable land which was harvested showed a tendency to decrease as the labor efficiency increased. The extent to which double-cropping and intercropping was followed on the farms had nothing to do with the efficiency in the use of labor. A very marked tendency for the farms with the larger gross income per man to have a higher percentage of the net cuerdas harvested in sugar cane, was observed. Conversely, the relative importance of tobacco, cotton and corn, form the point of view of acreage, tended to decrease with increases in labor efficiency.

TABLE 108. RELATION OF FARM GROSS INCOME PER MAN TO VARIOUS FARM EXPENSES AND RECEIPTS

240 farms, Southwestern Puerto Rico, 1942–43

Gross income per man		Number of farms	Total cash expenses per net cuerda harvested	Per cent expenses in hired labor is of total cash expenses	Per cent income from crop sales	Per cent income from cane sales	Per cent cane sales is of total crop sales	Per cent income from tobacco, cotton and corn sales
Range	Average							
$	$		$					
Less than 400..	282	35	30	60	62	21	34	41
400– 599.....	516	42	42	58	59	30	51	27
600– 799.....	703	43	44	64	61	29	47	29
800– 999.....	913	41	60	66	58	39	67	17
1000–1199.....	1,051	25	102	71	64	60	94	3
1200–1399.....	1,271	22	115	73	72	70	97	2
1400 and over..	1,609	32	71	67	60	52	87	5

Various Farm Expenses and Receipts. In table 108 it is attempted to present the relation of farm gross income per man, as a measure of labor efficiency, to various farm expenses and receipts.

In general, the inputs applied per net cuerda harvested, as measured by the total farm cash expenses, were found to be larger for the farms with a larger labor efficiency. The farms having the largest labor efficiency, however, did not apply the larger inputs per net cuerda harvested. The same group of farms which had from $1200 to $1400 in gross income per man reported, on the average, the largest amount of cash expenditures per net cuerda harvested. These farms were also found to have the largest percentage of the total farm cash expenses represented by expenses in hired labor.

The importance of crop sales as a source of income in the farms studied was found to bear no relationship at all with labor efficiency. In fact, very little variations were observed, on the average, among all groups of farms

studied. It was observed, however, that the farms which ranged between $1200 and $1400 in gross income per man had the highest per cent income from crop sales. These farms also had the largest per cent income from sugar cane sales, but the lowest per cent income from tobacco, cotton and corn sales. The per cent income from sugar cane sales showed marked tendencies to increase with increases in labor efficiency, up to that group of farms, and, thereupon showed a substantial decline. The relative importance of tobacco, cotton and corn as a source of income, on the contrary, showed tendencies of decreasing with labor efficiency increases down to the same group of farms, and then, showed an increase.

TABLE 109. RELATION OF FARM GROSS INCOME PER MAN TO VARIOUS OTHER LABOR EFFICIENCY FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Gross income per man		Number of farms	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Return on labor per man
Range	Average					
$	$				$	$
Less than 400	282	35	5.0	1.1	1,264	258
400– 599	516	42	5.7	2.2	1,715	402
600– 799	703	43	8.4	2.7	2,685	490
800– 999	913	41	8.2	4.2	2,893	628
1000–1199	1,051	25	6.0	4.8	3,207	708
1200–1399	1,271	22	6.6	5.7	3,609	788
1400 and over	1,609	32	9.5	6.9	4,737	1,149

Various Other Labor Efficiency Factors. Other measures of labor efficiency were related to farm gross income per man and the results are presented in table 109.

Net cuerdas harvested per man were not consistently related with gross income per man, but the relationship found indicated a definite tendency for both to increase together. Cuerdas in sugar cane harvested per man, capital invested per man and returns on labor per man were found to be very closely associated. They all showed consistent increases as the gross income per man increased.

Farm Earnings. Labor efficiency was found to have a very direct influence on farm earnings (table 110).

The capital turnover of the farms studied showed a clear tendency to decrease with increases in labor efficiency. The farms ranging from $1200 to $1400 in gross income per man had the lowest capital turnover.

The return on labor and net farm cash income increased with increases in labor efficiency, as measured by gross income per man. Again, the farms

which reported having, on the average, gross income per man ranging from $1200 to $1400 had the largest return on labor and net farm cash income.

Both labor income and labor earnings were very closely related with labor efficiency. As the efficiency in the use of labor increased, labor income and labor earnings showed very consistent increases.

TABLE 110. RELATION OF FARM GROSS INCOME PER MAN TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Gross income per man		Number of farms	Capital turn-over	Return on labor	Net farm cash income	Labor income	Labor earn-ings
Range	Average						
$	$			$	$	$	$
Less than 400	282	35	4.48	583	241	−72	229
400– 599	516	42	3.32	952	519	218	517
600– 799	703	43	3.82	2,077	1,166	485	978
800– 999	913	41	3.17	3,993	2,299	1,406	1,892
1000–1199	1,051	25	3.05	9,676	5,430	3,194	3,674
1200–1399	1,271	22	2.84	20,780	11,467	5,377	6,034
1400 and over	1,609	32	2.94	11,053	8,018	6,119	6,704

TABLE 111. RELATION OF FARM GROSS INCOME PER MAN TO FARM MORTGAGE INDEBTEDNESS AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Gross income per man		Number of farms	Age of operator	Farm popu-lation	Distance to near-est paved road (kms.)	Farm mortagge indebtedness		
Range	Average					Total	Per total cuerda in farm	Per cent of total captal
$	$					$	$	
Less than 400	282	35	55	16	1.3	0	0	0
400– 599	516	42	53	15	1.1	234	9	6
600– 799	703	43	48	28	1.0	830	8	7
800– 999	913	41	48	18	0.9	1,367	12	7
1000–1199	1,051	25	49	23	0.6	1,082	5	2
1200–1399	1,271	22	43	39	0.8	3,278	6	3
1400 and over	1,609	32	44	33	0.7	2,730	10	6

Farm Mortgage Indebtedness and Other Factors. In table 111, farm mortgage indebtedness and other factors were related with labor efficiency, as measured by farm gross income per man.

A tendency for the age of the operator to be lower from the farms which had a higher labor efficiency was observed. Apparently, younger farmers were able to use labor more efficiently. The population of the farms with higher gross income per man were also found to be larger in size. Fur-

thermore, the farms which reported having a higher labor efficiency were located closer to paved roads.

Although the total farm mortgage indebtedness showed tendencies of being larger for the farms of higher gross income per man, no relationship was found to exist when it was expressed in terms of per total cuerdas in farm, or as a per cent of the total farm capital. Only a tendency for the farm having the extreme labor efficiency to have the lowest farm mortgage burden was observed. This same tendency has been previously noticed and explained.

Summary of Relation of Labor Efficiency to Farm Earnings and Other Factors

The following were the most important relationships found between labor efficiency, as measured by farm gross income per man, to farm earnings and other factors.

1. The higher the labor efficiency the larger the size of farm business was found to be. However, the very largest farms did not have the highest labor efficiency.
2. Labor was utilized more efficiently in the farms located in the better lands.
3. Labor efficiency bore no relationship to the amount of doublecropping and intercropping carried on in the farms studied.
4. The farms with higher percentages of the net cuerdas harvested in sugar cane had a higher labor efficiency.
5. In general, the inputs applied per net cuerda harvested were found to be larger for the farms with a larger labor efficiency. The farms with the lagest labor efficiency, however, did not apply the largest inputs per cuerda.
6. Sugar cane sales was a more important source of income for the farms with a larger labor efficiency. The importance of crop sales as a source of income was found to bear no relationship at all to labor efficiency.
7. Labor efficiency was found to have a very distinct and direct influence on farm earnings. The higher the labor efficiency the larger the farm earnings.
8. Younger farm operators were found to use labor more efficiently than the older ones.
9. The farm population was larger in the farms where labor was utilized more efficiently.
10. The farms which had higher labor efficiency were found to be located closer to paved roads.

11. No apparent relationship existed between labor efficiency and farm mortgage burden, except a tendency for the farms with the extreme efficiency in the use of labor to have the lowest mortgage burden.

Relation of Combination of Enterprises to Farm Earnings and Other Factors

The problem of selecting and combining the enterprises on a farm is chiefly the concern of the individual farmer. It is true that the general tendency in agriculture, as well as in manufacturing enterprises, is towards specialization. But nobody can tell whether a specialized or a diversified farm pays better. No general rules can be established. A combination which is best for one farm, under one set of conditions, may be entirely wrong on another farm under another set of conditions. It depends on the conditions under which the farmer is operating. The problem is one of adaptation to conditions.

