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A FARM MANAGEMENT STUDY OF 60 DAIRY FARMS IN PUERTO RICO, 1935-36¹

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INTRODUCTION

The importance of the dairy industry in Puerto Rico from the standpoint of income as well as a source of food supply is realized by only a limited number of persons, in spite of the fact that everybody is in daily contact with its products. On account of the importance of this industry and the interest of the University in the dairy business and in the local production of foodstuffs, this study was undertaken by the Department of Agricultural Economics of this Station.

The relative economic importance of dairying as compared to certain other agricultural enterprises in Puerto Rico is shown in table 1. The total annual value of all agricultural enterprises is not shown in the table because figures on the annual production of meat and poultry products are not available.

TABLE 1. FARM VALUE OF CERTAIN CROPS AND LIVESTOCK PRODUCTS

(Based on production data obtained from the 1935 P. R. R. A. * Census of Agriculture of Puerto Rico, and estimated prices)

Product	Value
Sugar cane.....	\$37,349,896
Fruits and nuts.....	9,926,936
Tobacco.....	4,688,098
Coffee.....	3,102,665
Milk.....	2,684,777
Grains and seeds.....	1,941,665
Vegetables.....	1,773,225
Hay and forage.....	946,867
Cotton.....	49,870

¹Thesis presented to the Graduate Faculty of the College of Agriculture of Cornell University in partial fulfillment of the requirements for the degree of Master of Science in Agriculture, 1937.

* P. R. R. A.—Puerto Rico Reconstruction Administration.

DAIRYING IN PUERTO RICO

The best dairy sections of the world are cool and fairly moist. In Puerto Rico the mean annual temperature is about 76 degrees Fahrenheit and the rainfall over most of the Island ranges from 60 inches to 120 inches per year. The temperature is too warm to favor a high production per cow. Methods of feeding and management have been inadequate. Added to these conditions is the fact that much of our native cattle stock is of a nondescript breed and the male animals have been used mainly for work purposes. For all these reasons the production of milk per cow is low. According to the 1935 Census of Agriculture, the production of milk per cow in Puerto Rico was about 1,657 pounds. This production is low as compared to about 4,500 pounds per cow in the United States and about 9,600 pounds in Holland.

However, to counteract these difficulties, dairying in the tropics has many natural and distinct advantages over other sections of the world. Expensive buildings are not required, a supply of green feed can be had all the year around, labor costs are low, and milk commands a relatively high price.

Prior to 1900, native cows were almost the only kind found on the Island. The greatest improvement in cattle breeding began in 1911 when farmers started to import Holstein-Friesian cattle. Since then, Jerseys, Guernseys, Shorthorns, and Ayrshires have also been imported. At the present time there is a predominance of these breeds on the dairy farms. The majority are Holsteins, either grades, purebreds, or crosses with the native stock.

Cows are fed green feed the year around. On most commercial dairy farms the cows are fed concentrates, usually commercial mixed rations. The dairy farmers as a rule do not grow concentrates in Puerto Rico. About the only time when cows are seen in the barn, which is of the open-shed type, is during milking, so that the majority of the time they may be seen in the open pasture. Milking is by hand.

Different kinds of soilage crops and pasture are grown in the Island, but the most important are Guinea and Para grass. In 1929, according to the Census of Agriculture, there were 12,838 acres in Guinea grass and 9,142 acres in Para grass. Besides these two, other grasses are grown such as Guatemala, Elephant, and Molasses. Of these and other grasses, there were in 1929 about 6,713 acres.

On the southern coast where rainfall is scant (20 to 40 inches annually) there are a few silos, the only ones in the Island.

In 1935, there were 61,787 cows milked on farms as compared to 78,412 cows 5 years before. The average milk production per cow in 1935 according to the Census was 1,657 pounds, as compared to about 1,600 pounds per cow in 1930. This represented a small increase of about 4 per cent in production per cow and about 21 per cent decrease in the number of cows milked in the five-year period.

In 1935, there were 284,866 cattle in Puerto Rico as compared to 310,514 in 1930. This difference represents a decrease of about 8 per cent as compared to a decrease of 21 per cent in the number of dairy cows milked. Out of the total number in 1930, there were 4,144 pure bred registered animals on farms, or about 1.4 per cent of the total.

Concentrates are mainly imported from the United States. During the fiscal year 1935-36, the value of imported feeds was \$646,583, of which \$643,501 came from the mainland. Besides this, \$1,325,296 of dairy products from the United States and \$113,699 from other countries were imported.

In spite of the fact that in 1935 there were 23,335 farms, out of a total of 52,790 farms on the Island, reporting cows milked, there were only 661 dairy farms, that is, farms in which milk was the principal source of income. According to the Department of Health there were in 1936 a total of 705 dairies of which 297 had 10 cows or less, 330 had from 11 to 50 cows, and the remainder (78) had 51 or more cows. The average number of cows per farm was 24.5 for all farms. These farms had an average production per cow about twice the amount of the average for all cows in the Island. This is to be expected for they have better cows and feed more liberally than the average farmer.

METHOD OF PROCEDURE

The survey method was used in making this study. A letter of introduction from the President of the Farmers' Association, in which their cooperation was requested, was presented to the farmers visited. Besides, the field men explained the purpose of the study to the farmers and those willing to cooperate were asked specific questions concerning their farm businesses and the answers recorded on a specially-prepared form. Each report was carefully checked and if any items were missing, another visit was made. They were

rechecked and carefully analyzed. Some records were discarded for one or more important reasons, especially for the lack of accurate information. These records were taken during the month of July 1936 and covered the farm operations from July 1, 1935 to June 30, 1936. Sixty usable records were obtained in the vicinity of San Juan and all the farms studied supplied this market or the market of Río Piedras which for practical purposes can be classified as a single market due to the proximity of the two cities.

DESCRIPTION OF THE AREA STUDIED

Location: All of the dairy farms included in this study are in the vicinity of San Juan, capital of Puerto Rico. They are located in two geographic regions, namely, the Northern Coastal Lowlands, and the Northern Foothills,¹ in the municipalities of Dorado, Toa Alta, Toa Baja, Cataño, Bayamón, Guaynabo, Río Piedras, Trujillo Alto, Carolina, and Loíza (Canóvanas). (See figure 1).

Climate: The mean annual temperature in the area studied is about 78 degrees Fahrenheit. According to data compiled from the Weather Bureau at San Juan, for 32 years including 1930, the average temperature by months fluctuated from 75 degrees Fahrenheit to 80 degrees Fahrenheit. The former temperature occurred during the months of January, February, and March, and the latter from June to October, inclusive. These data can be used to represent the area studied, for conditions in all of it are similar if not identical. Relative humidity for San Juan is around 76 to 80 per cent average during the year.

In six out of the ten municipalities visited, records of rainfall have been kept for not less than 10 years and not more than 47 years. The data compiled by the Weather Bureau at the different stations are shown in table 2.

The average yearly rainfall ranges from about 68 to 92 inches in the area studied. Rainfall is not evenly distributed throughout the year, thus accounting for the so-called wet and dry seasons. The dry season, according to the Weather Bureau, is limited to the months of January to April, inclusive, and the wet season the remainder of the year.

¹ Picó, Rafael. Studies in the Economic Geography of Puerto Rico, Univ. of Puerto Rico Bull. ser. VII—No. 1, pp. 57-73, 1937.

