A FARM MANAGEMENT STUDY OF 224 COFFEE FARMS IN PUERTO RICO, 1934 *

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DESCRIPTION OF THE AREA STUDIED

LOCATION

The coffee farms included in this study are all located in the coffee region of Puerto Rico, which comprises practically all of the west central mountain section of the Island (figure 1).

This study is based on records of farm businesses in the municipalities of Mayagüez, Las Marías, Añasco, Moca, San Sebastián, Lares, Utuado, Adjuntas, Jayuya, Ciales, Ponce, Juana Díaz, Villalba, Guayanilla, Peñuelas, Yauco, Sabana Grande, San Germán, and Maricao (figure 2).

CLIMATE

The mean annual temperature in the coffee area of Puerto Rico ranges from 68 degrees Fahrenheit in the higher sections to 76 degrees in the sections of lower elevation.

The average yearly rainfall ranges from 60 to 120 inches. Rainfall is not evenly distributed throughout the year, thus accounting for the so-called wet and dry seasons. The wet season usually starts in May and lasts until October, while the dry season includes from November to April.

Abundance of sunshine and a continuous growing season throughout the year are characteristic of Puerto Rico, as well as of other tropical countries.

SOILS

Practically all of the soils in the area studied are of a clayey nature, generally lacking in lime and in organic matter.

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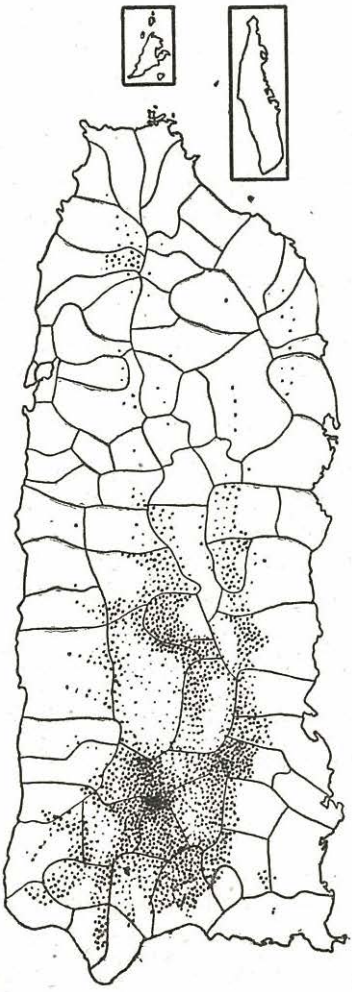

FIGURE 1. ACRES IN COFFEE IN PUERTO RICO, BY MUNICIPALITIES *
1 dot represents 100 acres.

* Puerto Rico Agricultural Experiment Station Bulletin 41, Types of Farming in Puerto Rico, p. 31. Based on U. S. Census, 1930.

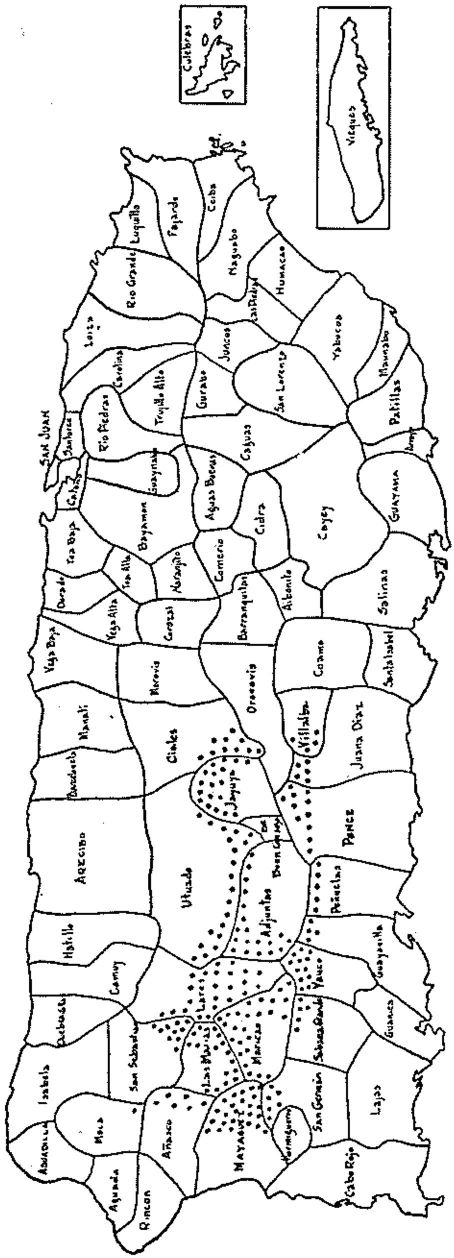

FIGURE 2. LOCATION OF THE FARMS STUDIED, BY MUNICIPALITIES

1 dot represents 1 farm.

The predominating soils in the coffee area of Puerto Rico are classified as Catalina, Frontón, Descalabrado, Utuado, Múcara, Moca, Viví and Cialito series, according to the soils survey of the Island.

TOPOGRAPHY

The elevation ranges from 500 to 2,500 feet above sea level in the area where coffee is grown in Puerto Rico.

TRANSPORTATION FACILITIES

Due mostly to the rough topography, transportation facilities are not very good. Several important insular highways run across the area, and many other gravel or dirt roads are also to be found. These, however, do not supply the entire needs for roads, and thus a large number of farms are to be found entirely off the roads, and are accessible only on horseback.

Of the 224 farms studied, 46 per cent were located on highways, 17 per cent were on gravel or dirt roads, and 37 per cent were entirely off the roads.

DEFINITIONS

CUERDA

The unit of land measure in Puerto Rico. It corresponds very closely to the acre, since it is equivalent to 0.9712 acres.

TOTAL CUERDAS IN CROPS

The total area planted to crops on a farm. Does not include permanent pasture, wooded pasture, or woods.

NET CUERDAS IN CROPS

From the total *cuerdas* in crops, subtract the *cuerdas* intercropped and double-cropped, to obtain the net *cuerdas* in crops. Represents the total area that was actually under cultivation.

ANIMAL UNIT

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, bull, horse, mule, 2 heads of young stock, or 100 hens are each considered as one animal unit.

MAN EQUIVALENT

The average number of persons working on a farm during a year, reduced to an adult-male basis. It is obtained by adding the total months of labor on the farm, including 12 months for the operator, and dividing by 12.

CAPITAL INVESTED

The value of all farm property, land, houses, buildings, livestock, feed, seed, and equipment. The average of the amounts at the beginning and end of the year is considered as the capital invested in the farm business. It is also termed farm capital.

RECEIPTS

Total farm receipts or gross receipts include: 1, the amount received for all crops sold plus the value of the crops at the end of the year which were to be sold; 2, the amount received from the sale of livestock; 3, the amount received from livestock products sold; 4, the amount received from miscellaneous sources, such as work off the farm and rent of farm buildings; 5, the amount by which the farm capital at the end of the year exceeded that at the beginning.

EXPENSES

Include all farm business expenses. In order to put all farms on a comparable basis, the value of the unpaid family labor, except that of the operator himself, was charged as an expense at what it would have cost to hire the work done. Value of livestock purchases, of new equipment or buildings, and repair of buildings and equipment were also included as expenses. When the farm capital at the end of the year was less than that at the beginning, this decrease in inventory was included as an expense. Household or personal expenses were not included.

FARM INCOME

Is the difference between total receipts and total expenses on a farm during a year. It represents what the farmer received for his year's work and for the use of all the capital invested in the farm business.

LABOR INCOME

Is the farm income less interest at 8 per cent on the average farm capital. It is what the operator received for his year's work in addition to having a house to live in and privileges from his farm.

Labor income is not comparable to the salary of a person living in a city. It is comparable, however, to the wages of a married hired man who is given a house and farm privileges besides his cash wages.

The labor income made on a farm is one of the best measures of its efficiency.

FARM PRIVILEGES

The value of all the products, such as milk, eggs, wood, charcoal, and livestock produced for home consumption, together with the estimated rental value of the farm house, constitute the farm privileges of a farmer.

LABOR EARNINGS

To the labor income add the value of the farm privileges, and this gives the labor earnings. This figure is more nearly comparable to the salary of a married hired man working in town.

RETURN ON CAPITAL

From the farm income subtract the estimated value of the operator's labor and management, to obtain the return on capital. In estimating the value of his work, the operator was advised to base his estimate on what it would have cost him to hire the work done by himself, in addition to the farm privileges he obtained during the year.

Since farm income, as already defined, is the income from capital and operator's labor, the return on capital is obtained by subtracting the value of this labor from the farm income.

PER CENT RETURN ON CAPITAL

This is the return on capital, as given above, expressed as a percentage of the average farm capital.

It is a very good measure of profits on a corporation type of farm with a large capital investment and where the owner does not run his business himself, but hires a manager.

CROP INDEX

The yield per *cuerda* of all crops on a farm, when expressed as a percentage of some base, is the crop index on this farm. For this study, the base used was the average yields during 1934 of all the farms studied. This base was considered as 100. If, for example, a farm had a crop index of 75, this means that the yields of all the

crops on that farm, averaged together, were 75 per cent of the yields of the same crops on all the farms.

The crop index was weighted by the acreage planted to each crop. For example, if a farmer had 30 *cuerdas* of coffee, and 10 *cuerdas* of bananas, the coffee received three times as much weight in the crop index as the bananas.