In selecting the best combination of enterprises for an individual farm the first thing to be determined is the relative profits from the different enterprises best adapted to the farm. The adaptation depends primarily on their requirements of climate, soils, topography and markets. To combine the adapted enterprises into a good business, other factors have to be considered such as a good labor distribution, the best utilization of the tillable and untillable lands, the best utilization of by-products, the maintenance of farm productivity, the rotation practices to be followed, the amount of risk involved in different enterprises, the desirability of a good distribution of income during the year, the best use of buildings and machinery, the amount of capital available, and, to some extent, the type of farming of the neighbors. Personal preferences or prejudices should be considered after all others.

In general, it could be said that wherever two or more enterprises are found to be about equally profitable, a diversified farm business is most desirable. But where there is one enterprise which is far more profitable than any other, a specialized business is desirable.

In Southwestern Puerto Rico there exists an apparent specialization in sugar cane growing. In the following pages we attempt to describe the extent to which this type of specialization contributed to the success of the farms studied in the area during the crop year 1942–43. Several factors, measuring the importance of the sugar cane enterprise in the farms surveyed were related to farm earnings and other factors of organization and operation; namely, per cent area in sugar cane is of total cuerdas harvested, per cent income from sugar cane, and per cent sales of sugar cane is of total crop sales. The most important findings are presented below.

Per Cent Area in Sugar Cane Is of Total Cuerdas Harvested

The relation of per cent area in sugar cane is of total cuerdas harvested to farm earnings and other factors is presented in tables 112 to 117 which follow. They will give an idea of the influence of relatively larger sugar cane acreages on the financial success of the farmers in Southwestern Puerto Rico.

Various Size Factors. Sugar cane specialization, as measured by the proportion that the sugar cane acreage was of the total cuerdas harvested, showed tendencies to be related with size of business (table 112). Although no general consistent relationships were found, definite tendencies for size of business to increase together with the per cent area in sugar cane is of total cuerdas harvested were observed.

TABLE 112. RELATION OF PER CENT AREA IN SUGAR CANE IS OF TOTAL CUERDAS HARVESTED TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent area in sugar cane is of total cuerdas harvested		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Tons of sugar produced	Man equivalent	Total capital invested
Range	Average								
									$
0	0	54	105	28	0.0	0	0.0	3.6	12,222
Less than 40	18	28	145	49	10.9	169	21.2	5.1	15,971
40–54	46	35	89	50	26.3	405	53.2	4.9	15,477
55–69	63	42	54	32	24.1	408	52.0	4.0	10,171
70–84	80	52	234	73	62.4	1,376	178.6	11.5	42,779
85 and over	93	29	322	127	119.6	3,509	441.2	20.1	64,183

Size of business was measured in this case by total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, tons of sugar cane harvested, tons of sugar produced, man equivalent and total capital invested. Only the tons of sugar cane harvested showed consistent increases in sugar cane acreage.

Land Use and Other factors. In general, the farms with relatively larger acreages in sugar cane had the better lands, as indicated by the economic land class (table 113). However, no relationship was observed between the per cent of the farm acreage which was arable and sugar cane specialization. No relationship was also found to exist between the per cent of the total arable land which was harvested and the relative importance of sugar cane acreage.

The farms with larger acreages of sugar cane were found to be mechanized to a larger extent than those with relatively less sugar cane, as shown by the fact that they had consistently larger investments in machinery and equipment per net cuerda harvested. When the total farm capital was

expressed in terms of per cuerda of arable land, consistent increases with increases in the relative importance of the sugar cane acreage were observed. In other words, the better lands could support economically larger investments per cuerda.

TABLE 113. RELATION OF PER CENT AREA IN SUGAR CANE IS OF TOTAL CUERDAS HARVESTED TO LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent area in sugar cane is of total cuerdas harvested		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Equipment investment per cuerda harvested	Total capital invested per cuerda of arable land
Range	Average						
						$	$
0	0	54	4.9	90	30	9	129
Less than 40	18	28	3.7	74	46	8	150
40–54	46	35	3.4	89	63	10	197
55–69	63	42	3.8	93	64	19	203
70–84	80	52	3.1	88	35	29	208
85 and over	93	29	2.0	94	42	108	212

TABLE 114. RELATION OF PER CENT AREA IN SUGAR CANE IS OF TOTAL CUERDAS HARVESTED TO IRRIGATION

240 farms, Southwestern Puerto Rico, 1942–43

Per cent area in sugar cane is of total cuerdas harvested		Investment in irrigation equipment					Cuerdas in sugar cane irrigated		
Range	Average	Number of farms	Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
0	0	54	0	0	0	0.0	0.0	0.0	0.0
Less than 40	18	28	17	2	20	0.1	0.9	0.8	7.9
40–54	46	35	3	*	*	†	0.0	0.0	0.0
55–69	63	42	75	3	144	0.7	0.5	1.0	2.2
70–84	80	52	588	9	28	1.4	21.0	10.2	33.6
85 and over	93	29	9,396	79	126	14.6	74.3	24.5	62.1

* Less than $0.50.

† Less than 0.05 per cent.

Irrigation. In table 114, the relation of per cent area in sugar cane is of total cuerdas harvested to irrigation is presented.

Definitely it was corroborated that the farmers who had relatively harvested more sugar cane owned practically all the irrigation equipment and practiced almost all the irrigation which was carried on in the farms studied. They also irrigated larger percentages of their sugar cane land.

Rates of Production and Labor Efficiency. Rates of production, as measured by tons of sugar cane per cuerda and tons of sugar produced per cuerda,

were in general consistently higher for the farms with relatively larger acreages in sugar cane (table 115).

The degree of efficiency in the utilization of labor was found to be higher on the farms with larger percentages of their total cuerdas harvested in sugar cane. The tons of sugar cane produced per man as well as the gross income per man showed consistent increases with increases in the per cent that the area in sugar cane was of the total cuerdas harvested.

The farms with the largest net acreage harvested per man were found to be those which had between 40 to 54 per cent of their total cuerdas harvested in sugar cane. Beyond this point, consistent decreases were observed. The same thing happened in the case of cuerdas in sugar cane harvested per man. The farms which had from 55 to 69 per cent of the total crop acreage in sugar cane were the ones to report the largest number

TABLE 115. RELATION OF PER CENT AREA IN SUGAR CANE IS OF TOTAL CUERDAS HARVESTED TO RATES OF PRODUCTION AND LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Per cent area in sugar cane is of total cuerdas harvested		Number of farms	Tons of cane per cuerda	Tons of sugar per cuerda	Tons of cane per man	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Gross income per man
Range	Average								
								$	$
0	0	54	0	0.0	0	7.8	0.0	3,411	733
Less than 40	18	28	16	2.0	33	9.6	2.1	3,112	878
40–54	46	35	15	2.0	83	10.3	5.4	3,182	932
55–69	63	42	17	2.2	103	8.1	6.1	2,570	1,023
70–84	80	52	22	2.9	120	6.4	5.4	3,734	1,185
85 and over	93	29	29	3.7	175	6.3	6.0	3,199	1,253

of cuerdas in sugar cane harvested per man. Beyond this point, as in the former case, gradual declines were observed.

The capital invested per man and the relative importance of the sugar cane acreage in the farms studied showed no apparent relationship. In fact, very little variation among the different groups of farms studied was found to exist.

Various Farm Expenses and Receipts. The hired labor expenses in sugar cane tended to be relatively higher for the farms with higher percentages of their total cropland in sugar cane (table 116). These farms also tended to apply more inputs per cuerda of cane as measured by the hired labor expenses in sugar cane per cuerda of cane harvested. The hired labor expenses in sugar cane when expressed in terms of per ton of cane harvested, however, showed a definite tendency to decrease as the importance of the sugar cane acreage increased. Heavier applications of fertilizer were also made in the farms which specialized more in the sugar cane enterprise.

The farms specialized to a larger extent in sugar cane growing, as measured by the per cent that the sugar cane acreage was of the total cuerdas harvested, had, on the average, larger receipts from sugar cane per cuerda of cane harvested. They also were found to derive a larger proportion of their gross income from sugar cane.