TABLE 2. COMPARISON BETWEEN THE LONG-TIME AVERAGE MONTHLY RAINFALL AND THE RAINFALL BY MONTHS FOR THE YEAR ENDING JUNE 30, 1936 IN THE AREA STUDIED

Month	Canóvanas		Río Piedras		Bayamón		Toa Baja		Toa Alta	
	Average	1935-36	Average	1935-36	Average	1935-36	Average	1935-36	Average	1935-36
1935										
July.....	9.09	7.07	7.57	6.98	8.05	8.69	8.08	7.80	10.48	11.06
August.....	8.05	9.08	7.75	7.30	8.30	10.04	6.32	8.24	10.03	15.25
September.....	7.46	7.99	8.23	6.00	7.96	10.12	6.73	4.41	9.82	11.10
October.....	7.01	8.31	6.66	6.62	6.58	16.35	5.33	6.94	7.85	9.31
November.....	8.77	2.92	7.14	3.86	7.42	7.18	6.82	5.93	9.08	8.71
December.....	7.22	2.75	6.33	1.97	6.24	2.46	5.38	0.89	7.45	0.67
1936										
January.....	5.64	3.75	4.70	1.58	4.77	1.68	5.57	2.55	7.36	2.94
February.....	3.31	1.63	3.12	1.03	3.40	1.01	3.69	1.12	4.81	1.44
March.....	3.84	0.59	3.61	0.88	3.81	1.52	4.37	1.01	5.10	3.88
April.....	4.78	1.40	4.69	1.87	4.66	4.45	3.56	1.02	4.17	1.31
May.....	6.95	13.41	6.77	16.11	7.50	15.77	7.14	9.10	9.71	25.76
June.....	6.82	6.83	6.16	5.49	7.03	6.77	4.60	1.39	6.50	4.72
Total.....	78.94	65.73	72.73	59.69	75.72	86.95	67.59	59.49	92.35	96.15

In general, the annual rainfall during 1935-36 was lower than the average except for two municipalities in which it was higher. The months of November to April were drier than normal, but heavy rainfall occurred during the months of May and October just before and after the dry spell.

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

Soils and topography: The Northern Coastal Lowlands region, where most of the farms studied are located, is of level topography, and the elevation is below 250 feet above sea level. A few of the farms are located in the Northern Foothills region where the topography is hilly in nature and at elevation somewhat higher than in the Coastal Lowlands.

In spite of the fact that the area studied is a small one, there are many different soil series. Among them are the Catalina, Alonso, Colinas, Tanamá, Múcara, Río Piedras, Bayamón, Vega Alta, Lares, Fajardo, Moca, Corozo, Toa and Coloso series. These soils range from a low to a high productivity and their origin may be alluvial or derived from the tuffs and igneous rocks, limestone or shale. They range in texture from sandy to clay soils. The most productive are of alluvial origin such as the Toa and Coloso series. The Catalina, Alonso, and Múcara series which are fairly productive are derived from the tuffs and igneous rocks. The Colinas, Tanamá, and Vega Alta soils series which range in productivity from medium to low are derived from limestone. The Río Piedras soil is of a low

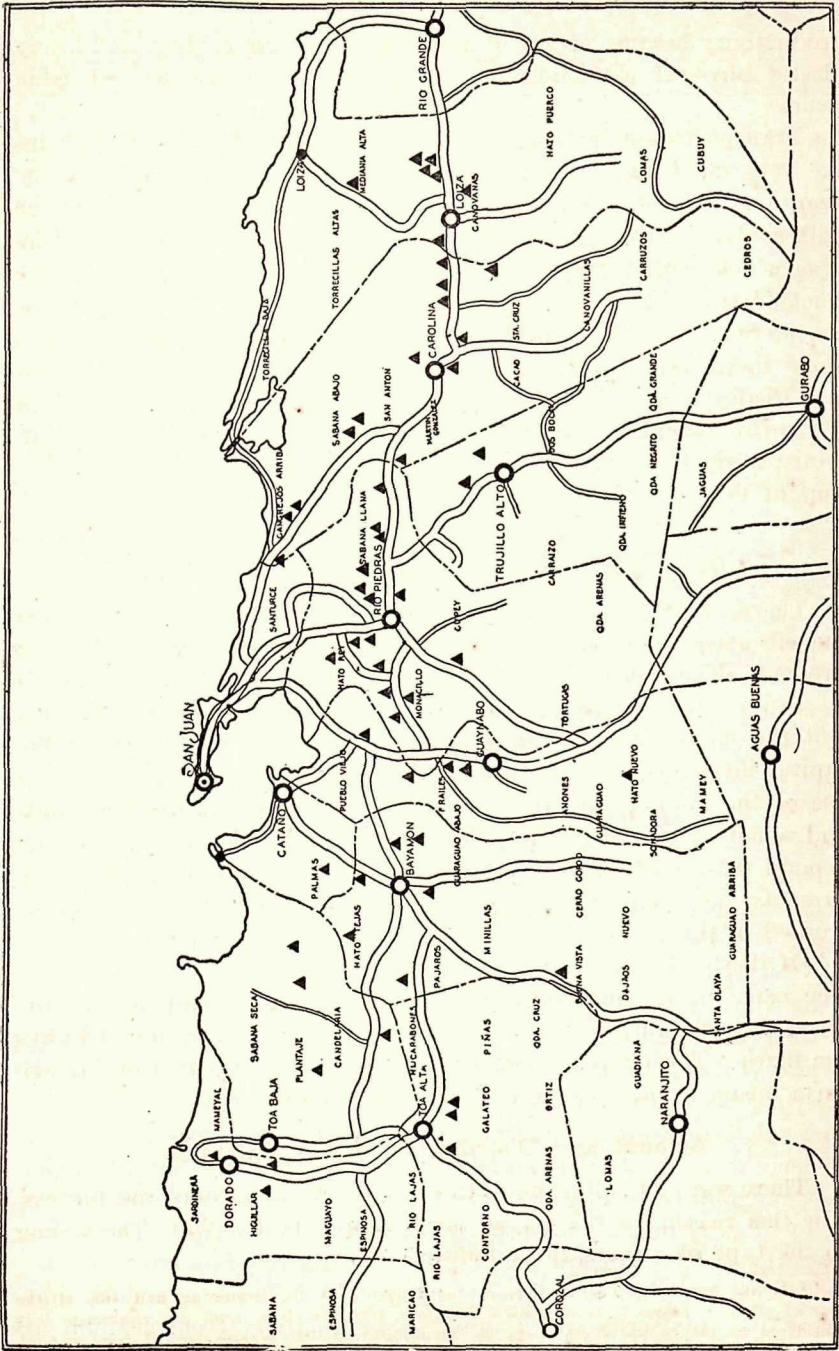


FIG. 1. Approximate location of the 60 commercial dairy farms included in the study.

productivity because of low organic matter, severe acidity, and heavy plastic physical characteristics of all layers. It is derived from shale.

Transportation facilities and markets: Transportation facilities are very good and all the farms studied were located by or very near a good road usually macadamized. The greatest bulk of the milk sold was disposed of at the markets of San Juan and Río Piedras which constitutes the most important fluid milk market in the whole Island. For practical purposes these two markets may be considered as one for they have the same city limits. In San Juan alone there were 137,215 inhabitants, and the urban population of Río Piedras was 16,849 inhabitants, out of a total of 1,723,534 in the entire Island, according to the Puerto Rico Reconstruction Administration Census of 1935. This market represented about 9 per cent of the total population of the Island.

ORGANIZATION OF THE FARMS STUDIED

The returns from the farm business are largely dependent upon the efficiency in production and upon the prices received for the product. The efficiency in the production of the product depends on two important features of the farm business, the organization and the operation. The organization relates to such items as the capital investments in the different parts of the farm business, the use of the land, the kinds and amounts of crops grown, the kinds and amounts of the livestock kept, and other items relative to the general set-up of the farm business. This section of the bulletin presents the analysis of the organization of the 60 dairy farms studied in this report.

Of the total, 29 farmers were full owners; the remainder renters. The usual agreement between the landlord and tenant is that the latter pays the former cash for the land rented and the landlord pays the taxes. The landlord does not share the expenses in running the farm business nor does he own part of the livestock.