Since coffee was the main crop on each of the farms included in this study, the crop index for each farm is very heavily weighted by the acreage of coffee. Hence, the crop index and the yield of coffee per *cuerda* on most farms were about the same.

LABOR COSTS PER CUERDA IN CROPS

Include the cash cost of the hired labor, together with the cost of the board furnished to this labor, divided by the net *cuerdas* in crops on each farm. The value of the operator's labor or of the unpaid family labor was not included.

CAPITAL TURNOVER

Is the number of years required for receipts to equal capital. The capital turnover of a farm is obtained by dividing the average farm capital by the total receipts.

METHOD OF PROCEDURE

The survey method was used in making this study of coffee farms in Puerto Rico. The survey blank used consisted of two parts: the economic part, on which this study is based; and the agronomic part, which covered as nearly as possible all the phases and problems of coffee farming in Puerto Rico. Each farm, after being surveyed, was thoroughly inspected by the enumerator and the farmer. The records were taken during February to April, 1935; and the information obtained refers to the calendar year 1934.

The sample consisted of 224 farms, selected at random, in the most important coffee municipalities, based on the acreage on coffee in each of these municipalities, as reported by the 1930 census. No farm was included which did not have at least 6 cuerdas of bearing coffee or which did not get a major portion of its receipts from coffee.

Office tabulation, labor-income summaries, and business analyses for each farm were made at the Department of Agricultural Economics of the University of Puerto Rico, under the supervision of the author. Further tabulations, sortings, and cross-tabulations of the data were made by the author at Cornell University.

SIZE OF FARMS AND USE OF THE LAND

The 224 farms surveyed for this study covered a total area of 41,241 *cuerdas,* of which 26,123 *cuerdas* were planted to different crops. Of these, 4,524 *cuerdas* were intercropped and 208 double cropped, leaving a total of 21,373 *cuerdas* net in crops (table 1).

Intercroppings consisted, for the most part, of banana and orange trees. Banana plants provided most of the temporary shade required by the coffee bushes. Orange trees were used to quite an extent to provide part of the permanent shade.

Double cropping is not characteristic of a coffee farm. It occurs only in those sections where tobacco is also one of the main cash crops, the land planted to tobacco being used for vegetables and minor crops after the tobacco crop has been harvested.

Wooded pasture, which occupied 19 per cent of the area, was in practically all cases land in preparation for coffee plantings. Much of this wooded pasture was planted to shade trees to replace those destroyed by the 1928 and 1932 hurricanes.

Permanent pasture accounted for 7,110 *cuerdas*, or 17 per cent of the total area. The rest of the land in these farms was devoted to woods (1,729 *cuerdas*), occupied by buildings, roads and fences (1,709 *cuerdas*), or actually waste land (1,532 *cuerdas*) entirely unfit for agriculture.

The average size of farm was 186 *cuerdas,* of which 96 *cuerdas* were devoted to crops, mostly coffee; 35 *cuerdas* to wooded pasture; 32 *cuerdas* to permanent pasture; 8 *cuerdas* to woods; 8 *cuerdas* occupied by buildings, roads and fences, and 7 *cuerdas* of waste land.

TABLE 1. SIZE OF FARMS AND USE OF THE LAND

224 COFFEE FARMS, PUERTO RICO, 1934

	Total for all farms	Average per farm	Per cent of total
	*cuerdas**	*cuerdas*	
Total in crops	26,123	117	.....
Intercropped	4,542	20	.....
Double cropped	208	1	.....
Net in crops	21,373	96	52
Permanent pasture	7,110	32	17
Wooded pasture (maleza)	7,788	35	19
Woods (monte)	1,729	8	4
In buildings, roads, and fences	1,709	8	4
Waste land	1,532	7	4
Total in farm	41,241	186	100

*The *cuerda* is the unit of land measure in Puerto Rico. Equivalent to 0.9712 acres.

FARM CAPITAL

The average farm capital for all farms studied was $15,580 (table 2). Of this, 95.8 per cent was invested in real estate, 1.8 per cent in livestock, and 2.4 per cent in equipment. The total investment per *cuerda* averaged $84.

The value of the land alone constituted 83.4 per cent of the total investment per farm, and averaged $70 per *cuerda*.

The value of the operator's house accounted for 5.2 per cent of the total investment. That of the buildings, of which houses for the "arrimados" were most important, represented 4.0 per cent of the farm capital. An "arrimado" is a hired man who is given a house to live in and usually a tract of land for a home garden. This type of hired man is characteristic of the coffee region of Puerto Rico, and may also be found in the tobacco areas, but is unusual in the sugar cane belt.

TABLE 2. FARM CAPITAL

224 COFFEE FARMS, PUERTO RICO, 1934

	Average value per farm	Per cent of total
Land	$12,997	83.4
Operator's house	808	5.2
Machinery house	388	2.5
Other buildings	629	4.0
Glacis*	104	0.7
Total real estate	$14,926	95.8
Livestock	286	1.8
Equipment	368	2.4
Total	$15,580	100.0

* Glacis is a concrete floor for drying coffee in the sunlight.

CROPS GROWN

Coffee culture in Puerto Rico is mainly a single crop type of agriculture. The acreage planted to coffee, both bearing and non-bearing, constituted 75.9 per cent of the total *cuerdas* in crops on these 224 farms in 1934 (table 3).

Bananas were second in importance as to acreage, and represented 11.7 per cent of the total *cuerdas* in crops. The banana plant constituted the most widely used type of temporary shade for coffee in Puerto Rico, because of its rapid growth, excellent shade, and its use for family consumption, hog feed, and as a source of cash income.

Citrus, especially oranges, occupied 5.2 per cent of the total *cuerdas* in crops. They were used as permanent shade, and were usually planted along the sides of the farm roads and lanes. The use of

citrus for shade has no particular advantage, besides the small income that may be derived from the crop, because of its susceptibility to certain insect and fungus pests that may also attack coffee. The present tendency of most coffee farmers is to eliminate citrus of all kinds from their coffee farms; but, as yet, the progress of this movement has been slow.

Other minor crops besides bananas, including plantains, corn, beans, yautías, and pigeon peas, together constituted 4.5 per cent of the total *cuerdas* in crops. These crops were mostly for home use.

TABLE 3. CROPS GROWN

224 COFFEE FARMS, PUERTO RICO, 1934

Crops	Total for all farms	Average per farm	Per cent of total
	Cuerdas	*Cuerdas*	
COFFEE:			
Non-bearing	8,243	36.8	31.6
Bearing	11,577	51.7	44.3
Total	19,820	88.5	75.9
CITRUS:			
Oranges	1,212	5.4	4.6
Other citrus	61	0.3	0.3
Non-bearing	58	0.3	0.3
Total	1,331	6.0	5.2
MINOR CROPS:			
Bananas	3,076	13.8	11.7
Plantains	136	0.6	0.5
Corn	345	1.5	1.3
Beans	246	1.1	0.9
Yautías	133	0.6	0.5
Pigeon peas	118	0.5	0.4
Other	207	0.9	0.9
Total	4,261	19.0	16.2
Sugar cane	192	0.9	0.8
Tobacco	302	1.3	1.1
Used by share-croppers	217	0.9	0.8
Total crops	26,123	116.6	100.0
Less: Intercrops	4,542	20.3	17.4
Double crops	208	0.9	0.8
Net cuerdas in crops	21,373	95.4	81.8

Sugar cane was the second most important cash crop on seventeen coffee farms, where the soil was especially adapted or where transportation facilities from the farm to the sugar mill were exceptionally good.

Tobacco was an important cash crop on 21 of the coffee farms. On these farms the income from this crop was a real help to the farmer, especially after the hurricanes; because, being an annual crop, it provided him with a source of income to help meet the large expenses involved in the rehabilitation of his coffee farm.

Of the total *cuerdas* in crops 17.4 per cent was intercropped. Intercropping is characteristic of the Puerto Rican coffee farms as they are today. A large percentage of the acreage in bananas and citrus was intercropped with the coffee.

Double crops were found almost exclusively in those farms which also grew tobacco, the land being planted to minor crops after the tobacco had been harvested. On these farms the system of share-croppers was also found. The area worked by share-croppers represented about 1 per cent of the total *cuerdas* in crops.

Net *cuerdas* in crops represented 81.8 per cent of the total *cuerdas* in crops or an average of about 96 *cuerdas* per farm. Of these 96 *cuerdas,* 88.5 were in coffee with bananas and citrus intercroppings. The balance was mostly in minor crops, tobacco or sugar cane.

AGE OF COFFEE BUSHES

The total *cuerdas* in coffee of all ages was 19,820 *cuerdas.* Of these, 8,243 *cuerdas,* or 42 per cent were from one to three years of age; 4,961, or 25 per cent, were from four to eight years old; and 6,616, or 33 per cent, were nine years old or more. Very few, if any, were more than twenty-five years old (table 4).

Under normal conditions in Puerto Rico, coffee bushes do not generally start to bear until after the third year. They will then bear lightly, and will reach full bearing capacity during the sixth or seventh year.

Of the area in coffee in these farms, 42 per cent was under bearing age and 58 per cent was either just starting to bear or in full bearing during 1934.

The new coffee plantings set after the 1928 hurricane would have started to bear by 1932, had it not been for a second hurricane in that year. Since this last hurricane, new plantings have been started again. This accounts for the large percentage of non-bearing coffee bushes in 1934.