TABLE 116. RELATION OF PER CENT AREA IN SUGAR CANE IS OF TOTAL CUERDAS HARVESTED TO VARIOUS FARM EXPENSES AND RECEIPTS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent area in sugar cane is of total cuerdas harvested		Number of farms	Per cent hired labor expenses in cane	Hired labor expenses in cane per cuerda	Hired labor expenses in cane per ton	Fertilizer costs per cuerda of cane	Total cane receipts per cuerda	Per cent income from cane
Range	Average							
				$	$	$	$	$
0	0	54	0	0	0.00	0	0	0
Less than 40	18	28	39	48	3.10	6	122	29
40–54	46	35	63	36	2.33	6	117	68
55–69	63	42	76	37	2.19	7	135	80
70–84	80	52	70	56	2.55	9	167	77
85 and over	93	29	87	73	2.49	8	204	97

TABLE 117. RELATION OF PER CENT AREA IN SUGAR CANE IS OF TOTAL CUERDAS HARVESTED TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent area in sugar cane is of total cuerdas harvested		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Net farm cash income	Labor income	Labor earnings
Range	Average							
			$			$	$	$
0	0	54	892	7.3	4.65	1,131	542	968
Less than 40	18	28	1,771	11.1	3.55	2,082	1,240	1,740
40–54	46	35	1,764	11.4	3.42	2,179	1,249	1,785
55–69	63	42	1,543	15.2	2.51	1,978	1,318	1,733
70–84	80	52	5,689	13.3	3.15	5,698	3,730	4,208
85 and over	93	29	7,585	11.8	2.55	9,601	4,211	4,600

Farm Earnings. Specialization in sugar cane, as measured by per cent area in sugar cane is of total cuerdas harvested, was found to be intimately related to the financial success of the farms studied (table 117).

The return on capital was found to increase consistently with increases in the relative importance of the sugar cane acreage. However, when it was expressed as a per cent of the total farm capital, consistent increases were observed up to the group of farms which had 55 to 69 per cent of their total crop acreage in sugar cane. The per cent return on capital decreased substantially beyond this point. A marked tendency was also observed for the farms with relatively more sugar cane to have a lower capital turnover.

Sugar cane specialization, net farm cash income, labor income and labor earnings were found to be very directly associated. In general they all increased consistently together.

Per Cent Sales of Sugar Cane Is of Total Crop Sales

The relation of sales of sugar cane is of total crop sales to farm earnings and other factors is presented in table 118 to 121 which follow. This factor measures, from the standpoint of crop sales, the importance of the sugar cane enterprise as compared to other crops grown on the farms studied. It also measures, to some extent, the importance of the sugar cane enterprise, considering the farm business as a whole.

Various Size Factors. In table 118 it is attempted to present the relation of per cent sales of sugar cane is of total crop sales to various size factors.

TABLE 118. RELATION OF PER CENT SALES OF SUGAR CANE IS OF TOTAL CROP SALES TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent sales of sugar cane is of total crop sales		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Man equivalent	Total capital invested
Range	Average							
								$
0	0	54	105	28	0.0	0	3.6	12,222
Less than 75	46	47	134	56	22.0	284	5.8	16,151
75–94	87	52	64	38	25.1	466	4.3	12,112
95 and over	99	87	245	84	76.0	2,015	13.4	47,276

Sugar cane specialization proved to be directly related to size of farm business, as measured by cuerdas in sugar cane harvested and tons of sugar cane harvested. They both increased consistently as the per cent sales of sugar cane is of total crop sales increased. When size of business was measured by total cuerdas in farm, net cuerdas harvested, man equivalent and total capital invested, no consistent direct relationships were observed. However, very definite tendencies for these factors to increase with increases in the degree of sugar cane specialization were found to exist.

Land Use and Other Factors. Sugar cane specialization, as measured by per cent sales of sugar cane is of total crop sales, was related to land use and other factors. The relationships found are shown in table 119.

The farms more highly specialized in the sugar cane enterprise were found to be located in the better lands of the area.

The per cent land arable showed no relationship with sugar cane specialization. The same lack of relationship was observed in the case of the

per cent of the arable land which was harvested. However, both groups of farms at the extreme in sugar cane specialization reported having, on the average, the lowest percentages of their total arable land harvested. The farms in which sugar cane sales accounted for between 75 to 94 per cent of their total crop sales harvested the highest proportion of their arable lands. These same observations were noticed in the case of the per cent of the total arable land which was planted in sugar cane. The per cent that the sugar cane acreage constituted of the net cuerdas harvested was found to increase consistently as the percent of the total crop sales derived from sugar cane increased.

The total capital invested per cuerda of arable land increased with increases in sugar cane specialization. This was due, of course, to the higher value of the better lands as well as to the higher investments in machinery and equipment per cuerda which these better lands could stand.

TABLE 119. RELATION OF PER CENT SALES OF SUGAR CANE IS OF TOTAL CROP SALES TO LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent sales of sugar cane is of total crop sales		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent of arable land in cane	Per cent net harvested land in cane	Total investments per cuerda of arable land
Range	Average							
								$
0	0	54	4.9	90	30	0	0	129
Less than 75	46	47	3.9	81	52	20	39	148
75–94	87	52	3.4	88	67	45	67	215
95 and over	99	87	2.8	91	38	34	90	213

Rates of Production and Labor Efficiency. The tons of sugar cane produced per cuerda and sugar cane specialization, was measured by per cent sales of sugar cane is of total crop sales, were found to be closely directly associated (table 120). The higher the degree of specialization, the better the yields of cane were found to be. As indicated before, these farms were located in the better lands and were found also to apply more inputs per cuerda of cane cultivated.

Labor efficiency, as measured by both tons of sugar cane produced per man and gross income per man, were found to be directly associated with the degree of specialization in the sugar cane enterprise. They all were found to increase consistently together.

Both cuerdas in sugar cane harvested per man and return on labor per man indicated a tendency to increase with increases in the per cent of the total crop sales constituted by sugar cane. Based on these two factors, the farms with the highest labor efficiency were those in which sugar cane sales

accounted for between 75 to 94 per cent of the total crop sales. Beyond this point, decreases in labor efficiency were recorded.

Net cuerdas harvested per man and capital invested per man were found to bear no relationship to sugar cane specialization.

Farm Earnings. Specialization in the sugar cane enterprise proved to be intimately related to farm earnings (table 121).

The farms with larger percentages of their crop sales accounted for by sugar cane sales had consistently larger returns on capital. When the

TABLE 120. RELATION OF PER CENT SALES OF SUGAR CANE IS OF TOTAL CROP SALES TO RATES OF PRODUCTION AND LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Per cent sales of sugar cane is of total crop sales		Number of farms	Tons of cane per cuerda	Tons of cane per man	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Return on labor per man	Gross income per man
Range	Average								
							$	$	$
0	0	54	0	0	7.8	0.0	3,411	477	733
Less than 75	46	47	13	49	9.7	3.8	2,789	626	865
75–94	87	52	19	111	8.8	5.9	2,829	810	1,097
95 and over	99	87	26	147	6.3	5.7	3,537	794	1,213

TABLE 121. RELATION OF PER CENT SALES OF SUGAR CANE IS OF TOTAL CROP SALES TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent sales of sugar is of total crop sales		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Return on labor	Labor income	Labor earnings
Range	Average							
			$			$	$	$
0	0	54	892	7.3	4.65	1,717	542	968
Less than 75	46	47	1,809	11.2	3.22	3,631	1,343	1,880
75–94	87	52	1,914	15.8	2.58	3,483	1,564	2,026
95 and over	99	87	5,815	12.3	2.92	10,640	3,511	3,936

return on capital was expressed as a per cent of the total farm capital, consistent increases were found to occur as sugar cane specialization increased, up to the farms which derived between 75 to 94 per cent of their total crop sales from sugar cane. A substantial decrease beyond this point was recorded. A very definite tendency for the gross receipts of the farms less specialized in sugar cane to take more years to equalize the total farm capital was observed.

Sugar cane specialization was found to be closely associated with the return on labor, labor income and labor earnings of the farms studied in Southwestern Puerto Rico. In other words, the more the farms studied

specialized in the sugar cane enterprise the higher the farm earnings were found to be. This finding is corroborated here once more.

Per Cent Income from Sugar Cane

The relation of degree of sugar cane specialization, as measured by per cent income from sugar cane, to farm earnings and other factors is shown in tables 122 to 127 presented below. This factor measures sugar cane specialization from the income viewpoint, and, therefore takes into consideration the farm business as a whole.

Various Size Factors. The relation of per cent income from sugar cane to size of business is presented in table 122.