Amount and Distribution of Farm Capital ¹

There were 29 full owners, 10 renters, and 21 owners and renters. For this reason, in this paper farm capital, is distributed according to the type of ownership or tenure.

¹ *Capital invested:* The average of the amounts at the beginning and end of the year of all farm property, land, houses, buildings, livestock, feed, seed, and equipment was considered as the capital invested in the farm business. It is also termed farm capital. Unless otherwise specified, it refers to the sum of both the landlord's and operator's capital.

The average farm capital for all farms studied was \$57,976 (table 3). Of this, about 80 per cent was in real estate, 18 per cent in livestock, and 2 per cent in equipment. The total capital per *cuerda* averaged \$234. The value of the land alone constituted about 72 per cent of the total capital per farm, and averaged \$169 per *cuerda*.

TABLE 3. AMOUNT AND DISTRIBUTION OF FARM CAPITAL
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Twenty-nine owner-operated farms		Ten rented farms				All 60 farms	
			Operator		Landlord			
	Average value per farm	Per cent of total	Average value per farm	Per cent of total	Average value per farm	Per cent of total	Average value per farm	Per cent of total
Operator's house..	\$1,753	3.2	\$51	0.4	\$358	1.1	\$1,506	2.6
Barns.....	2,053	3.8	30	0.2	1,550	4.7	2,101	3.6
Other improve- ments.....	976	1.8	90	0.7	791	2.4	863	1.5
Land.....	40,033	73.0	.....	.....	30,387	91.8	42,049	72.5
Total real estate..	44,815	81.8	171	1.3	33,086	100.0	46,519	80.2
Livestock.....	9,059	16.5	11,487	89.5	.....	.....	10,293	17.8
Equipment.....	937	1.7	1,173	9.2	14	.....	1,164	2.0
Total.....	\$54,811	100.0	\$12,831	100.0	\$33,100	100.0	\$57,976	100.0

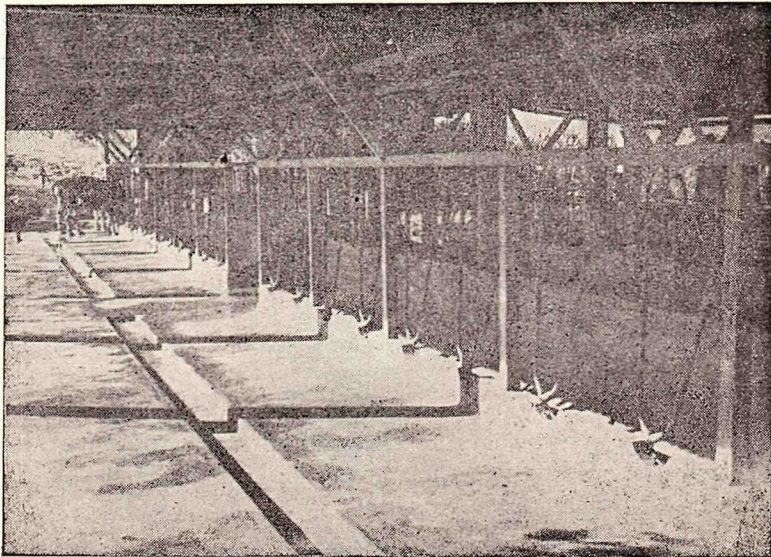


FIG. 2. Inside view of a very clean and well ventilated dairy barn with plenty of sunshine during daytime.

The value of the operator's house accounted for about 3 per cent of the capital, the barns for 4 per cent, and other buildings and real estate for 1 per cent.

A rather low investment in barns per cow is accounted for by the fact that these are of the open-shed type and there is no need of closed buildings for the protection of the cows during the winter. This amounted to about \$26 per cow.

Use of Land

The 60 farms surveyed for this study had an average of about 248 *cuerdas* per farm, of which 67.2 were planted to different crops. Of these, 1.8 were intercropped and 0.3 double-cropped, leaving a net of 65.1 *cuerdas* in crops. Double-cropping and intercropping were not important on the farms studied (table 4).

TABLE 4. USE OF LAND
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Total for all farms	Average per farm	Proportion of total area
	<i>Cuerdas</i> ¹	<i>Cuerdas</i> ¹	Per cent
Total in crops ²	4,032	67.2	.....
Inter-cropped.....	111	1.8	.....
Double-cropped.....	17	0.3	.....
Net in crops ³	3,905	65.1	26.2
Permanent pasture.....	9,992	166.5	67.1
Wooded pasture.....	274	4.6	1.8
Woods.....	162	2.7	1.1
In buildings, roads, fences, etc.....	442	7.4	3.0
Waste land.....	114	1.9	0.8
Total.....	14,889	248.2	100.0

¹ The *cuerda* is the unit of land measure in Puerto Rico. Equivalent to 0.9712 acres.

² Total *cuerdas* in crops: The total area planted to crops on a farm. It does not include permanent pasture, wooded pasture, or woods.

³ Net *cuerdas* in crops: From the total *cuerdas* in crops were deducted the *cuerdas* inter-cropped and double-cropped, to obtain the net *cuerdas* in crops which represent the total area that was actually under cultivation.

Permanent pasture accounted for 166.5 *cuerdas* per farm or about 67 per cent of the total area. The rest of the land was devoted to wooded pasture, 4.6 *cuerdas*; woods 2.7 *cuerdas*; land occupied by buildings, roads and fences 7.4 *cuerdas*; and 1.9 *cuerdas* which were waste land entirely unfit for agriculture.

Crops

Kind of crops grown: Sugar cane was the most important crop grown, accounting for about 44 per cent of the total crop area. The next most important group of crops were the soilage crops (Para grass, Elephant grass, Guinea grass, and Guatemala grass) which

occupied 37 per cent of the crop area. Coconuts accounted for 11 per cent of the total. These three groups of crops covered 92 per cent of the total land used for growing crops. Several other crops were grown, but they were relatively unimportant and included grapefruit, corn, and sweet potatoes (table 5).

TABLE 5. KIND OF CROPS GROWN
60 DAIRY FARMS, PUERTO RICO, 1935-36

Crop	Number reporting	Area (1)		Average per farm	Per cent of crop area
		<i>Cuerdas</i>	<i>Cuerdas</i>		
Sugar cane ⁽²⁾	31	1,711.9	28.5	43.8	
Para grass.....	53	1,346.5	22.4	34.5	
Coconuts ⁽³⁾	11	431.9	7.2	11.0	
Grapefruit.....	8	107.6	1.8	2.8	
Elephant grass.....	9	46.0	0.8	1.2	
Corn.....	9	42.3	0.7	1.1	
Guinea grass.....	6	35.5	0.6	0.9	
Sweet potatoes.....	7	29.7	0.5	0.8	
Plantains ⁽⁴⁾	12	27.2	0.5	0.7	
Yautias.....	12	26.5	0.4	0.7	
Guatemala grass.....	5	17.0	0.3	0.4	
Tobacco.....	2	13.6	0.2	0.3	
Bananas.....	9	12.4	0.2	0.3	
Dry beans.....	3	12.0	0.2	0.3	
Cucumbers.....	3	12.0	0.2	0.3	
Lettuce.....	2	7.0	0.1	0.2	
Cassava.....	4	5.0	0.1	0.1	
Other crops.....	12	23.4	0.4	0.6	
Total.....	59	3,907.5	65.1	100.0	

(1) 125.0 *cuerdas* planted to garden crops by "agregados" eliminated.

(2) 82.0 *cuerdas* of sugar cane not harvested included.

(3) 30.0 *cuerdas* of coconuts not-bearing included.

(4) 18.0 *cuerdas* of plantains not-bearing included.

Of the 31 farmers reporting sugar cane, only one fed it green to the livestock. Sugar-cane tops are used very much for the feeding of livestock during the harvesting season of sugar cane (January to May). It is relished by cows and is produced during part of the dry season when there may be a scarcity of pasture.