TABLE 4. AGE OF COFFEE BUSHES
224 COFFEE FARMS, PUERTO RICO, 1934

Age of Coffee Bushes	Cuerdas	Per cent of total
(Years)		
1—3	8,243	42
4—8	4,961	25
9—25	6,616	33
Total	19,820	100

CROP YIELDS

During 1934, the average yield of coffee per *cuerda* on the farms studied was 92 pounds (table 5). On 26 per cent of the number of farms, the yield of coffee per *cuerda* was less than 50 pounds, while on 11 per cent of the farms, it was more than 200 pounds. The highest yield obtained on any of the farms was 378 pounds, and the lowest was 12 pounds per *cuerda* of coffee. An average of 92 pounds per *cuerda* during 1934 was only from one-half to one-third of what is generally considered a satisfactory normal yield of coffee in Puerto Rico.

Sugar-cane yield on these coffee farms averaged 492 quintals per *cuerda*. This yield of sugar cane compares satisfactorily with the average for the northern coast of Puerto Rico where sugar cane is grown, but is much lower than the average for the southern coast, where a large proportion of the sugar cane is grown under irrigation.

Most of the coffee farms where tobacco was grown, were located in the municipalities of Utuado and Jayuya, two of the leading tobacco areas in Puerto Rico. The average yield of tobacco per *cuerda*, in these two municipalities is 600 and 700 pounds respectively.† On the farms surveyed, the average yield of tobacco was 450 pounds per *cuerda*, which is much lower than the average for the regions where most of these farms were located.

The average yields obtained per *cuerda* of bananas, plantains, corn, beans, and "yautías" might be considered satisfactory for these farms, in view of the fact that these minor crops are generally grown on the poorer soils, or for some other purpose besides cash crops.

The yields of the crops included in table 5 were used as a basis in the calculation of the crop index for each farm.

TABLE 5. CROP YIELDS
224 COFFEE FARMS, PUERTO RICO, 1934

Crop	Number of cuerdas harvested	Average yield per cuerda
Coffee	11,577	92 pounds
Sugar cane	192	492 quintals*
Tobacco	302	4.5 quintals
Bananas	3,070	9.2 thousands
Plantains	125	6.5 thousands
Corn	345	6.0 quintals
Beans	246	2.8 quintals
Yautías	124	22.4 quintals

* One quintal is equivalent to 100 pounds.

† F. Joglar Rodríguez, Puerto Rico Agricultural Experiment Station, Extension Bulletin No. 4, "Cultivo del Tabaco", Appendix Table 1.

CROP SALES

The total receipts from the sale of crops in the 224 coffee farms amounted to $214,723, or an average of $1,460 per farm. Of this, 65.7 per cent was solely from coffee; 10.0 per cent from bananas; 5.7 per cent from sugar cane; 5.6 per cent from tobacco; 4.8 per cent from oranges; 2.7 per cent from plantains; and 5.5 per cent from the sale of other crops (table 6).

The average farm price obtained on these farms per quintal (100 pounds) of coffee in 1934 was $21.32. The 5-year average price per exported quintal, for the 1930–1934 fiscal years, was $25.20.†

The farm price of coffee in Puerto Rico since 1928 has tended to drop in spite of the small supply, due principally to the depression and to the fact that during this period there has been heavy smuggling of cheap foreign coffee into the Island. Sugar cane and tobacco prices have also dropped during this period.

Such crops as oranges, plantains, and bananas, which are usually delivered at the farm to be sold at the local town markets, had also very low prices during 1934.

TABLE 6. CROP SALES

224 COFFEE FARMS, PUERTO RICO, 1934

Crop	Quantity sold	Total sales	Average price per unit of sale	Sales per farm	Per cent of total
Coffee	10,072*	$214,723	$21.32	$959	65.7
Sugar cane	94,147*	18,743	0.20	84	5.7
Tobacco	1,209*	18,320	15.15	82	5.6
Oranges	6,794**	15,576	2.29	69	4.8
Plantains	677**	8,924	13.18	40	2.7
Bananas (all kinds)	20,684**	32,650	1.58	146	10.0
Other crops	.....	18,196	.....	80	5.5
Total	.....	$327,132	.....	$1,460	100.0

* Quintals. ** Thousands.

LIVESTOCK

There was a wide variety of livestock on these farms, although the average value of livestock per farm was only $286. Most farmers kept some dairy cattle and work animals besides their usual small poultry flock.

† Weighted average computed from figures in the 1934 Yearbook of Statistics of the Department of Agriculture and Commerce of Puerto Rico, based on reports of the United States Customs House.

DAIRY CATTLE

Dairy cows were commonly kept on these coffee farms, mainly for the milk, which was used for home consumption. In some cases a part of the milk was sold to neighboring farmers or retailed at a near-by town.

The "native" cow was the predominant breed, in spite of its low milk production. A few Holstein, Jersey, and Guernsey grades were found on some farms.

The value of all dairy cattle kept on these farms was $133 per farm, or nearly 50 per cent of the total value of all livestock (table 7).

WORK ANIMALS

Work animals on these farms included oxen, horses, mules, and donkeys. Oxen were most numerous on those farms which grew sugar cane in addition to coffee. They were used mostly for plowing the fields and hauling the cane during harvest time.

Horses, mules, and donkeys were mostly used as pack animals for the transportation of produce from the farm to the local town markets. This method of transportation was most common on those farms where transportation facilities were poor because of the absence of suitable roads. The average value of all work animals on those farms was $113.

POULTRY

A small poultry flock was found on each of the farms surveyed. This flock was kept mainly to supply the family needs for eggs and chickens. Practically all of the birds were of the game breed, with but few cases in which Rhode Island Reds, White Leghorns, or other improved poultry breeds were kept. The total value of the poultry flock was $19 per farm.

OTHER LIVESTOCK

Swine were kept on most farms. The average value was $7 per farm. On many of the farms surveyed, swine provided the farmer and his family with most of the year's supply of lard, pork, and a wide variety of sausages and other products.

Goats and sheep are uncommon on coffee farms. Most farmers object to them because of the large amount of damage they do to crops.

Bees were very common several years ago on coffee farms in Puerto Rico. Because of the low price of honey during the past few years, most farmers have discontinued keeping bees.

The average value per head of stock was an indication of the poor quality of livestock kept on these coffee farms, and, consequently, showed the need for improvement. The average production of milk per cow during 1934 was only 530 quarts, of which 19 per cent was sold, thus leaving 429 quarts of milk for home use during the year. This amount of milk was hardly sufficient to supplement the needs of the average family on a coffee farm. By increasing the number of Holstein, Jersey, and Guernsey grades and improving the feeding practice, improvement along this line could be readily obtained.

TABLE 7. LIVESTOCK
224 COFFEE FARMS, PUERTO RICO, 1934

Type	Average per farm		Value per head of stock
	Number	Value	
DAIRY CATTLE:			
Cows	3.5	$100	$29
Heifers—1 year old or over	1.3	16	12
Heifers—under 1 year old	0.5	3	6
Calves	1.1	6	5
Bulls	0.4	8	20
Total	.....	$133	.....
WORK ANIMALS:			
Oxen	0.7	$24	$34
Horses	1.5	44	29
Mules	1.1	44	40
Donkeys	0.1	1	10
Total	.....	$113	.....
POULTRY:			
Hens	21.3	$11	$0.52
Roosters	2.7	4	1.48
Pullets	13.9	4	0.29
Other fowl	0.1	*	.....
Total	.....	$19	.....
OTHERS:			
Swine	1.1	$7	$6
Goats and sheep	0.3	1	3
Rabbits	0.4	*	.....
Bee hives	5.9	13	2
Total	.....	$286	.....

* Less than $1.

MISCELLANEOUS RECEIPTS

In addition to the income from the sale of crops or livestock, most farms had some miscellaneous source of income. The total income from these miscellaneous sources amounted to $23,640 in 1934, or an average of $106 per farm (table 8). Of these $106 per farm, $55 were from the sale of charcoal, which was made from the wood obtained from the pruning and topping off of the permanent shade trees. This work was usually done on a share basis with one of the hired men.

Second in importance was the income from the benefit and rental payments received from the Agricultural Adjustment Administration on those farms which also grew tobacco. The average income from this source was $28 per farm. Income from the sale of wood, fence posts, or other sources made up the balance of the miscellaneous receipts per farm. Man labor off farm was an insignificant source of income on these farms.

On the basis of the number of farms reporting, income from the Agricultural Adjustment Administration payments averaged $347 per farm; from the sale of charcoal, $126; from wood, $97; from fence posts, $85; from man labor off farm, $30; and $142 from other sources.

TABLE 8. MISCELLANEOUS RECEIPTS
224 COFFEE FARMS, PUERTO RICO, 1934

	Total	Average per farm reporting	Average per farm (all farms)
Charcoal	$12,203	$126	$55
Man labor off farm	61	30	.....
Wood	2,530	97	11
Fence posts	597	85	3
A. A. A.*	6,254	347	28
Other income	1,995	142	9
Total	$23,640	.....	$106

* Benefit and rental payments on the 1934 tobacco crop.

MACHINERY AND EQUIPMENT

The average value of all machinery and equipment on the farms studied was $358 per farm (table 9).

Depulping machines were the most common type of machinery found on coffee farms. Many different types of depulping machines were found on these farms, ranging from the hand machine, the overshot wheel type, and animal-power types to the gasoline engine and electric types. The value of these depulping machines was $100 per farm or $110 per machine.