Although no definite consistent relationship was observed between per cent income from sugar cane and size of business, there was a tendency for

TABLE 122. RELATION OF PER CENT INCOME FROM SUGAR CANE TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent income from sugar cane		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Tons of sugar produced	Man equivalent	Total capital invested
Range	Average								
									$
0	0	54	105	28	0.0	0	0.0	3.6	12,222
Less than 45	21	25	149	48	9.1	125	15.2	5.2	15,520
45–59	52	23	322	75	48.5	745	98.6	9.7	43,665
60–74	66	36	56	29	20.2	322	39.9	4.1	10,247
75–89	82	45	125	56	42.7	924	120.4	8.2	27,476
90 and over	97	57	213	96	86.9	2,385	302.1	13.8	43,935

the larger farms to derive more of their gross income from sugar cane. Curiously enough, the farms which derived from 45 to 59 per cent of their gross income from cane had a larger farm acreage than, and about the same total capital invested as, the farms which made nine-tenths or more of their gross receipts from sugar cane. These farms were mostly owned by people who have some of their lands at the valley planted in sugar cane and still larger acreages in pasture located in the surrounding hills or in the dry coastal area. The hilly and coastal lands are utilized principally in livestock farming, mainly dairying. On the other side, the farms which derived from 60 to 74 per cent of their gross income from sugar cane had the smallest total acreage and the smallest total capital investment. These ones are mainly the property of farmers who only own smaller acreages in the valley proper and utilized them mostly in sugar cane growing. This partly explains the apparent inconsistency observed between size of business and per cent income from sugar cane.

Land Use and Other Factors. In table 123 the relationships found to exist between sugar cane specialization and land use and other factors are presented.

The farmers more specialized in the sugar cane business had better lands than those with a less degree of specialization. That is, they were located in better land classes than the other farms.

The per cent of the total farm acreage which was arable showed no relationship with per cent income from sugar cane. However, a tendency for the farms more specialized in sugar cane to have higher percentages of their total arable land harvested was observed. The per cent of the net area harvested which was in sugar cane was found to increase consistently with increases in sugar cane specialization, as measured by per cent income from sugar cane.

TABLE 123. RELATION OF PER CENT INCOME FROM SUGAR CANE TO LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent income from sugar cane		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent net harvested land in cane	Equipment investment per cuerda harvested	Total investments per cuerda of arable land
Range	Average							
							$	$
0	0	54	4.9	90	30	0	9	129
Less than 45	21	25	3.8	72	44	19	9	144
45–59	52	23	3.7	91	26	64	20	149
60–74	66	36	3.8	91	58	69	14	202
75–89	82	45	3.2	82	55	76	32	269
90 and over	97	57	2.5	95	47	91	78	218

The farms more highly specialized in sugar cane growing were mechanized to a larger extent than those where sugar cane was of relatively less importance from the viewpoint of income. Sugar cane growing naturally requires larger investments in machinery and equipment. The machinery and equipment is not only larger in quantity but is of a more expensive nature, especially if it is for irrigation purposes. Logically, the total capital invested per cuerda of arable land was found to be higher for the farms which specialized more in the sugar cane enterprise. As indicated before, both the higher value of the better lands and the larger investments in machinery and equipment were mainly responsible for this relationship.

Irrigation. It is attempted in table 124 to indicate the fact that the farms studied in Southwestern Puerto Rico which were specialized in sugar cane to a higher extent had larger investments in irrigation equipment. They consequently practiced irrigation to considerably larger extents than those where the sugar cane enterprise was of less importance.

Rates of Production and Labor Efficiency. Rates of production, as measured by tons of sugar cane, and tons of sugar, produced per cuerda, were intimately related to the degree of sugar cane specialization in the farms studied (table 125). They were found to increase consistently with increases in the per cent income from sugar cane. As previously shown,

TABLE 124. RELATION OF PER CENT INCOME FROM SUGAR CANE TO IRRIGATION

240 farms, Southwestern Puerto Rico, 1942–43

Per cent income from sugar cane		Number of farms	Investment in irrigation equipment				Cuerdas in sugar cane irrigated		
Range	Average		Total	Per cuerda cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
0	0	54	0	0	0	0.0	0.0	0.0	0.0
Less than 45	21	25	19	2	20	0.1	1.0	0.9	10.5
45–59	52	23	168	4	13	0.4	13.1	4.5	27.0
60–74	66	36	0	0	0	0.0	0.0	0.0	0.0
75–89	82	45	491	12	52	1.8	9.4	9.2	22.1
90 and over	97	57	4,919	57	110	11.2	44.6	22.1	51.3

TABLE 125. RELATION OF PER CENT INCOME FROM SUGAR CANE TO RATES OF PRODUCTION AND LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Per cent income from sugar cane		Number of farms	Tons of cane per cuerda	Tons of sugar per cuerda	Tons of cane per man	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Gross income per man
Range	Average								
								$	$
0	0	54	0	0.0	0	7.8	0.0	3,411	733
Less than 45	21	25	14	1.7	24	9.2	1.8	2,982	844
45–59	52	23	15	2.0	77	7.7	5.0	4,487	1,153
60–74	66	36	16	2.0	78	7.1	4.9	2,484	897
75–89	82	45	22	2.8	112	6.8	5.2	3,342	1,041
90 and over	97	57	27	3.5	173	6.9	6.3	3,189	1,278

better lands, irrigation and higher inputs applied per cuerda explain these higher yields.

Labor efficiency is always very much related to size of business. As indicated above, no consistent relationship was found to exist between size of business and per cent income from sugar cane. Consequently, no general consistent relationship was observed between per cent income from sugar cane and labor efficiency as measured by various factors. For instance, cuerdas in sugar cane harvested per man and tons of sugar cane produced

per man increased consistently with increases in sugar cane specialization. On the other side, when labor efficiency was measured in terms of gross income per man, only a slight tendency to increase as the degree of sugar cane specialization increased was recorded. No relationship at all was observed between both net cuerdas harvested per man, and capital invested per man with per cent income from sugar cane.

Various Farm Expenses and Receipts. The farms which derived higher percentages of their gross receipts from sugar cane, that is, those which specialized more in sugar cane production, applied more inputs per cuerda of cane harvested (table 126).

Hired labor expenditures in sugar cane per cuerda of cane harvested increased with increases in the percent income from sugar cane. However,

TABLE 126. RELATION OF PER CENT INCOME FROM SUGAR CANE TO VARIOUS FARM EXPENSES AND RECEIPTS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent income from sugar cane		Number of farms	Per cent hired labor expenses in cane	Hired labor expenses in cane per cuerda	Hired labor expenses in cane per ton	Fertilizer costs per cuerda of cane	Total cane receipts per cuerda
Range	Average						
				$	$	$	$
0	0	54	0	0	0.00	0	0
Less than 45	21	25	35	51	3.75	5	100
45–59	52	23	59	44	2.87	7	121
60–74	66	36	67	40	2.53	8	122
75–89	82	45	68	52	2.42	9	164
90 and over	97	57	79	67	2.43	8	196

they were found to decrease nearly consistently when expressed in terms of per ton of cane harvested. The sugar cane enterprise consumed larger proportions of the total hired labor expenses in the farms specialized to a higher extent in sugar cane production. They were also found to make heavier applications of fertilizer per cuerda of cane harvested. Higher yields per cuerda accounted for consistently larger total receipts from sugar cane per cuerda of cane harvested.

Farm Earnings. Per cent income from sugar cane and farm earnings were not found to be so closely associated. Only tendencies for the farms with higher percentages of their gross income derived from sugar cane to have larger farm earnings were observed (table 127).

The return on capital, net farm cash income, labor income and labor earnings of the farms which derived from 45 to 59 per cent of their gross receipts from sugar cane were second to those obtained by the farms where sugar cane accounted for 90 per cent or more of their total gross income. It was explained before that considerable portions of the lands of these

farms were located on the surrounding hills and coast line, and that they were mostly used in pasture for livestock raising and dairying. This fact suggests the advisability of considering livestock raising and dairying as a profitable enterprise adapted to the hilly and coast lands not irrigable surrounding the valley.

The return on capital, when expressed as a per cent of the total capital investment showed definitely a tendency to increase as the degree of specialization in sugar cane was higher. It was also found that the farms more highly specialized in sugar cane tended to have lower capital turnover than those where sugar cane was less important. Therefore, from the capital investment standpoint, the higher the degree of specialization in sugar cane, the better the financial success of the farms studied in Southwestern Puerto Rico.

TABLE 127. RELATION OF PER CENT INCOME FROM SUGAR CANE TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent income from sugar cane		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Net farm cash income	Labor income	Labor earnings
Range	Average							
			$			$	$	$
0	0	54	892	7.2	4.65	1,131	542	968
Less than 45	21	25	1,654	10.7	3.53	1,955	1,148	1,643
45–59	52	23	5,100	11.7	3.89	4,905	3,195	3,932
60–74	66	36	1,151	11.2	2.77	1,433	921	1,344
75–89	82	45	3,121	11.4	3.21	3,448	1,954	2,423
90 and over	97	57	6,165	14.0	2.50	7,436	3,976	4,338

Summary of Relation of Combination of Enterprise to Farm Earnings and Other Factors

Sugar cane was by far the most important and profitable enterprise in the farms studied in Southwestern Puerto Rico during the crop year 1942–43. Several factors which attempt to measure the degree to which the farms surveyed specialized in this enterprise were related above to farm earnings and other factors of farm organization and operation. The most important findings observed are summarized below.