Pasture and soilage crops: There was an average of about 191 *cuerdas* per farm in permanent pasture and soilage crops which represent 77 per cent of the total area in the farms. Of these, 167 *cuerdas* or 87 per cent were in permanent pasture and 24 *cuerdas* or 13 per cent in soilage crops (table 6).

Para grass was the most important type of grass grown. It accounted for about 37 per cent of the total area in pasture. This crop thrives very well in low and wet soils where maximum yields are obtained. As shown in table 2, the area studied is supplied with an abundant rainfall during the year, which makes it an area well adapted to the growing of Para grass. The other types of pas-

ture such as the Guinea, Molasses, Elephant, and Guatemala grasses were relatively unimportant, accounting for 5 per cent of the area in pasture. Pastures which could not be classified as in the previous sentences, mostly "Gramma grass", were designated as other permanent pasture and this occupied about 58 per cent of the total area in pasture. There were 1.59 *cuerdas* of pasture per animal unit pastured of which 1.39 *cuerdas* were in permanent pasture and 0.20 *cuerdas* in soilage crops.

TABLE 6. DISTRIBUTION OF PASTURE AND SOILAGE CROPS PER FARM
60 DAIRY FARMS, PUERTO RICO, 1935-36

Kind	Soilage crops	Per manent pasture	Total per farm	Per cent of total	Cuerdas per animal unit pastured
	<i>Cuerdas</i>	<i>Cuerdas</i>	<i>Cuerdas</i>		
Para grass.....	22.4	47.8	70.2	36.8	.58
Guinea grass.....	0.6	6.8	7.4	3.9	.06
Molasses grass.....		0.9	0.9	0.5	.01
Elephant grass.....	0.8		0.8	0.4	.01
Guatemala grass.....	0.3		0.3	0.1	
Other permanent pasture.....		111.0	111.0	58.3	.93
Total.....	24.1	166.5	190.6	100.0	1.59



FIG. 3. View of a 'malojillo' soilage crop. Note its nearness to the dairy barn which can be seen on the left corner of the picture.

Crop yields: In general, the 1935-36 yields on the farms studied are below those commonly accepted in Puerto Rico as satisfactory. The high yield of Para grass for harvesting purposes was due to the fact that the best fields are used for the cultivation of this grass. Usually, soilage crops are planted near the barn where they are supplied constantly with water and manure.

Such crops as yautías and sweet potatoes are not usually harvested at once and this makes it more difficult for the farmers to estimate the yields; which may account for the low production per *cuerda* of these crops.

Sugar-cane yields are about the average. This may be explained by the fact that the greatest portion of the sugar cane was a ratoon crop which has lower yields than both the "primavera" and "gran cultura" plantings. Average yields for other crops are shown in table 7.

TABLE 7. AVERAGE YIELD PER CUERDA OF THE PRINCIPAL CROPS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Crop	Unit	Cuerdas harvested per farm	Yield ¹ per cuerda
Sugar cane.....	Tons.....	28.5	26.5
Coconuts.....	Thousands.....	7.2	1.4
Para grass.....	Tons (green).....	22.4	(1) 25.1
Grapefruit.....	Thousands.....	1.8	4.8
Corn.....	Hundredweight.....	0.7	5.7
Sweet potatoes.....	Hundredweight.....	0.5	16.7
Plantains.....	Thousands.....	0.5	12.4
Yautías.....	Hundredweight.....	0.4	24.9
Tobacco.....	Hundredweight.....	0.2	6.2
Bananas.....	Thousands.....	0.2	27.8
Dry beans.....	Hundredweight.....	0.2	1.4
Cucumbers.....	Boxes.....	0.2	225.1

(1) Data are for 11 farmers only, who had some basis for estimating the production.

Livestock

Kinds and amounts of livestock: Statements of the inventories, sales, and purchases are given in table 8. There was an average of about 121 animal units¹ per farm on the 60 dairy farms studied. Of this number 95 per cent were in cattle. Cows were 67 per cent of the total animal units on all farms.

¹ *Animal unit:* Animal unit is 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, two head of young stock, or 100 hens are each considered as one animal unit.

Poultry was kept on only 29 of the 60 farms studied. This can be explained by the fact that only 32 farmers lived at the farm. In similar studies made by the Division of Agricultural Economics of the Agricultural Experiment Station of the University of Puerto Rico, it has been shown that the majority of the farms keep a number of hens for the supply of eggs for home use (Bulletin No. 43, "A Farm Management Study of Small Farms in Two Areas of Puerto Rico", by J. E. McCord, S. L. Descartes, and R. Huyke).

Value per head: Of the total farm capital, about 18 per cent or \$10,293 per farm was invested in livestock. The value of important livestock at the end of the year is shown in table 9. The highest value per head was for the bulls, amounting to \$140 and next for the cows at \$98 per head. Heifers 2 years old or over not fresh, work oxen, stallions and mules were valued at about the same rate, or about \$50 per head.

TABLE 8. KINDS OF LIVESTOCK, INVENTORIES AND VALUES

60 DAIRY FARMS, PUERTO RICO, 1935-36

Type of livestock	Animal Units		Beginning of year			Purchases			Sales			End of year		
	No. of farms reporting	Total number	Total value	No. of farms reporting	Total number	Total value	No. of farms reporting	Total number	Total value	No. of farms reporting	Total number	Total value	Total number	Total value
Cows.....	60	4,564	438,951	24	475	42,345	50	607	23,115	60	607	23,115	5,095	498,372
Heifers 2 years old.....	58	1,642	80,231	3	32	1,390	7	35	1,449	48	35	1,449	48	46,100
Heifers 1 year old.....	54	820	13,446	.....	.....	.....	3	9	179	54	9	179	54	23,956
Heifers under 1 year.....	.....	.....	.....	1	1	.....	11	127	397	57	130	12,407	1,130	12,407
Male calves less than 1 yr.....	.....	.....	.....	1	1	25	39	955	1,542	32	206	1,542	206	1,549
Male calves 1 year & over.....	22	99	1,513	2	3	86	7	21	384	21	75	384	75	1,881
Bulls.....	55	118	15,987	10	12	1,855	7	7	237	58	7	237	58	17,106
Work oxen.....	56	557	27,981	8	32	1,573	10	31	1,579	57	31	1,579	57	26,558
Stallions.....	47	176	9,005	1	1	36	1	3	85	46	3	85	46	8,969
Mares.....	30	72	1,570	1	1	10	1	1	20	31	1	20	31	1,500
Colts.....	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,270
Mules.....	7	14	780	1	1	30	7	.....	.....	8	8	.....	8	810
Jackasses.....	2	7	58	.....	.....	.....	.....	.....	.....	2	7	.....	7	58
Bears.....	6	8	160	1	1	14	1	1	35	7	1	35	7	175
Brood sows.....	19	59	933	.....	.....	.....	3	10	201	16	10	201	16	884
Small pigs.....	.....	.....	.....	1	1	.....	7	143	409	8	76	242	8	242
Hogs.....	7	60	380	6	15	43	12	65	835	15	44	835	15	407
Sheep and lambs.....	3	40	139	.....	.....	.....	.....	.....	.....	3	41	.....	3	142
Goats and kids.....	5	16	52	2	19	149	.....	.....	.....	7	31	.....	7	201
Hens.....	10	40	777	1	6	3	4	61	38	29	960	642	29	642
Cocks.....	29	115	198	1	1	1	.....	.....	.....	29	177	335	29	335
Pullets.....	3	44	112	.....	.....	.....	1	30	6	17	345	129	17	129
Cockerels.....	3	06	104	.....	.....	.....	2	102	29	13	267	91	13	267
Other fowls.....	0	79	48	1	2	1	1	4	8	7	65	58	7	58
Total.....	7,247	18	\$592,425	.....	.....	\$47,562	.....	.....	\$30,548	.....	.....	\$642,733	.....	\$642,733

TABLE 9. VALUE OF IMPORTANT ANIMALS AT THE END OF THE YEAR
60 DAIRY FARMS, PUERTO RICO, 1935-36

Type	Number of farms reporting	Value per head
Cows.....	60	\$98
Heifers 2 years old.....	48	52
Heifers 1 year old.....	54	30
Heifers under 1 year.....	57	11
Male calves under 1 year.....	32	8
Male calves 1 year and over.....	21	24
Bulls.....	58	140
Work oxen.....	57	48
Stallions.....	46	52
Mares.....	31	21
Mules.....	8	54
Brood sows.....	16	18
Hens.....	29	0.67
Cocks.....	29	1.89

Monthly statement of cow numbers and replacements: The monthly inventory of cows, including purchases, sales, deaths, heifers and cows freshening and size of herd are shown in table 10.