The hot-air coffee drier is an expensive modern type of machine, and was found on only twelve of the farms studied.

Ox-carts were used mostly for hauling the sugar cane, although motor trucks were also being used on those farms within easy access of satisfactory roads.

All of the cultivation of the coffee bushes was done by hand. The average value of hand-cultivating equipment was not so high as would have been expected, because the hired men furnished their own equipment in most cases.

Though very little plowing is done in the coffee fields, some plows are to be found, especially in those farms growing crops other than coffee.

The almost complete absence of tractors from coffee farms was indicated by the fact that only one tractor was found on the 224 coffee farms. This particular farm had a large acreage in tobacco.

TABLE 9. MACHINERY AND EQUIPMENT

224 COFFEE FARMS, PUERTO RICO, 1934

Type	Number	Value	
		Total	Per farm (all farms)
Depulping machines	204	$22,392	$100
Motors	115	10,967	49
Bombo (hot-air coffee drier)	12	28,120	126
Trucks	11	5,515	25
Ox-carts	48	2,341	10
Horse-carts	2	34	.....
Hand cultivating equipment	.....	3,803	17
Plows	51	689	3
Harrows	7	106	.....
Tractor	1	206	1
Trapiche*	1	77	.....
Other	.....	5,953	27
Total	.....	$80,203	$358

* Small mill for grinding sugar cane at the farm.

FARM PRIVILEGES

Farm privileges include what the farmer got from his farm for his year's work besides his labor income. The yearly rental value of the farm house, plus all the farm and livestock products obtained during the year constituted the farm privileges. The value of the farm privileges for all farms studied averaged $451 during the year 1934 (table 10).

Minor produce, which included coffee, bananas, and minor crops from the farm used in the farmer's home, accounted for the major part of the privileges ($150). Next in importance was the yearly rental value of the farm house, which averaged $125. Milk was third in importance as a farm privilege, averaging $119 per farm. Other products, such as charcoal, eggs, livestock, wood, fruits, honey, lard, and sausages also constituted some of the farm privileges which these coffee farmers in Puerto Rico received.

The farm privileges, when added to the labor income, represented the labor earnings of the farmer. The average labor earnings for all of the farms studied was $-669 per farm (table 11).

TABLE 10. FARM PRIVILEGES
224 COFFEE FARMS, PUERTO RICO, 1934

	Average per farm	
	Amount	Value
Milk (quarts)	1,484	$119
Eggs (dozens)	86	16
Livestock	.....	11
Minor produce	.....	150
Rent value of dwelling	.....	125
Charcoal	.....	19
Wood	.....	7
Fruits	.....	2
Honey, lard, and sausages	.....	2
Total	.....	$451

CASH FARM EXPENSES

The average cash farm expenses for all farms was $1,336 (table 11). Of this amount, 77.2 per cent was spent for labor; 8.5 per cent for taxes; 4.6 per cent for new buildings and repairs; 3.5 per cent for fertilizer; 2.3 per cent for livestock feed; and 3.9 per cent for other cash expenses.

LABOR

Labor was the most important item of expense on these farms, most of it being for hired day labor, which averaged $870 per farm, and $890 per farm reporting. Only 5 farms out of the 224 did not hire day labor in 1934. There were three farms operated by managers. The expense for manager's salary represented 1.1 per cent of the cash farm expenses, and amounted to $1,100 per year on those farms reporting. A "mayordomo", or foreman, was employed on 88 of the coffee farms. The expense for his salary was 8.0 per cent of the cash expenses per farm, and amounted to $272 per farm reporting. Labor compensation insurance averaged $40 per farm, and $59 per farm reporting.

TAXES

Taxes were the second most important group of cash farm expenses, averaging $113 per farm. The expense for taxes represented 8.5 per cent of the cash farm expenses, and 0.73 per cent of the average farm capital per farm.

LIVESTOCK FEED

Livestock feed averaged $31 per farm, of which $22 was for poultry feed. The expense for cattle feed averaged only $6 per farm. Since there were only 19 farms reporting cattle feed expense, the average per farm reporting was $72.

MISCELLANEOUS EXPENSES

Cash expenses for fertilizer averaged $45 per farm, and $179 per farm reporting. Fertilizer was purchased on 56 of the farms surveyed, but on only 17 of these farms it was applied to the coffee bushes. On the other farms it was applied either to sugar cane or to tobacco.

TABLE 11. CASH FARM EXPENSES
224 COFFEE FARMS, PUERTO RICO, 1934

	Total expense	Average per farm reporting	Average per farm (all farms)	Per cent of total
	Dollars	Dollars	Dollars	
LABOR:				
Manager's salary	3,300	1,100	15	1.1
Mayordomo's salary	23,973	272	107	8.0
Hired day labor	194,844	890	870	65.1
Labor compensation insurance	8,948	59	40	3.0
Total	231,065	.....	1,032	77.2
TAXES:				
Property tax	23,607	105	105	7.9
Coffee insurance tax	1,536	24	7	0.5
Tobacco protection tax	287	16	1	0.1
Total	25,430	.....	113	8.5
LIVESTOCK FEED:				
Cattle	1,377	72	6	0.4
Poultry	4,848	36	22	1.7
Other animal feed	719	90	3	0.2
Total	6,944	.....	31	2.3
Fertilizer	10,035	179	45	3.5
Insecticides	328	25	2	0.1
BUILDINGS:				
New	5,909	311	26	1.9
Repairs	7,798	134	35	2.7
Total	13,707	.....	61	4.6
Equipment:				
Purchased	531	59	2	0.1
Repairs	309	26	1	0.1
Total	840	.....	3	0.2
Transportation of produce	3,774	22	17	1.4
Hired animals	124	31	1	0.1
Shoeing horses	612	6	3	0.2
Seed purchased	1,529	27	7	0.5
Fences	1,824	27	8	0.6
Farm share auto	556	111	2	0.1
Truck	885	177	4	0.3
Bags	760	7	3	0.2
Toldas*	465	9	2	0.1
Gas and oil for depulping machine	481	5	2	0.1
Total	299,359	.....	1,336	100.0

* Burlap for drying coffee.

The expense for construction and repair of buildings averaged $61 per farm. New buildings were constructed on 19 farms at an average cost of $311.

Equipment costs were relatively insignificant on the 224 coffee farms. Of the other cash farm expenses, the most important was

that for the transportation of produce, which averaged $17 per farm, or 1.4 per cent of the cash farm expenses. Because of the fact that many farms lacked suitable roads, the transportation of the farm produce to the local market was slow and expensive. Such expenses as purchase of seed, bags, "toldas", and gas and oil for the depulping machine, although common, were of minor importance.

LABOR INCOME

Labor income is one of the most generally accepted measures of the business success of a farm. It represents what the farmer received for his year's work and management, in addition to having a house to live in and products furnished by the farm, after allowing a reasonable amount of interests on his capital invested in the farm business. It is comparable to the cash wages of a married hired man on a farm, who also receives the use of a house and farm products.

The average total receipts per farm was $1,633, most of which was derived from the sale of crops, especially coffee (table 11). The average total expenses per farm was $1,506. The value of the unpaid family labor as estimated by the farmer was included as an expense, since that would have been the approximate cost of hiring the work done. The increase in farm capital during the year was not enough to balance the decrease, resulting in a net decrease in farm capital, which was also charged as an expense.

The average total receipts exceeded the average total expenses on these farms by $127. This was the farm income, or the amount which the operator received for his year's work and for the use of the capital invested. In order to put all farms on a comparable basis, regardless of mortgage indebtedness, 8 per cent interest on the average capital invested was deducted from the farm income to obtain the labor income.

The average labor income on these 224 farms was $–1,120 per farm. This means that, on the average, these farmers failed by $1,120 to meet their total farm expenses and interest on investment, and received nothing for their year's work.

A farmer's labor income might be nothing, or even less than nothing, as in this case, and yet he might be making a living. If the farm income were $500 and the capital invested were $10,000, the labor income would be $500 less 8 per cent on the $10,000 capital ($800), or minus $300. However, if he had no mortgage nor any other debt, the farmer would have $500 to live on. If he had had a son working at the farm who was not paid wages, but whose time

was included in the expenses as $200, the family would then have had $700 to live on. The farmer might thus be living well, in spite of having a negative labor income.

Labor earnings is the labor income plus the value of the farm privileges. The average value of farm privileges per farm (table 10) was $451, which, when added to the labor income, resulted in an average labor earnings of $-669 per farm.

The return on capital is calculated by subtracting the value of the operator's time, as estimated by the farmer, from the farm income. The farm income, as already stated, represents the amount the operator received for his year's work and the use of his farm capital. By subtracting the estimated value of the operator's time from the farm income, the return on his capital invested is obtained. The average return on capital for these farms was $-377.

TABLE 12. LABOR INCOME SUMMARY
221 COFFEE FARMS, PUERTO RICO, 1934

	Total	Average per farm
RECEIPTS:		
Crops sold	$327,132	$1,469
Livestock sold	3,973	18
Livestock products sold	10,891	49
Miscellaneous	23,640	106
Total	$365,636	$1,633
EXPENSES:		
Cash farm expense	$299,359	$1,336
Livestock purchased	2,026	9
Unpaid labor	20,659	92
Net decrease in farm capital	15,296	69
Total	$337,340	$1,506
Farm income	28,296	127
Less: 8 per cent interest on average farm capital	279,207	1,247
Labor income:	**$-250,911**	**$-1,120**
Labor earnings	-149,904	-669
Return on capital	-84,528	-377
Per cent return on capital	-2.42	-2.42
Value of operator's time	112,824	504
Capital turnover	.....	9.54

The per cent return on capital is the return on capital expressed as a percentage of the average farm capital. These farmers had an average of $15,580 invested in their farm businesses. The return on this capital averaged minus $377, or minus 2.42 per cent of the capital.