The farms which specialized to a larger extent in the sugar cane business:

1. Tended to be larger in size.
2. Were found to be located in better land classes.
3. Were mechanized to a larger extent.
4. Had larger investments per cuerda of arable land.
5. Had larger investments in irrigation equipment and carried irrigation practices to larger extents.

6. Were found to have higher yields of sugar cane per cuerda.
7. Utilized labor more efficiently.
8. Tended to apply more inputs per cuerda of sugar cane including such items as labor and fertilizer.
9. Were found to have larger returns both from the standpoint of capital investment and of returns to operators.

It was stated previously that no general rules can be established as to the best combination of enterprises. The only assertion made was that wherever two or more enterprises are found to be about equally profitable, a diversified farm business is most desirable, but where there is one enterprise which is far more profitable than any other, a specialized farm business is desirable. There is no doubt that sugar cane was the most profitable enterprise in the farms studied in the Lajas Valley proper during the crop year 1942–43. Therefore, its intensification is highly commendable. It was a'so found that livestock raising, mainly dairy farming, was apparently the enterprise most profitably adapted to the hilly and coast lands not irrigable surrounding the valley.

Relation of Farm Mechanization to Farm Earnings and Other Factors

The extent to which farms are mechanized may be very influential on farm returns. Mechanization is very important from both standpoints of saving human labor and doing a better work. However, low investments in machinery and equipment do not mean higher efficiency in the use of same and vice-versa. The main objective of mechanizing is to do better work in the least period of time and with a minimum of human labor, which is becoming more and more expensive every day.

To achieve higher efficiency in the use of machinery and equipment and to reduce its cost, several factors must be taken into consideration. Only the necessary equipment should be bought and, if possible buy second-hand equipment if the amount of use is small. In this way depreciation and interest costs would not be so high. The equipment purchased should also be properly cared for. This does not mean that it should not be used much. On the contrary, the more a machine is used, the less the fixed expenses, such as depreciation and interest are. Farmers themselves should be very careful in watching out for these points.

Per Cent Investment in Machinery and Equipment Is of Total Capital Invested

In Southwestern Puerto Rico, the degree of farm mechanization among the farms studied showed significant variations. Therefore, it is attempted to show in tables 128 to 133, which follow, its relation to the financial success of the farm businesses studied and to other factors. The per cent

that the total investments in machinery and equipment constituted of the total farm capital was used as an indication of the extent of farm mechanization.

Various Size Factors. As was logically expected, the size of business was found to be intimately related to farm mechanization (table 128).

TABLE 128. RELATION OF PER CENT INVESTMENT IN MACHINERY AND EQUIPMENT IS OF TOTAL CAPITAL INVESTED TO VARIOUS SIZE FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent investment in machinery and equipment is of total capital invested		Number of farms	Total cuerdas in farm	Net cuerdas harvested	Cuerdas in cane harvested	Tons of cane harvested	Tons of sugar produced	Man equivalent	Total capital invested
Range	Average								
									$
Less than 1	0.2	56	31	20	15.4	308	40.1	2.9	6,039
1–2	1.9	87	156	47	19.0	333	43.2	5.4	18,769
3–4	3.7	45	160	60	42.8	904	115.6	8.1	29,404
5 and over	17.3	52	271	107	86.8	2,356	298.4	16.3	55,146

TABLE 129. RELATION OF PER CENT INVESTMENT IN MACHINERY AND EQUIPMENT IS OF TOTAL CAPITAL INVESTED TO LAND USE AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent investment in machinery and equipment is of total capital invested		Number of farms	Economic land class	Per cent land arable	Per cent of arable land harvested	Per cent of arable land in cane	Equipment investment per cuerda harvested
Range	Average						
							$
Less than 1	0.2	56	4.3	94	70	52	*
1–2	1.9	87	3.9	85	35	14	7
3–4	3.7	45	4.0	90	41	30	18
5 and over	17.3	52	3.2	91	43	35	89

* Less than $0.50.

Size of business, as measured by total cuerdas in farm, net cuerdas harvested, cuerdas in sugar cane harvested, tons of sugar cane harvested, tons of sugar produced, man equivalent and total capital invested, increased consistently as the per cent of the total farm capital which was made by machinery and equipment increased.

Land Use and Other Factors. In table 129, the relation of per cent investment in machinery and equipment is of total capital invested to land use and other factors is presented.

The relationships found were not very definite. For instance, only tendencies for the farms with relatively larger investments in machinery

and equipment of having better lands, as measured by economic land class, were observed. No relationship was observed in the case of the per cent of the total farm acreage which was arable. The per cent that the net area harvested, as well as the area in cane harvested, constituted of the total arable land showed tendencies to be lower for the farms mechanized to a higher extent. The investment in machinery and equipment per net cuerda harvested was found to be definitely larger for the farms with higher percentages of their capital invested accounted for by machinery and equipment.

Irrigation. It was found that the farms where relatively larger investments in machinery and equipment were made has also more of the investments in irrigation equipment and, consequently, carried on irrigation practices to a larger extent (table 130).

TABLE 130. RELATION OF PER CENT INVESTMENT IN MACHINERY AND EQUIPMENT IS OF TOTAL CAPITAL INVESTED TO IRRIGATION

240 farms, Southwestern Puerto Rico, 1942–43

Per cent investment in machinery and equipment is of total capital invested		Number of farms	Investment in irrigation equipment				Cuerdas in sugar cane irrigated		
Range	Average		Total	Per cuerda of cane harvested	Per cuerda of cane irrigated	Per cent of total capital	Total	Per cent of total arable land	Per cent of cane harvested
			$	$	$				
Less than 1.	0.2	56	0	0	0	0.0	0.0	0.0	0.0
1–2.....	1.9	87	24	1	7	0.1	3.4	2.6	17.9
3–4.....	3.7	45	140	3	14	0.5	10.1	7.0	23.5
5 and over..	17.3	52	5,740	66	117	10.4	48.9	19.8	56.3

Rates of Production and Labor Efficiency: Sugar cane yields, as measured by tons of sugar cane and of sugar produced per cuerda, indicated a clear tendency to be larger as the per cent that the investments in machinery and equipment constituted of the total capital invested increased (table 131). Besides other factors such as better lands and irrigation, higher mechanization may have also contributed in some respects to the higher yields obtained insofar as the farm jobs may have been performed better, especially those relative to the preparation of the soils.

The per cent sucrose content of cane was found to decrease consistently with increases in farm mechanization. Very probably the fact that the farms less mechanized were located in higher lands and that they practiced very little or no irrigation, may have been causal factors to the higher sucrose content of the cane harvested.

Labor efficiency, as measured by tons of sugar cane per man and gross income per man showed marked tendencies of increasing with increases in

farm mechanization. However, farm mechanization was not found to be related to net cuerdas harvested per man, cuerdas in sugar cane harvested per man nor capital invested per man.

Various Farm Expenses and Receipts. In table 132, the relation of farm mechanization, as measured by per cent investment in machinery and equipment is of total capital invested, to various farm expenses and receipts is presented.