TABLE 10. INVENTORY OF COWS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Year and month	Purchases	Sales	Deaths	Heifers freshening	Size of herd	Cows freshening
	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
1935						
July.....	100	54	3	33	4,564	196
August.....	90	33	2	47	4,640	219
September.....	7	57	5	52	4,742	271
October.....	7	37	3	63	4,739	306
November.....	72	29	1	66	4,789	276
December.....	12	55	7	64	4,877	292
1936						
January.....	30	62	7	66	4,891	267
February.....	42	53	9	68	4,918	276
March.....	24	75	13	75	4,966	309
April.....	29	54	10	81	4,977	339
May.....	23	31	7	71	5,023	318
June.....	39	67	9	53	5,079	262
Total.....	475	607	76	739	5,095	3,331

The dairy men increased the size of their dairy herds during the year as evidenced by the figures in table 8. The average number of cows per farm at the beginning of the year was about 76 and at the end it was 85, an increase of 9 cows per herd. The average number¹ of cows per farm for the year was computed to be 81. About 84 per cent of the average number of cows per farm freshened during the year. About 11 per cent of the average number of cows

¹ *Number of cows*: The average number of cows on the farm during the year based on the thirteen-month inventory was used.

died or were sold during the year. Thus the replacement of cows was about 11 per cent for the year.

Age of cows: Of the 5,095 cows on farms at the end of the year 96.1 per cent were from three to ten years of age. Below this range were 2.1 per cent and above it only 1.8 per cent (table 11).

TABLE 11. AGE OF COWS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Age of cows	Total number	Per cent of total
2 years old.....	107	2.1
3 years old.....	672	13.2
4 years old.....	1,115	21.9
5-10 years old.....	3,108	61.0
Over 10 years old.....	93	1.8
Total.....	5,095	100.0

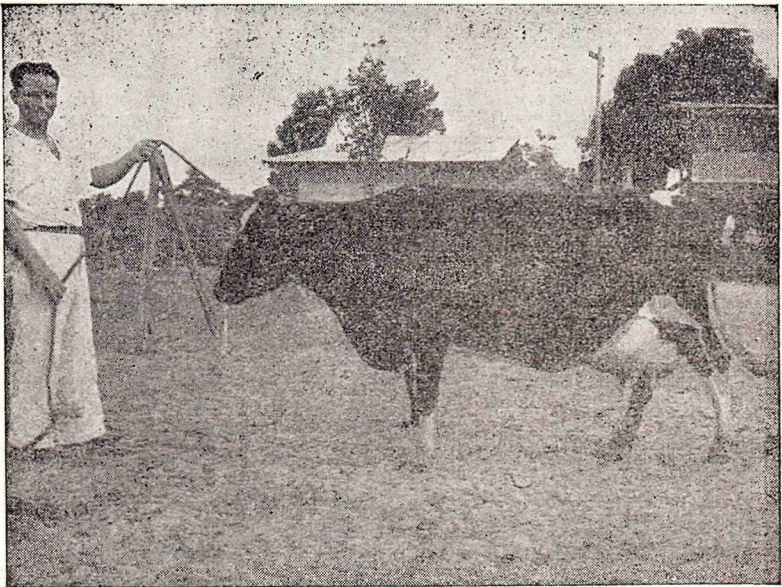


FIG. 4. Holstein cow (15/16) born and reared in Puerto Rico, which produced 13,300 pounds of milk during a year. Notice the splendid development of the udder.

Breed of cows and bulls: Farmers were asked the breeds of the cows they had at the end of the year. Cows having 50 per cent or more blood of one of the recognized breeds were classified as such. There existed a great predominance in Holstein-Friesian cows which

accounted for 78.5 per cent of the total. Guernseys accounted for 8.3 per cent; Jerseys for 6.8 per cent; Shorthorns for 0.9 per cent; Ayrshires for 0.3 per cent and native cows for 5.2 per cent. In this area results indicate that where milk production is the main purpose of the farm business, Holstein cows are expected to be the most important single breed of cows. Since the importation of well-known breeds, native cows have decreased in importance, due to the low-milk production per cow. They have been used for crossing purposes with other breeds of dairy cattle especially Holstein-Friesian.

TABLE 12. BREED OF COWS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Breed	Total number	Per cent of total
Native.....	268	5.2
Holstein.....	3,999	78.5
Guernsey.....	422	8.3
Jersey.....	348	6.8
Shorthorn.....	44	0.9
Ayrshire.....	14	0.3
Total.....	5,095	100.0

There were 122 bulls at the end of the year of which only 27 were purebred and registered. Of these 18 were Holstein bulls, 8 Guernsey and 1 Jersey. Of the 95 grade bulls, 82 were Holstein, 6 were Guernseys, 4 Jerseys, 2 Zebu and 1 Brown Swiss. Of the total number of bulls, 82.0 per cent were Holstein and 11.5 were Guernseys. There was 1 bull which was a crossbred between Holstein and Guernsey, and another one between a Holstein and Brown Swiss.

TABLE 13. BREED OF BULLS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Breed	Purebred	Grades	Total	Per cent of total
	Number	Number	Number	
Holstein.....	18	82	100	82.0
Guernsey.....	8	6	14	11.5
Jersey.....	1	4	5	4.1
Zebu (Brahama).....		2	2	1.6
Brown Swiss.....		1	1	0.8
Total.....	27	95	122	100.0

Zebu bulls were kept for the purpose of having their male progeny utilized for work purposes.

Farmers were asked about their preference of breeds of dairy cows. About 75 per cent of them preferred cows with Holstein blood.

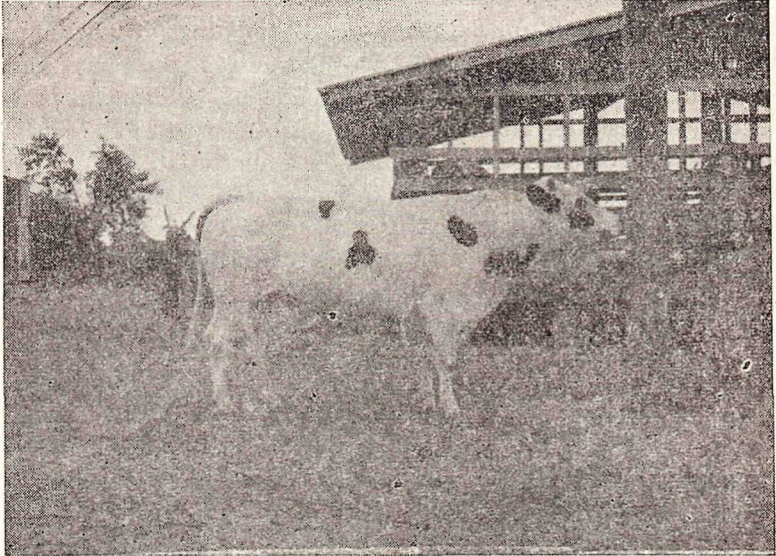


FIG. 5. Splendid purebred Holstein specimen reared in Puerto Rico.