Capital turnover is the number of years required for receipts to equal capital. An average of 9.54 years, as obtained for these coffee farms, indicates a very slow capital turnover during 1934.

TOTAL CUERDAS IN COFFEE AND LABOR INCOME

Total *cuerdas* in bearing and non-bearing coffee was a satisfactory measure of size of business in the farms studied. The farms were divided into five different groups, according to total *cuerdas* in coffee per farm. In each of these groups the average labor income obtained was a negative figure, indicating a loss (table 13).

The group containing the smallest farms has 16 *cuerdas* in coffee, and made a labor income of $–344. The second group, with 49 *cuerdas* in coffee, made a labor income of $–663. In the third group there were 96 *cuerdas* in coffee, and the labor income was $–1,264. The fourth group had 149 *cuerdas* in coffee and averaged $–1,656 labor income. The group with the largest farms had 274 *cuerdas* in coffee, and made a labor income of $–3,180. The relation between total *cuerdas* in coffee and labor income indicated that the greater the number of *cuerdas* in coffee, the larger was the loss.

Size of business may have a direct or an indirect relationship to labor income, depending on whether the crop year was good or poor. There were many conditions that made 1934 a poor crop year for coffee farmers in Puerto Rico: low yields of coffee were obtained; a large percentage of the coffee bushes was not yet bearing; and prices for coffee had also dropped. Under such conditions the larger farms would be expected to lose more money than the smaller farms.

Other measures of size of business, such as total *cuerdas* per farm, capital invested, and gross receipts, had the same relation to labor income as did total *cuerdas* in coffee. The larger the size of the farm business, as measured by each of these other factors, the greater the loss, as indicated by the labor incomes. Mortgage debts per farm, both Federal Land Bank and Hurricane Relief Commission mortgages, increased together with size of farm.

Yield and crop index did not show the same relationship to labor income with increasing acreage in coffee as did the measures of size of business. There was a curvilinear relationship, indicating that high yields could be obtained on small farms as well as on large farms.

As the total *cuerdas* in coffee increased the per cent income from coffee also increased, indicating that the larger farms had less diversification and were thus more dependent on sales of coffee for their income.

TABLE 13. RELATION OF TOTAL CUERDAS IN COFFEE TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

	Total cuerdas in coffee					Average for all farms
	Less than 30	30-79	80-129	130-179	180 or more	
Number of farms	63	71	36	23	31	224
Cuerdas in coffee:						
Bearing	10	31	51	93	154	52
Non-bearing	6	18	45	56	120	37
Total	16	49	96	149	274	89
Labor income	$-344	$-363	$-1,264	$-1,656	$-3,180	$-1,120
Farm income	$52	$78	$-143	$364	$526	$127
SIZE FACTORS:						
Size of farm (cuerdas)	59	114	203	300	489	186
Total cuerdas in crops	27	72	124	196	333	117
Net cuerdas in crops	20	55	101	157	290	96
Capital invested	$4,945	$9,265	$14,008	$25,250	$46,320	$15,580
Gross receipts	$545	$1,037	$1,439	$2,915	$4,764	$1,633
Receipts from coffee sales	$185	$516	$750	$1,767	$3,218	$963
Federal Land Bank mortgage	$1,675	$2,542	$3,639	$7,630	$9,468	$3,955
Hurricane Relief Commission mortgage	$944	$2,190	$3,861	$6,022	$8,855	$3,424
Man equivalent	3.0	4.8	8.0	12.2	19.4	7.5
EFFICIENCY FACTORS:						
Yield of coffee per cuerda (pounds)	112	96	84	97	107	92
Crop index	120	98	94	106	110	100
Gross returns per cuerda	$12	$10	$8	$10	$10	$10
Cuerdas in crops per man equivalent	7.5	13.2	15.2	15.5	17.5	12.7
Coffee sales per man equivalent	$62	$108	$94	$145	$166	$76
Per cent income from coffee	50	56	59	65	74	58

TOTAL CUERDAS PER FARM AND LABOR INCOME

There were 42 farms of less than 50 *cuerdas* in size. The average labor income for this group of farms was $–230. These farms had 15 *cuerdas* in coffee, and their average farm capital was $3,069 (table 14).

The second group consisted of 82 farms, averaging 90 *cuerdas* per farm, and with a labor income of $–718. This group had 48 *cuerdas* in coffee and $8,552 in capital.

In the last group are included 31 farms whose size was 350 *cuerdas* or more. The average size of farm in this group was 547 *cuerdas*, and their labor income $–2,868. They had 245 *cuerdas* in coffee and a capital of $43,805.

The relation existing between total *cuerdas* per farm and labor income indicated that as the size of farm increased the acreage in coffee, capital invested, and *cuerdas* in crops per man equivalent also increased, but the labor income decreased. This relation points again to the fact that, during 1934, the larger farms lost more money than did the smaller farms.

TABLE 14. RELATION OF SIZE OF FARM TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Size of farm (cuerdas)		Number of farms	Total cuerdas in coffee	Capital invested	Cuerdas in crops per man equivalent	Labor income
Range	Average					
Less than 50	27	42	15	$3,069	7.4	$-230
50-149	90	82	48	8,552	13.1	-718
150-249	199	47	95	16,224	13.9	-1,184
250-349	291	22	146	24,532	14.7	-1,718
350 or more	547	31	245	43,805	16.0	-2,868

CUERDAS IN BEARING COFFEE AND LABOR INCOME

The number of *cuerdas* in bearing coffee was a good measure of size of business. On these 224 coffee farms it showed the same relationship to labor income as did the other measures of size (table 15).

The first group consisted of 106 farms averaging 14 *cuerdas* of bearing coffee per farm, and a man equivalent of 4.1. Fifty per cent of their total income was from the sale of coffee. The average farm income for this group of farms was $-21, and the labor income $-556.

In contrast with these small farms the 20 largest farms had an average of 194 *cuerdas* in bearing coffee and a man equivalent of 18.6. About three-fourths of the receipts on these farms were from the sale of coffee. These farmers made $793, besides paying all their farm expenses. Their labor incomes, however, were much lower than those for the first group of farms. They averaged $-3,181. This was due to the fact that the large farms had a much greater investment in capital. The farm income on these farms was not large enough to allow for the 8 per cent interest deduction, and, consequently, a large negative labor income resulted. If all the farms had been completely out of debt, the larger farms would have been much better off than the smaller farms, since they made approximately $800 above expenses.

TABLE 15. RELATION OF CUERDAS IN BEARING COFFEE TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Cuerdas in bearing coffee		Number of farms	Man equivalent	Per cent income from coffee	Farm income	Labor income
Range	Average					
Less than 30	14	106	4.1	50	$-21	$-556
30-79	51	74	7.1	62	100	-1,061
80-129	103	24	15.5	71	303	-2,078
130 or more	194	20	18.6	73	793	-3,181

NET CUERDAS IN CROPS AND LABOR INCOME

An indirect relationship was observed between net *cuerdas* in crops and labor income. Labor income decreased as the average number of net *cuerdas* in crops in each group of farms increased (table 16).

The smaller farms with 27 net *cuerdas* in crops, including 24 in coffee, had an average capital of $5,773. The yield obtained was 108 pounds of coffee per *cuerda,* and the labor income $–424. Fifty-four per cent of the gross income on these farms was from the sale of coffee. Labor costs averaged $11 per *cuerda* in crops, and there were 9.1 *cuerdas* in crops per man equivalent.

The large farms averaged 294 net *cuerdas* in crops, 274 *cuerdas* in coffee, and had a capital of $47,017. The yield of coffee was 106 pounds per *cuerda,* and the labor income $–3,119. Seventy-one per cent of the income was from coffee sales. Labor costs averaged $10, and there were 17.1 *cuerdas* in crops per man equivalent.

Yield of coffee per *cuerda* was low for each group of farms in general. There was no relation between net *cuerdas* in crops and yield of coffee per *cuerda.*

As the net *cuerdas* in crops increased, the per cent income from coffee also increased, indicating that the larger farms were more dependent on coffee for their income. Labor costs per *cuerda* in crops tended to remain fairly constant as the size of farm business increased.

TABLE 16. RELATION OF NET CUERDAS IN CROPS TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Net cuerdas in crops		Number of farms	Total cuerdas in coffee	Capital invested	Yield of coffee per cuerda (*Pounds*)	Per cent income from coffee	Cuerdas in crops per man equivalent	Labor costs per cuerda in crops	Labor income
Range	Average								
Less than 50	27	96	24	$5,773	108	54	9.1	$11	$–424
50-99	73	55	67	11,695	86	56	15.0	10	–920
100-149	118	25	111	17,686	90	59	15.0	12	–1,382
150-199	167	18	158	24,728	105	68	15.3	11	–1,750
200 or more	294	30	274	47,017	106	71	17.1	10	–3,119

CAPITAL INVESTED AND LABOR INCOME

There was a marked relationship between the amount of capital invested and the labor income on the farms studied. The larger the capital invested, the greater the loss (table 17).