TABLE 131. RELATION OF PER CENT INVESTMENT IN MACHINERY AND EQUIPMENT IS OF TOTAL CAPITAL INVESTED TO RATES OF PRODUCTION AND LABOR EFFICIENCY

240 farms, Southwestern Puerto Rico, 1942–43

Per cent investment in machinery and equipment is of total capital invested		Number of farms	Tons of cane per cuerda	Tons of sugar per cuerda	Per cent sucrose content of cane	Tons of cane per man	Net cuerdas harvested per man	Cuerdas in cane harvested per man	Capital invested per man	Gross income per man
Range	Average									
									$	$
Less than 1	0.2	56	20	2.6	13.01	105	7.0	5.2	2,061	991
1–2	1.9	87	18	2.3	12.98	61	8.6	3.5	3,454	981
3–4	3.7	45	21	2.7	12.79	111	7.3	5.3	3,615	1,147
5 and over	17.3	52	27	3.4	12.67	144	6.6	5.3	3,380	1,162

TABLE 132. RELATION OF PER CENT INVESTMENT IN MACHINERY AND EQUIPMENT IS OF TOTAL CAPITAL INVESTED TO VARIOUS FARM EXPENSES AND RECEIPTS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent investment in machinery and equipment is of total capital invested		Number of farms	Per cent hired labor expenses in cane	Hired labor expenses in cane per cuerda	Hired labor expenses in cane per ton	Fertilizer costs per cuerda of cane	Total cane receipts per cuerda
Range	Average						
				$	$	$	$
Less than 1	0.2	56	77	44	2.20	7	163
1–2	1.9	87	52	44	2.53	6	138
3–4	3.7	45	67	50	2.34	8	159
5 and over	17.3	52	73	70	2.56	9	190

The farms with larger investments in machinery and equipment showed no relationship with the proportion of the total hired labor used in the sugar cane enterprise. The hired labor expenses in sugar cane per cuerda of cane harvested were found to increase with increases in the degree of farm mechanization. However, when hired labor expenses in sugar cane were expressed in terms of per ton of cane harvested insignificant variations were observed. The farms more highly mechanized also spent more in fertilizer per cuerda of cane harvested. In spite of the larger inputs per cuerda of

cane, the receipts from sugar cane per cuerda of cane harvested were found in general to be larger for the farms with larger relative investments in machinery and equipment.

Farm Earnings. Farm mechanization and earnings were found to be very closely associated (table 133).

The return on capital increased consistently with increases in the per cent the investments in machinery and equipment constituted of the total farm capital. However, the per cent return on capital tended to be smaller for the farms mechanized to a higher extent. These farms tend to have also higher capital turnover. In other words, from the standpoint of capital investment, the farms less mechanized were apparently more efficient.

TABLE 133. RELATION OF PER CENT INVESTMENT IN MACHINERY AND EQUIPMENT IS OF TOTAL CAPITAL INVESTED TO FARM EARNINGS

240 farms, Southwestern Puerto Rico, 1942–43

Per cent investment in machinery and equipment is of total capital invested		Number of farms	Return on capital	Per cent return on capital	Capital turnover	Net farm cash income	Labor income	Labor earnings
Range	Average							
			$			$	$	$
Less than 1.....	0.2	56	1130	18.7	2.08	1366	1002	1218
1–2.....	1.9	87	2257	12.0	3.52	2429	1574	2066
3–4.....	3.7	45	4147	14.1	3.15	4613	2956	3506
5 and over.....	17.3	52	5652	10.2	2.91	6885	2943	3516

On the contrary, the farms more mechanized had consistently larger net farm cash income, labor income, and labor earnings.

Summary of Relation of Farm Mechanization to Farm Earnings and Other Factors

To summarize, the farms mechanized to a larger extent:

1. Were found to be larger in size.
2. Tended to be located in better land classes.
3. Had larger investments in irrigation equipment and, consequently, practiced irrigation to larger extents.
4. Were found to obtain better cane yields but had lower sucrose contents.
5. Tended to use labor more efficiently.
6. Applied more inputs per cuerda of cane and had larger receipts per cuerda of cane harvested.
7. Were found to be financially more successful.

Relation of Other Miscellaneous Factors to Farm Earnings and Other Factors

Land Tenure

The relation of type of land tenure to farm earnings and other factors is presented in table 134. Size of business was measured by total capital invested, intensity of land use by economic land class, rates of production by tons of sugar cane per cuerda, labor efficiency by gross income per man, sugar cane specialization by per cent income from sugar cane and farm earnings by labor income. The farms studied were then ranked according to these factors in each different type of land tenure.

The farms operated by managers ranked first in size of business, in intensity of land use, in rates of production, in labor efficiency, in the extent

TABLE 134. RELATION OF TYPE OF LAND TENURE TO FARM EARNINGS AND OTHER FACTORS

240 farms, Southwestern Puerto Rico, 1942–43

Type of land tenure	Number of farms	Size of business	Intensity of land use	Rates of production	Labor efficiency	Sugar cane specialization	Farm earnings
				Ranking			
Managed	146	1	1	1	1	1	1
Rented	41	3	4	2	2	2	2
Owned and Rented	16	2	3	4	3	5	3
Owned and Managed	12	5	2	5	4	3	4
Owned	25	4	5	3	5	4	5

of sugar cane specialization and in farm earnings. The rented farms were next in farm earnings, in rates of production, in labor efficiency and in sugar cane specialization. However, they ranked third in size of business and fourth in intensity of land use.

The group of farms which were partly owned and partly rented made third in farm earnings. They also ranked third in intensity of land use and in labor efficiency. They were found, however, to be the second largest businesses but the fourth in rates of production.

The farm businesses partly owned and partly managed came next, ranking fourth as to farm earnings. These farms were second in intensity of land use, third in sugar cane specialization, and fourth in labor efficiency. They were also found to be the smallest sized businesses studied.

The farms with the lowest farm earnings, on the average, were those completely operated by owners. They ranked third as to rates of production but were fourth in size of business and in sugar cane specialization. Furthermore, these farms were located in the poorest lands and utilized labor less efficiently than any of the other groups of farms.

To conclude, the most successful farms in the area studied were those completely operated under management, followed by those which were fully rented. The farms operated by owners who were also renting part of the land ranked third followed by those farms which were operated by owners who also were managing part of the business. The most unsuccessful farms were found to be those completely operated by their owners. Besides the economic reasons pointed out above, which obviously contributed to the lowest farm earnings, it is very probable that the higher sense of security which is naturally tied up to full ownership may also be partly responsible for the lowest intensity in the use of the land the lowest efficiency in the use of labor which characterized these farms. In other words, psychological reasons may have indirectly influenced farm earnings.

It is of great interest to observe that of the factors studied only labor efficiency ranked in the same order as farm earnings when related with type of land tenure. There is no doubt of the paramount importance of this factor relative to its influence on the financial success in farming.

Distance to Nearest Paved Road

The farms surveyed were classified as to their distances from the nearest paved roads, and its relation to farm earnings and other factors was studied.

No relationship was found to exist between distance to the nearest paved road and farm earnings. Furthermore, it showed no relation to economic land class, size of business, sugar cane specialization, inputs applied per cuerda, rates of production, nor to labor efficiency.

The only observation worth mentioning is the fact that the farms located at the very side of, or crossed by, a paved road were found to be the largest in size, to fall in the best land classes, to be specialized in sugar cane to the largest extent, to apply the most inputs per acre, to obtain the highest rates of production, to utilize labor most efficiently and, consequently, to have the largest farm earnings. So the most efficient and successful farm businesses were located on paved roads.

Age of Operator

The age of the operator is usually associated with farm earnings and other factors. Curiously enough, in the case of the farms studied in Southwestern Puerto Rico, no relationships were observed. The only observation that could be made was that the smallest sized farms were found to be those operated by individuals ranging between 41 to 50 years of age. The largest ones were operated by individuals 61 years old and over. They were also found to be the most successful farmers. This corroborates once more the fact that the largest farms had the highest returns and vice versa.

Comparative Analysis of Sugar Cane Farms with and without Irrigation

It is attempted in table 135 to present a comparative analysis of the organization and financial returns of the sugar cane farms with and without irrigation which were studied in the Lajas Valley during the year 1942–43.

Of the 186 sugar cane farms studied, in only 14 were irrigation practices carried on. These farms are larger in size as may be observed by the total cuerdas in the farm, which was 18 times greater, by the total capital invested, which was 21 times above, and by the man equivalent which surpassed 14 times that reported by the other sugar cane farms. For instance, the sugar cane farms with irrigation had an average total farm area of 1302 cuerdas as compared to 74 cuerdas for the others. Their capital invested amounted to $245,860 in comparison to $11,976 which was that of the farm with no irrigation. As to the number of men employed, the farms with irrigation reported an average total of 63.4 while the others reported only an average of 4.5 men.

These large farms had not only a large acreage but also a somewhat higher percentage of arable land, out of which they cultivated 34 per cent as compared to 55 per cent which was cultivated by the sugar cane farms with no irrigation. The per cent of the total acreage which was fitted for irrigation is only 6 per cent larger for the farms which practiced irrigation. They reported 61 and 55 per cent each. These farms also were found to be specialized to a higher degree in sugar cane production, as shown by the fact that the average total of 333 cuerdas in sugar cane represented 88 per cent of the net area in crops. In the case of the farms with no irrigation an average of 25 cuerdas in sugar cane were reported per farm making only 72 per cent of the net crop acreage. Furthermore, the per cent income from sugar cane, as shown in the same table is 10 per cent higher for these farms. The farmers who irrigated, performed this practice in only 72 per cent of their sugar cane area. For one or the other reason, they were unable to irrigate all the sugar cane planted.