FARM RECEIPTS, EXPENSES, AND NET RETURNS

The principal receipts from these 60 farms were from the sales of milk, sugar cane, coconuts, and cucumbers. The major expenses were for labor, feed purchases, taxes, buildings, fertilizers, and machinery.

Farm Receipts

Crop sales: The total receipts from the sale of crops in the 60 dairy farms amounted to \$215,643 or an average of \$3,594 per farm. Of this, \$3,264 per farm or about 91 per cent was solely from sugar cane; \$158 or 4 per cent from coconuts; \$58 or 2 per cent from cucumbers and \$49 or 1 per cent from grapefruit. The receipts from the crops mentioned above amounted to \$3,529 per farm or 98 per cent of the total. Other crops sales amounted to \$65 per farm or 2 per cent of the total. (See table 14.)

Of the 60 farms studied, 43 reported sales of crops of which 30 reported sales of sugar cane. When this is taken into consideration the crop sales per farm reporting crops sold has increased to \$5,015 per farm.

In so far as the value per *cuerda* harvested of the different crops is taken into consideration, there were five crops of major importance. These were tomatoes, cucumbers, sugar cane, lettuce, and pumpkins. All of these crops had sales per *cuerda* harvested amounting to at least \$100 and up to \$297. It is interesting to note that four of the five crops were vegetables.

TABLE 14. CROP SALES
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Number of farms reporting sales	Value of total sales	Per cent of total	Value per farm (all farms)	Value per farm reporting sales	Value per <i>cuerda</i> harvested
Sugar cane (1).....	30	\$195,834	90.8	\$3,264	\$6,528	\$122
Coconuts.....	8	9,501	4.4	158	1,188	24
Cucumbers.....	3	3,475	1.6	58	1,158	290
Grapefruit.....	5	2,929	1.4	49	586	27
Tobacco (1).....	2	883	0.4	15	442	65
Lettuce.....	2	738	0.3	12	369	105
Plantains.....	6	707	0.3	12	118	77
Yautias.....	7	353	0.2	9	79	21
Tomatoes.....	2	235	0.1	4	118	297
Sweet potatoes.....	3	164	0.1	3	55	6
Bananas.....	2	145	0.1	2	72	12
Onions.....	1	125	0.1	2	125	42
Pumpkins.....	1	100	0.1	2	100	100
Corn.....	3	76	.....	1	25	2
Other crops.....	6	178	0.1	3	30	8
Total.....	43	\$215,643	100.0	\$3,594	\$5,015	\$94

(1) Benefit payments for sugar cane and tobacco from the Agricultural Adjustment Administration not included (see table 17).

In general, the northern coast of the Island is a sugar-cane producing area. The topography is level and soils are of good productivity which may be utilized to a better advantage in growing sugar cane which is an intensive crop and more profitable than the majority if not all of the crops raised in the Island. Several sugar mills or centrals are located in the area studied.

Of the total crop production only \$30 worth of products were consumed per farm.

Milk sales: The milk sold per farm amounted to 125,341 quarts of which 60,817 quarts or about 48 per cent were sold during the months of July to December inclusive. Milk sales during the year were fairly uniform. The highest milk production came in during the spring and summer months, or in other words, during the rainy season and consequently, abundance of green pasture. The comparatively low production during the dry season was offset by a higher price and so the receipts from milk sales were fairly uniform, although somewhat higher in the fall and winter months.

The cows and heifers freshening during the year per farm was about the same for the two periods from July to December inclusive and January to June inclusive. Although somewhat higher in the latter period the difference is not significant.

The average milk sales per farm amounted to \$11,958 or 66 per cent of the total receipts (table 15).

TABLE 15. DISTRIBUTION OF MILK PRODUCTION
60 DAIRY FARMS, PUERTO RICO, 1935-36

Year and month	Milk sold per farm					Average price	Cows & heifers freshening per farm
	Quarts	Per cent	Per cent Nov. = 100*	Value	Per cent		
	<i>Number</i>					<i>Cents</i>	
1935							
July.....	10,341	8.2	106	\$922	7.7	8.9	3.8
August.....	10,314	8.2	105	944	7.9	9.2	4.4
September.....	10,024	8.0	102	919	7.7	9.2	5.4
October.....	10,072	8.0	103	962	8.1	9.6	6.2
November.....	9,781	7.8	100	969	8.1	9.9	5.7
December.....	10,285	8.2	105	1,016	8.5	9.9	5.9
Total.....	60,817	48.4	.....	\$5,732	48.0	9.4	31.4
1936							
January.....	10,372	8.3	106	1,032	8.6	9.9	5.5
February.....	9,716	7.8	99	984	8.2	10.1	5.7
March.....	10,628	8.5	109	1,068	8.9	10.0	6.4
April.....	10,470	8.4	107	1,033	8.6	9.8	7.0
May.....	11,555	9.2	118	1,065	8.9	9.2	6.5
June.....	11,783	9.4	120	1,047	8.8	8.9	5.3
Total.....	64,524	51.6	.....	6,226	52.0	9.6	36.4
Grand Total.....	125,341	100.0	.....	\$11,958	100.0	9.5	67.8

* The per cent of the milk sold each month compared with November as a base period.

Of the 125,341 quarts of milk sold per farm, 75,114 quarts or 60 per cent was sold wholesale and the remainder, 50,227 quarts or 40 per cent retailed. The average price received by the farmer was 7.9 cents per quart for the milk sold wholesale and 12.0 cents per quart for the milk retailed. The average price for the total milk sold was 9.5 cents per quart. Although about 20 per cent more milk was sold wholesale, the value for this milk was a little less than that sold retail due to the difference in price of milk. Milk sales accounted for 99.9 per cent of the receipts from livestock products sold.

Egg sales: Only \$7 worth of eggs were sold per farm, or 0.1 per cent of the total receipts from livestock products sold, at an average price of 32.3 cents per dozen.

TABLE 16. SUMMARY OF LIVESTOCK PRODUCTS PER FARM

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Product (Quantity)	Price (Cents)	Value	
			(Dollars)	(Per cent)
Milk wholesale.....	75, 114 qts..	7. 9	5, 945	49. 7
Milk retail.....	50, 227 qts..	12. 0	6, 013	50. 2
Total milk.....	125, 341 qts..	9. 5	11, 958	99. 9
Eggs.....	21 doz..	32. 3	7	0. 1
Total.....			11, 965	100. 6

Miscellaneous receipts: In addition to the income from sale of crops, livestock and livestock products, most farms had some miscellaneous source of income. The total income from these miscellaneous sources amounted to \$22,869 or an average of \$381 per farm (table 17). Of these, \$239 was what the farmer received as benefit payments from the Agricultural Adjustment Administration for sugar cane and \$4 for tobacco. Farmers sold seedlings for an average of \$46 per farm, as well as succulents (Para grass) for an average of \$26 per farm. Some pasture land was rented to other farmers for which an average rent of \$15 per farm was received. Empty sacks were sold for a value of \$15 per farm and equipment and fence posts for \$14 per farm each. Other miscellaneous receipts were unimportant.

TABLE 17. MISCELLANEOUS RECEIPTS

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Number of farms reporting	Average per farm	Average per farm reporting
A. A. A. payments for sugar cane.....	29	\$239	\$494
Sale of seedlings.....	6	46	464
Succulents sold.....	4	26	394
Pasture rent.....	2	15	450
Empty sacks.....	35	15	25
Sale of equipment.....	4	14	206
Fence posts.....	1	14	816
A. A. A. payments for tobacco.....	2	4	132
Wood.....	2	2	70
Hauling milk.....	1	2	130
Charcoal.....	1	2	125
Hauling sugar cane.....	1	1	55
Rent of house on farm.....	1	1	36
Animal labor off farm.....	1	.....	10
Total.....	54	\$381	\$422

Farm privileges: Farm privileges include what the farmer received from his farm 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 \$479 (table 18).