The first group of farms, with an average capital of $2,959, had a total area of 40 *cuerdas,* 20 of which were in coffee. The gross receipts for this first group of farms averaged $373, of which $161 was from the sale of coffee. This group of farms had an average labor income of $–267.

The last group of farms had an average capital of $44,224 and 447 *cuerdas* per farm, with 237 *cuerdas* in coffee. Gross receipts amounted to $4,569 per farm, including $2,955 from the sale of coffee. This group had an average labor income of $–2,894.

Considering the facts that coffee yields in 1934 were unusually low and that most of the farmers actually lost money in their businesses, it was reasonable to expect that the larger the amount of capital invested in the farm business, the greater would be the loss.

The amounts of Federal Land Bank mortgages, as well as those of the Hurricane Relief Commission increased, together with capital invested. However, when the mortgage indebtedness from these two sources was expressed as a percentage of the farm capital, the larger farms had 40 per cent, while the smaller farms had approximately 60 per cent. The average mortgage debt held by these two agencies on the 224 coffee farms was 47 per cent of the farm capital.

TABLE 17. RELATION OF CAPITAL INVESTED TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Capital invested (dollars)		Number of farms	Size of farm (*cuerdas*)	Total cuerdas in coffee	Gross receipts	Coffee sales	Federal Land Bank mortgages	Hurricane Relief Commission mortgages	Labor income
Range	Average								
Less than 5,000	$2,959	55	40	20	$373	$161	$1,082	$700	$–267
5,000— 9,999	7,450	57	110	46	964	443	2,237	1,974	–575
10,000—14,999	12,047	36	169	76	1,193	744	3,389	2,806	–978
15,000—24,999	19,912	37	251	111	2,107	1,069	5,635	5,851	–1,496
25,000 or more	44,424	39	447	237	4,569	2,955	9,449	7,654	–2,894
Average (all farms)	15,580	224	186	89	1,633	963	3,955	3,424	–1,120

GROSS RECEIPTS AND LABOR INCOME

The relation between gross receipts and labor income was also indirect. There were 61 farms with gross receipts of less than $500, averaging $258 per farm (table 18). These farms had 30 *cuerdas* in coffee, and a crop index of 91. They were short by $176 in meeting their total farm expenses, and their average labor income was $–596.

Gross receipts of $2,000 or more were obtained in 49 farms. The average was $4,779 per farm. This group of farms had 193 *cuerdas* in coffee and a crop index of 139. After paying all the farm expenses, these farmers made $1,033; but even then their labor income was $–1,849. If these farms had had no mortgage indebtedness, the farmers would have had an income of $1,033 to live on, and, consequently, would have been much better off than those farmers in the first group of farms.

Total *cuerdas* in coffee and crop index were closely associated with gross receipts. Both varied directly with gross receipts, and were causal factors in determining the amount of gross receipts per farm.

TABLE 18. RELATION OF GROSS RECEIPTS TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Gross receipts (dollars)		Number of farms	Total cuerdas in coffee	Crop index	Yield of coffee per cuerda (*Pounds*)	Coffee sales	Animal units	Farm income	Labor income
Range	Average								
Less than 500	258	61	30	91	74	163	3.0	$-176	$-596
500-999.....	713	52	51	96	90	371	5.1	-102	-830
1,000-1,499...	1,233	42	87	103	106	690	8.7	-94	-1,180
1,500-1,999...	1,791	20	112	105	103	1,005	10.9	-121	-1,563
2,000 or more	4,779	49	193	139	137	2,803	21.2	-1,033	-1,849

MAN EQUIVALENT AND LABOR INCOME

The relation between man equivalent and labor income was the same as that for other measures of size of business already discussed. The larger the man equivalent in any group of farms, the smaller the labor income (table 19).

Fifty of the farms studied had less than 3.0 man per farm. The average labor income on these farms was $–281. There were 54 *cuerdas* per farm, 22 of which were in coffee. Crop index averaged 101; *cuerdas* in crops per man equivalent, 11.9; labor costs per *cuerda* in crops, $7; and coffee sales per man equivalent, $84.

In contrast with this group of small farms, the 40 largest farms had an average of 20.0 man, and a labor income of $–2,714. These farms had 10 times as many *cuerdas* in coffee as the small farms; the crop index was only about 20 per cent higher; *cuerdas* in crops per man equivalent were practically the same; and labor costs per *cuerda* in crops doubled. Labor costs per *cuerda* in crops showed a direct relationship to man equivalent. However, this increased cost of labor did not produce an increased efficiency in the use of labor,

since there was no relation between crop index or *cuerdas* in crops per man equivalent and number of men per farm.

Coffee sales per man equivalent increased steadily from $84 in the small farms to $149 in the large farms. This direct relationship was partly due to the fact that the larger farms were more dependent on coffee for their income.

TABLE 19. RELATION OF MAN EQUIVALENT TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Man Equivalent		Number of farms	Size of farm (*Cuerdas*)	Total cuerdas in coffee	Crop index	Cuerdas in crops per man equivalent	Labor costs per cuerda in crops	Coffee sales per man equivalent	Labor income
Range	Average								
Less than 3.0	2.1	50	54	22	101	11.9	$7	$34	$-281
3.0-5.9.....	4.4	84	112	49	105	12.3	11	104	-697
6.0-8.9.....	7.4	29	203	99	95	14.7	11	107	-1,328
9.0-11.9.....	10.2	21	256	134	105	14.5	12	124	-1,487
12.0 or more.	20.0	40	447	225	122	12.4	14	149	-2,714

GROSS RETURNS PER CUERDA AND LABOR INCOME

The relation between gross returns per *cuerda* and labor income showed that, in general, the larger the gross returns per *cuerda*, the smaller the losses. This relation was true particularly on those farms with gross returns of more than $5 per *cuerda* (table 20).

Of the 224 coffee farms, 58 had a gross return per *cuerda* of less than $5. They made a farm income of $–316 and a labor income of $–1,269. This group of farms had an average of 74 *cuerdas* in coffee, a crop index of 70, and 14.2 *cuerdas* in crops per man equivalent.

The second group consisted of 82 farms, with an average of $7 gross returns per *cuerda*, a farm income of $–125, and a labor income of $–1,455. The labor income for this group of farms decreased in spite of the higher gross returns per *cuerda*, crop index, acreage in coffee, and farm income obtained; thus indicating that these farms were over-capitalized.

The group of farms with the largest gross returns per *cuerda* averaged $29. The farm income was $1,085, and the labor income was $–109. The crop index for this group was 2.3 times as large as that of the first group. These farms had 8.3 *cuerdas* in crops per man equivalent.

This table showed that gross returns per *cuerda* were directly associated with crop index and farm income; indirectly associated with *cuerdas* in crops per man equivalent and labor income; and had no definite relationship to total *cuerdas* in coffee.

TABLE 20. RELATION OF GROSS RETURNS PER CUERDA TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Gross returns per cuerda (Dollars)		Number of farms	Crop index	Total cuerdas in coffee	Cuerdas in crops per man equivalent	Farm income	Labor income
Range	Average						
Less than 5...	3	58	70	74	14.2	$-316	$-1,269
5-9.....	7	82	97	103	14.1	-125	-1,455
10-14.....	11	39	126	97	11.9	415	-1,019
15-19.....	17	19	132	86	10.3	656	-811
20 or more....	29	26	164	63	8.3	1,085	-109

CROP INDEX AND LABOR INCOME

Crop index was directly associated with labor income. As the average crop index in each of the five groups of farms increased from 40 to 254, the average labor income also increased from $–1,486 to $–113 (table 21). In other words, the group of farms having an average crop index of 40 lost approximately 13 times as much money as the group of farms with an average crop index of 254.

Cuerdas in bearing coffee had no direct relationship to crop index. The relation appeared to be curvilinear, showing that the first group of farms which had the largest number of *cuerdas* in bearing coffee had the lowest crop index; while the last group of farms, with practically the same acreage in bearing coffee, had the highest crop index.

Man equivalent increased together with crop index, while *cuerdas* in crops per man equivalent decreased. This indicated that, as crop index increased, more labor was required to harvest a *cuerda* of coffee. Consequently, a man could not be able to harvest as many *cuerdas* of coffee as when the crop index was low.

Yield of coffee per *cuerda* also increased together with the crop index. Since the crop index itself was heavily weighted by the yield of coffee, their magnitudes were in all cases very similar.

Gross returns per *cuerda* increased from $7 in the first group to $24 in the last group of farms. Labor costs per *cuerda* in crops increased from $8 to $16 in the first and last group respectively. Coffee sales per man equivalent averaged $64 in the first group of

farms, and increased to $273 in the last group. The farm income had also a direct relationship to crop index, increasing from $–40 to $1,759.

In general, a higher crop index implied the employment of more men and increased labor costs per *cuerda* in crops. The increasing yields and the more intensive cultivation involved reduced the number of *cuerdas* in crops per man equivalent, but increased the gross returns per *cuerda* and the coffee sales per man equivalent, thus offsetting the higher labor costs. This resulted in an increase in the farm income and labor income.

The statement that crop yields, especially of coffee, were low during 1934 is again supplemented by the fact that even those farms with a crop index 2.54 times the average crop index for all farms were not able to make a positive labor income.