Although the average land value per cuerda was practically the same for both groups of farms, the total capital investment per cuerda was found to be larger for the farms with irrigation. This is accounted for by the higher degree of mechanization of these farms as shown by the fact that the total investment in machinery and equipment per net cuerda cultivated averaged $89 for them as compared to an average of $13 for the other group. The investment in irrigation equipment, which is a very expensive proposition, could only be afforded by them, and this item alone accounted for $92 per cuerda of cane irrigated.

TABLE 135. COMPARATIVE ANALYSIS OF SUGAR CANE FARMS WITH AND WITHOUT IRRIGATION

186 farms, Southwestern Puerto Rico, 1942–43

Item	Farms with irrigation	Farms with no irrigation
	Average per farm	
Number of farms	14	172
Total area in farms, cuerdas	1,302	74
Per cent arable	90	86
Per cent fitted for irrigation	61	55
Per cent arable land cultivated	34	55
Cuerdas in sugar cane	333	25
Per cent of net area in crops	88	72
Per cent irrigated	71	0
Capital invested	$245,860	$11,976
Per cuerda in farm	$189	$162
Value of land per cuerda	$137	$132
Investment in machinery and equipment per net cuerda cultivated	$89	$13
Investment in irrigation equipment	$21,683	$0
Per cuerda of cane irrigated	$92	$0
Man equivalent	63.4	4.5
Per cent hired	98	73
Yield of cane per cuerda, tons	28.9	17.4
Yield of sugar per cuerda, tons	3.67	2.24
Income from cane per cuerda of cane harvested	$158	$95
Total income from cane (including A.A.A. payments) per cuerda of cane harvested	$202	$137
Total farm gross receipts per net cuerda cultivated	$203	$131
Per cent income from cane	85	75
Farm cash expenses per net cuerda cultivated	$117	$66
Hired day-labor in sugar cane per cuerda of cane harvested	$74	$41
Total cost of hired labor per net cuerda cultivated	$88	$40
Total cost of hired labor per hired man	$550	$418
Farm income	$30,149	$2,081
Per net cuerda cultivated	$77	$60
Capital turnover	3.1	2.6
Return on capital	$28,402	$1,711
Per cent return on capital	11.6	14.3
Return on labor	$50,616	$3,286
Return on labor per man	$799	$733
Labor income	$15,397	$1,362
Per net cuerda cultivated	$39	$39

As indicated above, the number of men hired during the year by the group of farms with irrigation was larger than that reported by the other

group of sugar cane farms. But what is still more interesting is the fact that the sugar cane farms with irrigation, on the average, hired 98 per cent of the total number of men employed during the year, while the other group hired only an average of 73 per cent. This shows definitely the higher degree of commercialization of these farms.

The yields of sugar cane, expressed both in tons of sugar cane and in sugar production per cuerda, was far higher for the group of farms which practiced irrigation. It is shown in table 135 that this group of farms produced 28.9 tons of sugar cane or 3.67 tons of sugar per cuerda while the farms with no irrigation produced only 17.4 tons of sugar cane or 2.24 tons of sugar to the acre. These higher yields can be mostly attributed to the irrigation practice followed, since, as stated above, the quality of the land, as measured by its value per cuerda, was practically the same. It is true, however, that because of the fact that they are more mechanized they can perform better jobs; but it should be remembered that the mechanization of these farms is mostly accounted for by the investment in irrigation equipment. It may be argued also that, as shown in table 135, these farms put more labor per cuerda of cane harvested. However, we should not forget that the practice of irrigating sugar cane is an expensive high-labor-consuming practice which very probably accounts for most of the difference found. As to the quality of the labor itself, it is true that the table shows an apparent higher quality for these farms as indicated by the total cost of hired labor per man. However, the difference is not so great and furthermore it is convenient to point out here again that practically all of the labor employed by these farms was hired and of a more specialized nature. Hired labor is more expensive, on the average, than family labor, which is generally evaluated at a lower level.

Higher yields brought consequently higher receipts which were large enough to offset the larger expenditures in which the farms which practiced irrigation incurred. With a larger sized business and $17 more of farm income per net cuerda cultivated, the farm income for the farms where irrigation was practiced was consequently larger. This accounted for a larger total return on capital, return on labor and labor income for this group of farms. This labor income averaged $15,397 per farm as compared to $1,362 for the farms with no irrigation. However, it takes more years on these farms than on the others for the total receipts to equalize the capital invested as shown by a capital turnover of 3.1 and 2.6 respectively. The per cent return on capital was also lower for the farms irrigating, that is, 11.6 as compared to 14.3 for the others. Furthermore, when the labor income is calculated (which puts the farms on a comparable basis regardless of capital) and express it in terms of net cuerdas cultivated, amazingly enough, it was found that the labor income per net cuerda cultivated was $39 for

both groups of farms. From the point of view of capital investment irrigation is not such a good paying proposition on the part of the farmers who contributed the capital. This suggests, furthermore, that such large investments which undoubtedly increase substantially the farm income, had to be financed by outsiders, in our case, the Government.

From the social point of view, as indicated by the larger average return on labor which the farms with irrigation reported having, and a return on labor per man of $66 above the other group, the practice of irrigating land in the area brings an average yearly higher income per man employed in the farm business, and may consequently bring higher levels of living to them and their families.

Summary of Factors Affecting Farm Earnings

One of the main objectives of the farm management study undertaken in the Southwestern part of the Island was to determine the reasons for variations in farm returns, that is, why some farmers paid more than the others. In this section the relation of size of business, intensity of land use, rates of production, labor efficiency, combination of enterprises, farm mechanization and of other miscellaneous factors, to farm earnings and other factors of farm operation and functioning were presented. Several measures for each one of the above-mentioned factors were selected and the most important relationships observed were summarized. In spite of this fact, a brief, final, general summary of the most important relevant findings may prove very valuable. The paragraphs below will serve this purpose.

Size of business, intensity of land use, rates of production, labor efficiency, combination of enterprises and farm mechanization were found to be very influential to the success of the farms surveyed in Southwestern Puerto Rico. No one can tell which was the most important. As indicated before, those farms which were able to combine these factors to the best advantages were undoubtedly the most profitable.

The most successful farmers were found to be those who:

1. Had the largest size business.
2. Operated the farms located in the best land classes and who used their lands more intensively.
3. Obtained the highest tonnage of sugar cane per cuerda.
4. Utilized farm labor with the highest degree of efficiency.
5. Operated the farms most specialized in the sugar cane enterprise.
6. Had the farms which were mechanized to the highest extent and owned practically all the irrigation equipment of the area.
7. Operated farms located at the very side of, or crossed by, a paved road.
9. Were the oldest in age; that is, 61 years or older.

From the standpoint of capital investment, it was found that the farms which had the highest per cent return on capital were those that:

1. Ranged between $5,000 to $10,000 in total capital investment, had between 60 to 100 total cuerdas in farm, harvested between 50 to 100 cuerdas in sugar cane, and employed from 5 to 10 men during the year. By no means were these the largest in size.
2. Were located in the best economic land classes.
3. Obtained yields of sugar cane ranging from 21 to 25 tons per cuerda. These yields averaged second to the highest.
4. Utilized labor with the highest efficiency.
5. Were specialized to the highest extent in the sugar cane enterprise.
6. Were mechanized to the lowest extent. That is, those farms where the total investments in machinery and equipment constituted less than one per cent of the total farm capital.
7. Were operated by individuals who owned part of their business and acted as managers of the remaining part.
8. Were located at the very side of, or crossed by, a paved road.
9. Were operated by individuals ranging from 41 to 50 years of age.

As could be observed, the farms which were found to be the most successful from the standpoint of operator's returns were not in general the same ones which led from the point of view of capital investments. The first were found to be the largest sized farms while the latter were rather of a medium size. This is a particularly important point to be given full consideration in implementing a land tenure program for Southwestern Puerto Rico.

FARM CREDIT[7]

The financial conditions of the farmers studied in Southwestern Puerto Rico were very good, as shown by the fact that the average net worth was 93 per cent of the total assets even when the receivables from Agricultural Adjustment Administration payments were not included in the assets.

Of the farmers studied, only 67 reported mortgages, the majority of which were held by the Federal Land Bank and Land Bank Commissioner. Individual, sugar centrals and commercial banks were the other agencies holding mortgages on these farms. The Federal Land Bank charged the lowest rate of interest and held the largest mortgages.