Milk used in the household accounted for the major part of the privileges (\$235). Next in importance was the yearly rental value of the dwelling or farm house, which averaged \$172. Minor produce, which included bananas, sweet potatoes, and other minor crops, averaged \$30 per farm. Livestock consumed by the household averaged \$21 and eggs \$19 per farm. The farm privileges, when added to the labor income, represented the labor earnings of the farmer. The average labor earnings for all the farms studied averaged \$3,048 per farm. (See table 21.)

TABLE 18. FARM PRIVILEGES
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Average per farm	
	Value	Quantity
Milk.....	\$235	2,535 quarts
Eggs.....	19	75.6 dozens
Livestock.....	21	
Minor produce.....	30	
Dwelling.....	172	
Charcoal.....	1	
Other.....	1	
Total.....	\$479	

Farm Expenses

General operating expenses: The total farm expenses included the cash farm expenses incurred by the operator and landlord and unpaid labor excluding value of the rent.

The average farm expenses for all farms amounted to \$9,859 (table 19). Of this amount, about 38 per cent was spent for labor; 28 per cent for cattle feed; and 8 per cent for taxes. These three items amounted to \$7,261 per farm or 74 per cent of the total farm expenses. Other expenses averaged \$2,598 per farm or 26 per cent of the total.

Labor was the most important item of expense on these farms averaging \$3,733 per farm. Out of this total, \$2,023 was paid to monthly and weekly labor, and \$1,540 to day labor. The average unpaid labor amounted to \$53 per farm and the labor compensation insurance averaged \$117 per farm.

Cattle feed bought was the second most important item of expense, amounting to \$2,792 per farm or about 28 per cent of the total expenses. There were two farmers who did not buy any cattle feed.

Other feeds were bought mainly for poultry and this averaged \$26 per farm.

TABLE 19. EXPENSES PER FARM
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Farms reporting	Amount	
		Dollars	Percent
Monthly and weekly labor.....	60	2,023	20.5
Day labor.....	57	1,540	15.6
Unpaid labor.....	5	53	0.6
Labor compensation insurance.....	55	117	1.2
Total labor costs.....	60	3,733	37.9
Cattle feed.....	58	2,792	28.3
Other feed.....	27	26	0.3
Fertilizers.....	36	383	3.9
Repairs for buildings.....	44	278	2.8
New buildings.....	10	302	3.1
Machinery repairs.....	53	69	0.7
New machinery.....	50	364	3.7
Farm share auto.....	23	86	0.9
Farm share truck and bus.....	22	268	2.7
Horseshoeing.....	43	11	0.1
Taxes.....	60	736	7.5
Fences.....	48	77	0.8
Gas and oil.....	21	43	0.4
Electricity.....	48	161	1.6
Ice.....	3	21	0.2
Advertising.....	3	16	0.2
Veterinary service and medicine.....	59	43	0.4
Disinfectants.....	60	21	0.2
Transportation of produce.....	11	43	0.4
Caps, etc.....	55	157	1.6
Water.....	13	17	0.2
Marketing expenses in milk stores.....	2	70	0.7
Telephone.....	7	10	0.1
Transportation of milk.....	1	28	0.3
Other expenses.....	57	104	1.0
Total.....	60	(1) 9,859	100.0

(1) Includes unpaid labor, landlord's expenses, and operator's expenses excluding rent.

Taxes averaged \$736 per farm or 7.5 per cent of the total farm expenses and 1.27 per cent of the average farm capital per farm.

Cash expense for fertilizers averaged \$383 per farm, and \$638 per farm reporting. The fertilizer bought was applied mainly to sugar cane.

The expense for construction and repairs of buildings averaged \$580 per farm or 5.9 per cent of the total farm expenses. New buildings were constructed on ten farms at an average cost of \$302.

New equipment and machinery repairs averaged \$433 per farm.

Feed purchases: Feeds purchased averaged \$2,792 per farm, of which \$2,437 or 87 per cent of the total expenses for feeds was spent in concentrates, mainly commercial rations such as Larro and Michigan State rations. The average price paid per ton for these was \$41.08. Two farmers did not report any feed bought during the year.

Succulents purchased averaged \$223 per farm or 8 per cent of the total feed expenses. Beet pulp accounted for \$213 per farm of the succulents purchased, and cane tops and pasture, mainly Para grass, for \$5 per farm each.

Purchases of molasses averaged \$88 per farm, salt and mineral mixtures \$21 per farm, and calf meals \$21 per farm. Only five farmers reported purchases of calf meals or \$248 per farm reporting, and two farmers purchased skimmed milk which averaged \$2 per farm or \$63 per farm reporting.

It is well to note the high prices which farmers have to pay for feed in Puerto Rico. With such high prices for feed it is important to obtain high productions of milk per cow.

TABLE 20. FEED PURCHASES
60 DAIRY FARMS, PUERTO RICO, 1935-36

	Farms reporting	Total quantity	Price	Value per farm	Percent of total
Total succulents.....	28			\$223	8.0
Beet pulp.....	26	6,689 cwt.....	\$1.91	213	7.6
Cane tops.....	1			5	0.2
Pasture.....	3	10,230 bun.....	0.03	5	0.2
Concentrates.....	58	71,192 cwt.....	2.05	2,437	87.3
Molasses.....	24	76,170 gal.....	0.07	88	3.1
Salt and mineral mixtures.....	28	960 cwt.....	1.33	21	0.8
Calf meals.....	5	490 cwt.....	2.53	21	0.7
Skimmed milk.....	2	12 cwt.....	10.50	2	0.1
Total.....	58			\$2,792	100.0

Summary of Receipts, Expenses, and Financial Returns

Labor income is one of the most generally accepted measures of the business success of a farm. In this paper it is the net farm income less interest at 8 per cent on the average farm capital. 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 interest at 8 per cent on his capital invested in the farm business. It is somewhat 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 were \$17,859, most of which were derived from the livestock products sold, especially milk (table

* *Receipts*: Total farm receipts or gross income 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, etc.; (5) the amount by which the farm capital at the end of the year exceeded that at the beginning. Unless otherwise stated, it refers to the sum of both the landlord's and the operator's receipts excluding rent.

21). Milk alone averaged \$11,958 per farm. Crop sales accounted for \$3,594 per farm and livestock sold during the year averaged \$509. The miscellaneous receipts averaged \$381 per farm. The increase in capital was larger than the decrease, resulting in a net increase of \$1,410 per farm, which was considered as a receipt.

The average *total expenses* ** per farm were \$10,652. Of these, \$9,806 per farm were represented by the farm cash expenses and \$793 per farm for the livestock bought during the year. The value of the unpaid family labor as estimated by the farmer was also included as an expense, since that would have been the approximate cost of hiring the work done. This item averaged \$53 per farm.

TABLE 21. SUMMARY OF RECEIPTS, EXPENSES, AND FINANCIAL RETURNS
60 DAIRY FARMS, PUERTO RICO, 1935-36

	Average per farm		
	Operator	Landlord	Total
Receipts:			
Crops sold.....	\$3,573	\$21	\$3,594
Livestock sold.....	509	.....	509
Livestock products sold.....	11,965	.....	11,965
Miscellaneous.....	379	2	381
Net increase in inventory.....	1,429	.....	1,410
Rent of farm.....	.....	643	.....
Total.....	\$17,855	\$666	\$17,859
Expenses:			
Farm expenses.....	\$9,591	\$215	\$9,806
Livestock bought.....	793	.....	793
Unpaid labor.....	53	.....	53
Rent of farm.....	643	.....	.....
Net decrease in inventory.....	.....	19	.....
Total.....	\$11,080	\$234	\$11,652
Farm income.....	\$6,775	\$432	\$7,207
Interest at 8%.....	3,648	.....	4,638
Labor income.....	3,127	.....	2,569
Labor earnings.....	3,607	.....	3,043
Return on capital.....	5,402	.....	5,834
Per cent return on capital.....	11.8	3.5	10.1
Net cash income.....	\$5,399	.....	\$5,880

The average total receipts exceeded the average total expenses on these farms by \$7,207. This was the *farm income*, or the amount which the operator received for his year's work and management and for the use of the capital invested. In order to put all farms on a

** *Expenses*: 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. Unless otherwise stated, it refers to the sum of the landlord's and operator's expenses excluding rent.