TABLE 21. RELATION OF CROP INDEX TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Crop index		Number of farms	Cuerdas in bearing coffee	Man equivalent	Cuerdas in crops per man equivalent	Yield of coffee per cuerda (*pounds*)	Gross returns per cuerda	Labor costs per cuerda in crops	Coffee sales per man equivalent	Farm income	Labor income
Range	Average										
Less than 50	40	40	60	5.9	16.8	39	$7	$8	$64	$-401	$-1,486
50—99.....	76	86	58	7.1	13.6	66	8	10	110	-84	-1,242
100—149.....	124	50	39	8.3	10.5	120	11	12	109	308	-1,024
150—199.....	169	33	40	8.3	10.9	173	11	13	158	294	-964
200 or more.	254	15	59	11.0	9.0	236	24	16	273	1,759	-113

YIELD OF COFFEE PER CUERDA AND LABOR INCOME

There was a direct relationship between yield of coffee per *cuerda* and labor income, especially on those farms with yields of more than 50 pounds of coffee per *cuerda* (table 22).

The yield of coffee per *cuerda,* on most of the farms studied, was considerably lower than what is generally considered a satisfactory yield of coffee in Puerto Rico. Fifty-eight farms had yields of less than 50 pounds of coffee per *cuerda,* averaging 32 pounds. On these farms the farm income was $–194, and the labor income $–1,180. These farms averaged 144 *cuerdas* in size, 55 of which were in bearing coffee. The crop index was 58, gros returns per *cuerda* $6, and coffee sales per man equivalent $62.

The second group included 76 farms with an average yield of 69 pounds per *cuerda.* On this group, the farm income increased to

$–79, but the labor income decreased, instead of increasing, to $–1,385. This decrease in the labor income, in spite of the increase in yield, *cuerdas* in bearing coffee, crop index, gross returns per *cuerda,* coffee sales per man equivalent and farm income, was due to the fact that the average capital invested on these farms was too large compared to that of the preceding group. The increase in farm income was not enough to cover the interest charge on this large capital, and, consequently, the labor income decreased.

There were 24 farms with an average yield of 255 pounds of coffee per *cuerda,* which represented 2.8 times the average yield for all farms. These farms made a farm income of $886, but were not able to make a positive labor income. The fact that the yield of coffee per *cuerda* in the farms studied was very low during 1934 was thus observed again.

Size of farm business, measured either by total *cuerdas* in farm, *cuerdas* in bearing coffee, or capital invested, did not show any relation to yield of coffee per *cuerda.*

TABLE 22. RELATION OF YIELD OF COFFEE PER CUERDA TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Yield of coffee per cuerda (pounds)		Number of farms	Size of farm *cuerdas*	Cuerdas in bearing coffee	Capital invested	Crop index	Gross returns per cuerda	Coffee sales per man equivalent	Farm income	Labor income
Range	Average									
Less than 50	32	58	144	55	$12,322	58	$6	$62	$-194	$-1,180
50—99	69	76	197	61	16,321	82	9	108	-79	-1,385
100—149	123	42	199	38	16,195	126	10	117	148	-1,148
150-199	168	24	245	54	20,108	162	12	179	760	-846
200 or more	255	24	153	34	15,520	206	20	240	886	-356

LABOR COSTS PER CUERDA IN CROPS AND LABOR INCOME

On 27 of the farms studied, the labor costs were less than $5 per *cuerda* in crops; there were 30 *cuerdas* in coffee; and the labor income was $–615 (table 23).

Sixty-one farms had labor costs of $10 to $14 per *cuerda* in crops; 103 *cuerdas* in coffee; and made a labor income of $–1,456. On 20 farms, with average labor costs of $26 per *cuerda* in crops and 42 *cuerdas* in coffee, the labor income was $–1,066. This showed that labor costs per *cuerda* in crops had a curvilinear relationship to total *cuerdas* in coffee and to labor income.

Crop index and gross returns per *cuerda* were much higher for the last two groups of farms than for the first three. These two factors caused the curvilinear relationship stated above.

Cuerdas in crops per man equivalent had an indirect relation to labor costs per *cuerda* in crops. This indicated that with higher labor costs, the coffee farms were more intensively cultivated.

TABLE 23. RELATION OF LABOR COSTS PER CUERDA IN CROPS TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Labor costs per cuerda in crops (dollars)		Number of farms	Total cuerdas in coffee	Crop index	Yield of coffee per cuerda (pounds)	Cuerdas in crops per man equivalent	Gross returns per cuerda	Coffee sales per man equivalent	Labor income
Range	Average								
Less than 5.	3	27	30	63	52	18.2	$5	$81	$-615
5-9.....	7	88	98	102	93	15.7	10	148	-1,024
10-14.....	12	61	103	104	103	10.8	8	108	-1,456
15-19.....	17	28	98	145	141	8.0	14	165	-1,216
20 or more.	26	20	42	133	134	5.1	18	78	-1,066

PER CENT INCOME FROM COFFEE AND LABOR INCOME

The relation between per cent income from coffee and labor income showed that, in general, the larger the per cent income from coffee, the smaller the labor income (table 24). This relation was constant throughout the table, except in the last group of farms. The labor income on this last group increased instead of decreasing, as compared to that of the preceding group.

The last group of farms consisted of 41 farms, with an average of 95 per cent of their income being from coffee. The increase in labor income was due to a much larger crop index, yield of coffee, and coffee sales per man equivalent, over the preceding group of farms. Gross returns per *cuerda* and *cuerdas* in coffee were also somewhat larger. The farm income, which had been decreasing, also showed a decided increase in this last group.

TABLE 24. RELATION OF PER CENT INCOME FROM COFFEE TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Per cent income from coffee		Number of farms	Total cuerdas in coffee	Crop index	Yield of coffee per cuerda (pounds)	Gross returns per cuerda	Coffee sales per man equivalent	Farm income	Labor income
Range	Average								
Less than 30	15	44	52	104	82	$13	$44	$378	$-570
30-59.....	46	63	82	103	96	11	110	270	-946
60-89.....	75	73	104	93	94	8	127	-218	-1,575
90 or more.	95	41	110	135	138	10	210	240	-1,180

USE OF FERTILIZER ON COFFEE AND LABOR INCOME

Only 17 of the 224 farms studied applied any kind of commercial fertilizer to the coffee bushes (table 25). This limited number of farms using fertilizer was too small to attempt any grouping based on quantity of fertilizer applied per *cuerda*.

Those farms using some fertilizer on coffee made an average labor income of $–796, which was $351 higher than that for the farms using no fertilizer. The farm income increased $446; yield of coffee per *cuerda* was 21 per cent higher; and the crop index showed a 28 per cent increase. Gross returns per *cuerda* were 70 per cent higher, in spite of the larger size of the farms in this group.

The increases noted above are not to be attributed solely to the application of fertilizer, since the number of farms reporting such applications was very small, and the cost of such fertilizer averaged only approximately $3 per *cuerda*. There were other factors also responsible for these increases. About one-third of the farms using fertilizer on coffee had other important cash crops, such as sugar cane, tobacco, or plantains, on which fertilizer was also used.

TABLE 25. RELATION OF USE OF FERTILIZER ON COFFEE TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Factor	Farms using no fertilizer on coffee	Farms using some fertilizer on coffee
Number of farms	207	17
Labor income	$–1,147	$–796
Farm income	$92	$538
Yield of coffee per cuerda (pounds)	99	120
Crop index	104	133
Gross returns per cuerda	$13	$17
Size of farm (cuerdas)	189	235

RELATION OF SIZE OF FARM AND TYPE OF MANAGEMENT TO LABOR INCOME

The majority of the farms included in this study were operated by the owners themselves. However, when, for some reason or other, the owner was not able to live on his farm, or when the farm business was too big for him to attend alone, he usually hired a "mayordomo", or foreman. A *mayordomo* is a skilled laborer who has had experience in coffee farming and who is given a house to live in and farm privileges besides his regular wage. Usually he is well acquainted with the farm, and is in a position to run the farm business successfully. Some of these *mayordomos* had actually been owners of coffee farms themselves. Only three of the farms studied were operated by managers (table 26).

For the purpose of this analysis, the farms were divided into two groups: those of less than 200 *cuerdas* and those of 200 or more *cuerdas* in size. In each of these groups the farms operated by the owners made higher labor incomes than those operated either by the owner and a *mayordomo* or by a manager.

The average labor income on the smaller farms was $–445, when operated by the owner, and $–1,058, when operated by owner and *mayordomo*. The owner-*mayordomo* operated farms had twice as many *cuerdas* in coffee and nearly twice as much capital invested, but the crop index and gross returns per *cuerda* were lower than those on the owner-operated farms.

The large farms operated by the owners made a labor income of $–1,760. Those operated by the owner and a *mayordomo* made $–2,211, while the farms operated by managers made a labor income of $–3,825. Crop index, yield, and gross returns per *cuerda* were highest on this last group of farms, but yet they had the largest loss. This was due mostly to the large capital investment and increased cost of labor.

When the farms were operated by the owners they were able to make $85 above expenses on the small farms and $259 on the large farms. In both cases the labor income was a negative figure, the larger farms losing about 4 times as much money as the small farms.

Small farms operated by the owner and a *mayordomo* lacked $167 to meet expenses, and made a labor income of $–1,058. In contrast, the large farms operated by the owner and a *mayordomo* made $376 above expenses; but their labor income was $–2,211.

None of the small farms was operated by a manager. The three large farms under this type of management had a farm income of $–181 and a labor income of $–3,825.