[7] Source. Luis A. Nazario, A credit Study of the Lajas Valley, Puerto Rico, 1942–43. Thesis presented to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the degree of Master of Science in Agriculture—1944. As courtesy of the Puerto Rico Agricultural Experiment Station, Mr. Nazario was permitted to analyze and use for his master's thesis the credit phase of this study.

Most of the short-term credit received by the farmers studied was for the cultivation and harvesting of sugar cane and cotton. Other short-term credit constituted only 7 per cent of the total.

The most important course of production credit for sugar cane was the sugar centrals. Mentioned in order of importance, the other sources of production credit found were: commercial banks, Production Credit Association and individuals. Sugar centrals provided all the harvesting credit regardless of which agency made the production loan. No interest was charged on this credit. Harvesting credit may be looked upon as an advance payment on the crop. The sugar centrals generally charged a 7 per cent interest for the production credit, while governmental agencies charged only from 4 to 5 per cent. Sugar mills granted the smallest amount of credit per cuerda and per ton for sugar cane cultivation. The farmers who received credit from them had 22 per cent lower yields than those receiving credit from other agenices.

Credit for cotton was supplied mainly by the Emergency Crop Loan Office, the Production Credit Association and the Farm Security Administration. Commercial banks loaned mostly to large farmers who secured their loans by notes. No credit was reported to be granted for livestock raising or milk production even though they were important enterprises in some of the farms studied.

Of the farmers growing sugar cane, 14 per cent obtained no credit for this crop, 17 per cent received credit for production only and 16 per cent just for harvesting purposes. The average total amount borrowed per cuerda was $56, of which $37 were for production and $19 for harvesting. On a per ton basis, the total was $2.78, of which $183 was for cultivation and $0.95 for harvesting.

The great majority of the short-term loans were secured by the crops themselves and some loans were made with no security at all. One fifth of the loans made were guaranteed with other securities such as Agricultural Adjustment Administration payments, crops and animals, crops and equipment, notes, and even by real estate.

By the end of the crop year, 86 per cent of all the short-term loans received by farmers were paid in full and only 2 per cent did not make a payment on the principal, but even these paid the interest due.

Even though no relationship was found to exist between rates of production or size of business and the amount lent per ton or per cuerda of sugar cane, a definite tendency for the larger farms with better yields to borrow more for sugar cane than the others was observed. Furthermore, there was no definite relationship between per cent income from livestock or sugar cane and the amount of credit received by farmers.

To conclude, there is not much risk involved in lending to farmers in the Lajas Valley for sugar cane cultivation and harvesting. Farmers, in gen-

eral, are in very good economic condition; and, furthermore, the sugar centrals, which are the most important source of this type of credit, have complete control of the crop.

It is a fact that the majority of the farmers studied rated higher the convenience of borrowing from the sugar centrals rather than from the governmental agencies at lower interest rates. The lack of knowledge on the part of a great number of farmers in regard to the proper way of obtaining credit from the government-sponsored agencies may partly explain this preference. Furthermore, farmers are very suspicious of the large amount of red tape which usually characterizes these agencies. It is very advisable, therefore, that this situation be well understood by the Government and that a well organized educational campaign aimed towards the proper orientation of farmers on all credit aspects be initiated.

CONCLUSIONS AND RECOMMENDATIONS

The general objective of this study was to provide the Lajas Valley Committee with basis data relative to the farm management and land use aspects in Southwestern Puerto Rico. This information is expected to serve as a partial guidance to the above-mentioned governmental officials in delineating the general development program for the Lajas Valley Area. In spite of the fact that other important findings were observed throughout the study which are more related to the techniques of farm management and land use, this section is to be restricted only to the discussion of two main problems: irrigation and land tenure. It seems to the author that these are the major points of special interest to the Committee.

The following are perhaps two general questions for which the Committee very probably will like to find an answer. First, would the establishment of an irrigation project result in benefits for the area and for the Island as a whole? Second and last, what land tenure pattern would it be best to implant in the area if the irrigation system is found to be feasible? Our study was not specifically intended to answer these questions in full. However, it may enlighten the problems to some extent.

This study revealed that in the farms of the area where irrigation was practiced average yields of 28.9 tons of sugar cane or 3.67 tons of sugar per cuerda were obtained. On the other hand those farms where no irrigation was carried on had average yields per cuerda of only 17.4 tons of sugar cane or 2.24 tons of sugar. These higher yields could be mostly attributed to the irrigation practice followed, since the quality of the land, as measured by its value per cuerda was practically the same. Considerable sugar cane lands suited for irrigation were not irrigated at all. This suggests the fact that if all the lands fitted for irrigation were irrigated the total production of the area would increase to levels which would undoubtedly reflect in the general economy of the Island as a whole.

From the point of view of capital investment irrigation, however, was not such a good paying proposition for the farmers who made the investment. For instance, it takes more years, on these farms than on those where irrigation was not practiced for the total receipts obtained in the crop year 1942-43 to equalize the total capital invested, as shown by a capital turnover of 3.1 and 2.6 respectively. The per cent return on capital was also lower for the farms irrigating; that is, 11.6 as compared to 14.3 for the others. This suggests that the farmers themselves could not economically afford to incur such large investments. Undoubtedly these investments would increase substantially the total farm income of both the area and the Island, but would need to be financed in some way by outsiders, in our case, the Government. It also indicates that government investments should be made from a long time point of view and, furthermore, that the arrangements with the farmers in the area which may use irrigation services should be carefully worked out having mostly in mind the idea that it be a blessing to them rather than an economic burden.

If the Government decides on the establishment of an irrigation system, then, the next decision to be made is that relative to the land tenure pattern for the area which will be most in agreement with the policy of helping the largest possib'e number of families. The main aspect of the land tenure problem as seen by the author, is mostly a question of the size of farm unit which will best serve the economic and social objective of securing the highest returns as well as the best distribution of both the present and potential income of the area.

It is true that a large number of families could be helped by the establishment of small size farm units. However, it has been demonstrated in this and in many other studies that a farm unit needs sufficient size of business in order to be profitable. As a rule, the larger farms make the better profits because of their advantage over small ones of being able to use more efficiently the factors of production and marketing. This last statement has been found to be true only within certain limits. For instance, in years of unfavorable weather or very low prices the largest farms suffer the largest losses. Furthermore, beyond a certain top limit of size, labor is less efficiently used.

This study definitely demonstrated that the largest sized farms operated by ten or more men during the year were found to bring the highest labor income. These farms had an average total capital invested of around $156,000, a total farm acreage of a little over 850 cuerdas, out of which 225 were in sugar cane, and produced a little over 5,800 tons of cane. The return on labor per man which is to some extent a measure of the possible standard of living of the persons employed on the farms, amounted to an average of $778 on these farms. These farms made plenty for the owners but helped a relatively fewer number of needy families.

The farms which made the highest returns on labor per man were those which employed between 5 to 10 men during the year; had an average total acreage of 167 cuerdas, harvested around 30 cuerdas of cane, produced around 600 tons of cane, and had an average total capital of almost $23,000. Their return on labor per man averaged $786, and their labor income was very close to $2,500.

The return on labor per man of the above farms was slightly above that obtained in the very largest ones. Furthermore, these farms obtained the highest per cent return on capital. This fact may indicate to some extent that if one is interested in high returns per man and high returns on the capital invested there is not much point in operating units in the area which may exceed the size of these farms. It further suggests to those in charge of implementing the land tenure program of the Island the possibility of giving some consideration to the advisability of establishing proportional benefit units of this size.

A farm unit employing 5 to 10 men will combine to a larger extent the advantages of both the large-scale and the moderately sized operations. Besides the advantages of making economies in the use of labor, equipment, capital and in large-scale buying and selling, they will also have the benefits derived from the availability of governmental technical experts and highly trained employees. In addition, because of the fact that these units will be looked upon by the laborers as something closer to the individual type of operation, they may develop more interest in the business; and in emergencies they may put in longer hours of work. There is no doubt also that decisions are made more quickly in this type of farm operaton than in the large-scale ones.

If the efficiency in the organization, management and operation of the suggested units is maintained, they will bring the highest returns per man, the highest return on the capital invested and at the same time will conform to the social objective for which they were created.

As indicated before, the ultimate objective of any development program for the Lajas Valley Area is the social enjoyment of land by the people in general. The achievement of this ambitious goal involves the greatest possible coordination and cooperation among the different branches of the Government which may be responsible for the execution of the plan. In addition, an integrated planned social and economic reorganization can only be carried out successfully through the development and utilization of leadership, both professional and voluntary. Real leadership is necessary not only to perserve confidence in the possibility of crystallizing the development plan but also to get active participation from the people themselves and to make them conscious that the success of the program is an issue of vital importance in their lives.