TABLE 26. RELATION OF SIZE OF FARMS UNDER DIFFERENT TYPES OF MANAGEMENT TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Size of farm (cuerdas)	Average size of farm (cuerdas)	Number of farms	Total cuerdas in coffee	Gross returns per cuerda	Capital invested	Crop index	Yield of coffee per cuerda (pounds)	Farm income	Labor income
LESS THAN 200:									
Operated by the owner...	75	112	35	$11	$6,622	107	97	$85	$-445
Operated by owner and mayordomo.....	115	34	70	10	11,138	100	98	-167	-1,058
200 OR OVER:									
Operated by the owner...	360	27	139	7	25,228	100	96	258	-1,760
Operated by owner and mayordomo.....	373	48	190	9	32,338	108	107	376	-2,211
Operated by a manager...	423	3	242	15	45,550	157	166	-181	-3,825

EFFECT OF SIZE OF FARM AND LOCATION ON LABOR INCOME

The location of a farm is an important factor in most types of farm businesses. A farm located near a highway generally has considerable advantages over a farm located on a dirt road, chiefly because of the easy access to the farm and to near-by markets provided by the highway.

Of the farms of less than 200 *cuerdas* in size, 72 were located on highways, 27 on dirt roads, and 47 were off the road (table 27). The average capital invested in these farms was very much the same. The main differences between these small farms were in the gross returns per *cuerda*, crop index, farm income, and labor income. The farms on dirt roads had the highest labor income ($–365), while those on the highways had the lowest ($–658).

TABLE 27. RELATION OF SIZE OF FARM AND LOCATION TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Size of farm (cuerdas)	Average size of farm (cuerdas)	Number of farms	Total cuerdas in coffee	Gross returns per cuerda (dollars)	Capital invested (dollars)	Crop index	Farm income (dollars)	Labor income (dollars)
LESS THAN 200:								
On highway	78	72	41	11	7,781	97	–36	–658
On dirt roads	77	27	33	14	6,894	122	187	–365
Off road	98	47	51	9	7,959	108	30	–607
200 OR OVER:								
On highway	359	31	161	7	29,492	90	–48	–2,407
On dirt roads	505	12	239	15	47,575	166	2,054	–1,752
Off road	335	35	163	8	25,281	102	37	–1,985

Of the farms of 200 or more *cuerdas* in size, 31 were on highways, 12 on dirt roads, and 35 off the road. The farms on dirt roads had again the highest labor income ($–1,752), while those on highways were again lowest ($–2,407). The dirt-road farms differed considerably from the other farms. Their size and number of *cuerdas* in coffee was much larger than for the other groups. The crop index was also higher, and the gross returns per *cuerda* about twice that of the other groups. These four factors, together, were directly responsible for the very high farm income ($2,054) in this group of farms. However, although this farm income appeared to be high, it was not sufficient to cover an 8 per cent interest on the average capital of $47,575, and thus a negative labor income resulted.

In general, this table indicated that, contrary to what would have been the general expectation, the best coffee farms, of those studied,

were not to be found along the highways. The only explanation with respect to this point is the fact that the highways are usually located along the lower sections of the coffee region in Puerto Rico, where the temperature and probably the soils are not so well adapted to coffee as they are in the higher sections. This accounted in part for the low crop indices obtained on the highway farms. The dirt-road farms had, in both cases, the highest crop indices.

EFFECT OF TOTAL CUERDAS IN COFFEE AND CROP INDEX ON LABOR INCOME

The relation between total *cuerdas* in coffee and labor income was already discussed in table 13. The object of table 28, however, was to show how this relation between total *cuerdas* in coffee and labor income was affected by different crop indices. For this purpose the farms were classified, on the basis of crop index, into three major groups: less than 75, 75 to 149, and 150 or more. Each of these groups was in turn sub-divided, according to total *cuerdas* in coffee into three minor groups: less than 50 *cuerdas*, 50 to 99, and 100 or more.

On each of the three major groups the labor income decreased, regardless of crop index, as the total *cuerdas* in coffee *increased.* This same relationship was observed in table 13. When the crop index was taken into consideration it was observed that labor income increased as the crop index for each minor group of farms increased. The larger farms, however, did not show this relationship so closely.

The group of small farms with a low crop index had an average labor income of $–530. That, with a medium crop index, increased its labor income to $–450. With a high crop index, the labor income was further increased to $–233.

The medium-sized farms showed a similar relationship. Those with a low crop index had an average labor income of $–1,120; with a medium crop index, it increased to $–998; and with a high crop index, the labor income again increased to $–333.

Large farms, with a low crop index, made a labor income of $–2,319. On those with a medium crop index the labor income decreased to $–2,504. With a high crop index, however, the labor income for the large farms increased considerably to $–1,666. This large increase indicated that the general tendency was for the large farms to show the same relationship as did the small and medium farms. Due to some reason, the second group of large farms failed to show such relationship.

TABLE 28. TOTAL CUERDAS IN COFFEE AND CROP INDEX IN RELATION TO LABOR INCOME AND OTHER FACTORS

224 COFFEE FARMS, PUERTO RICO, 1934

Total cuerdas in coffee	Number of farms	Average cuerdas in coffee	Average cro index	Gross returns per cuerda (dollars)	Yield of co ee per cuerda (pounds)	Cuerdas in crops per man equivalent	Labor income (dollars)
FARMS WITH A CROP INDEX OF LESS THAN 75:							
Less than 50 cuerdas	29	30	47	7	40	13.1	-530
50—99	24	76	54	6	48	17.2	-1,120
100 or more	25	172	51	6	49	18.3	-2,319
FARMS WITH A CROP INDEX OF 75 TO 149:							
Less than 50 cuerdas	47	23	105	12	104	8.3	-450
50—99	21	67	100	9	93	12.3	-998
100 or more	30	201	105	9	95	15.5	-2,504
FARMS WITH A CROP INDEX OF 150 OR MORE:							
Less than 50 cuerdas	25	21	200	17	196	7.8	-233
50—99	8	66	174	12	157	12.7	-333
100 or more	15	220	200	15	205	13.2	-1,666

EFFECT ON LABOR INCOME OF HAVING DIFFERENT FACTORS ABOVE THE AVERAGE

The effect on labor income of having different factors above the average is shown in table 29. It has already been demonstrated in preceding tables that during 1934 not all of the factors showed the same relation to labor income. Some were directly, while others indirectly related to labor income.

TABLE 29. EFECT ON LABOR INCOME OF HAVING DIFFERENT FACTORS ABOVE AVERAGE

224 COFFEE FARMS, PUERTO RICO, 1934

	Number of farms	Labor income
Average for all farms	224	$-1,120
AT LEAST ONE FACTOR ABOVE AVERAGE:		
Capital invested	72	-2,273
Total cuerdas in coffee	81	-2,128
Cuerdas in crops per man equivalent	104	-1,402
Labor costs per cuerda in crops	95	-1,312
Yield of coffee per cuerda	90	-857
Crop index	88	-791
Gross returns per cuerda	84	-691
AT LEAST TWO FACTORS ABOVE AVERAGE:		
Total cuerdas in coffee and capital invested	61	-2,470
Total cuerdas in coffee and gross returns per cuerda	25	-1,587
Cuerdas in crops per man equivalent and yield of coffee per cuerda	27	-1,196
Labor costs per cuerda in crops and gross returns per cuerda	48	-992
Crop index and yield of coffee per cuerda	74	-717
Crop index and gross returns per cuerda	54	-607
Total cuerdas in coffee and crop index	12	-590
AT LEAST THREE FACTORS ABOVE AVERAGE:		
Capital invested; total cuerdas in coffee; and labor costs per cuerda in crops	25	-2,882
Crop index; gross returns per cuerda; and yield of coffee per cuerda	48	-529
Total cuerdas in coffee; crop index; and gross returns per cuerda	9	-487

The average labor income on those farms having at least one factor above average ranged from $–2,273 to $–691. On those farms with at least two factors above average it varied from $–2,470 to $–590. On the farms with at least three factors above average the labor income also showed considerable variation, ranging from $–2,882 to $–487. It is, therefore, apparent that a farmer in order to increase his profits or reduce his losses should have a suitable combination of factors above the average.

Summary

This farm management study consisted of 224 coffee farms in Puerto Rico. The study was conducted by the Division of Agricultural Economics of the Puerto Rico Agricultural Experiment Station during 1935, and covered the calendar year 1934.

The average size of the farms was 186 *cuerdas,* with 88.5 *cuerdas* in coffee. Forty-two per cent of the coffee bushes were still under bearing age.

There was an average investment of $15,580 per farm. The value of land alone constituted 83.4 per cent of the investment.

All of the farms studied were still in a period of reconstruction, following the effects of the 1928 and 1932 hurricanes.

The average labor income on these farms was $–1,120 during 1934. Only 9 per cent of the farmers made positive labor incomes, averaging $414 per farm. Seven farmers made labor incomes of $500 or more.

Labor income showed an indirect relationship with all measures of size of business, and a direct relationship with the measures of efficiency of operation. In none of the tables included in this study was a positive labor income obtained for any of the groups of farms.

Farms operated by the owners themselves did not lose as much money as those operated either by the owner and a *mayordomo* or by salaried managers.

Farms located on dirt roads made better labor incomes than those located either on highways or off the roads.

Every coffee farmer in Puerto Rico should compare his farm with the averages given in table 13, and try to make his farm better than average in every point, particularly those in which it falls below the average.