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 farms was \$2,569 per farm. This means that, on the average, these farmers after deducting all business expenses and interest on investment from the total receipts received \$2,569 for their year's work and management.

A farmer's labor income might be nothing, or even less than nothing, as was the case with 16 farmers who had negative labor incomes, and yet have enough net income for a living. If the farm income were \$800 and the capital invested were \$20,000, the labor income would be \$800 less 8 per cent on the \$20,000 capital (\$1,600), or minus \$800. However, if he had no mortgage nor any other debt, the farmer would have \$800 on which to live. If he 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 \$1,000. 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 18) was \$479, which when added to the labor income resulted in an average labor earnings of \$3,048 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 \$5,834.

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 \$57,976 invested in their farm businesses. The return on this capital averaged \$5,834 or 10.1 per cent of the capital.

From the farm income, unpaid labor was added and the increase in inventory was subtracted, the resulting figure being the *net cash income* which averaged \$5,860 per farm. This figure represents the amount which the farmer had to meet the necessities of life. Interest on indebtedness was not taken into consideration.

Capital turnover is the number of years required for receipts to equal capital. An average of 3.2 years, as obtained from these dairy farms, indicates a rapid capital turnover during the year 1935-36.

FACTORS AFFECTING FARM EARNINGS

The object of this section is to ascertain the factors associated with financial success in farming. It has been found that returns from farming vary considerably from farm to farm within a given group. It is, therefore, important to find out why some farmers make and others lose money.

For this purpose, farms were sorted on different factors in three groups; each one including 20 farm records. However, the success or failure of a farm business is not normally determined by a single factor but rather by a combination of many factors. Farms were sorted on the basis of being above average in a single factor and then subsorted for two, three and more factors above the average at the same time.

These combinations of factors are especially significant from the farmer's point of view, because on any farm it is the proper combination of these factors and the relative attention given to each one that will ultimately determine the success or failure of that farm. A good farm organization should excel not only in the individual factors but in the proper combinations in order to obtain as favorable a financial return as possible. Results of these sorts are presented in subsequent tables (tables 22 to 32).

Relation of Size of Business to Farm Earnings

Total "cuerdas" in farm: One-third of the farms were small with an average of 69 *cuerdas*. The average labor income for this group of farms was \$1,137. These farms had an average of 37 cows, 24 net *cuerdas* in crops, and their farm capital was \$23,933 (table 22).

The middle-third group had an average of 192 *cuerdas* per farm and \$1,847 of labor income. This group had an average of 73 cows, 62 net *cuerdas* in crops and \$43,908 in capital.

For the large farms the average size was 484 *cuerdas* and their average labor income \$4,723. They had 133 cows, 109 net *cuerdas* in crops and an average farm capital of \$106,088.

The relation existing between total *cuerdas* per farm and labor income indicated that as the size of farm increased, the number of cows, net *cuerdas* in crops, capital invested and labor income increased. The only two factors which did not show a consistent increase with increase in size of farm were net *cuerdas* in crops per man and animal units per man. Although the net *cuerdas* in crops

per man increased in the second group and then decreased, this may tend to show that the efficiency decreased but this might be explained if it is taken into consideration that the third group has a greater proportion of the net *cuerdas* in crops in sugar cane.

TABLE 22. RELATION OF TOTAL CUERDAS IN FARM TO FARM EARNINGS AND OTHER FACTORS

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Total cuerdas in farm			
	Lower third	Middle third	Upper third	Average
	Average per farm			
Number of farms.....	20	20	20	60
Total <i>cuerdas</i> in farms.....	69	192	484	248
MEASURES OF FARM EARNINGS:				
Labor income.....	\$1,137	\$1,847	\$4,723	\$2,569
Labor earnings.....	\$1,600	\$2,215	\$5,330	\$3,048
Return on capital.....	\$2,290	\$4,037	\$11,174	\$5,834
Per cent return on capital.....	10	9	11	10
SIZE OF BUSINESS:				
Net <i>cuerdas</i> in crops.....	24	62	109	65
Number of cows.....	37	73	133	81
Animal units.....	55	111	196	121
Man equivalent (1).....	6	11	24	14
Capital invested.....	\$23,933	\$43,908	\$106,088	\$57,976
Gross receipts.....	\$7,937	\$14,333	\$31,879	\$18,050
DIVERSITY OF BUSINESS:				
Receipts from sugar cane.....	\$1,090	\$2,422	\$6,996	\$3,503
Value of milk sales.....	\$5,393	\$9,220	\$21,261	\$11,958
Per cent receipts from sugar cane were of total	14	17	22	19
LABOR EFFICIENCY:				
Net <i>cuerdas</i> in crops per man.....	3.8	5.6	4.5	4.7
Animal units per man.....	8.7	9.9	8.1	8.7
OTHER FACTORS:				
Milk sales per cow.....	\$146	\$126	\$160	\$147
<i>Cuerdas</i> in sugar cane.....	7	19	54	27
Percent of land in permanent pasture.....	58	59	72	67

(1) *Man Equivalent*: The average number of persons working on a farm during a year reduced to an adult male basis was termed the man equivalent. It is obtained by adding the total months of labor on the farm, including 12 months for the operator and dividing by 12.

Number of cows: The average number of cows per farm in the lower-third group was 30 cows. This group had an average labor income of \$2,012. They handled 5,400 quarts of milk per man and sold 1,392 quarts of milk per cow at an average price of 10 cents for a total of \$140.

TABLE 23. RELATION OF NUMBER OF COWS TO FARM EARNINGS AND OTHER FACTORS

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Number of cows			
	Lower third	Middle third	Upper third	Average
	Average per farm			
Number of farms.....	20	20	20	60
Number of cows.....	30	62	151	81
MEASURE OF FARM EARNINGS:				
Labor income.....	\$2,012	\$1,003	\$4,692	\$2,569
SIZE OF BUSINESS:				
Capital invested.....	\$22,304	\$49,510	\$102,113	\$57,976
Man equivalent.....	8	12	21	14
Total milk production (100 qts.).....	452	875	2,637	1,321
Milk sales (100 qts.).....	417	804	2,539	1,253
Gross receipts.....	\$9,198	\$12,796	\$32,156	\$18,050
DIVERSITY OF BUSINESS:				
Receipts from sugar cane.....	\$3,357	\$3,875	\$3,276	\$3,503
Value of milk sales.....	\$4,180	\$6,922	\$24,771	\$11,958
Per cent receipts from sugar cane were of total	36	30	10	19
RATES OF PRODUCTION:				
Milk production per cow (qts.).....	1,509	1,399	1,748	1,629
Milk sold per cow (qts.).....	1,392	1,287	1,683	1,546
Value of milk sold per cow.....	\$140	\$111	\$164	\$147
LABOR EFFICIENCY:				
100 quarts of milk per man.....	54	73	124	95
OTHER FACTORS:				
Capital turnover.....	2.4	3.9	3.2	3.2
Average price of milk (cents per qt.).....	10.0	8.6	9.8	9.5

In contrast with this group, the largest farms as measured by number of cows averaged 151 cows, handled 12,400 quarts of milk per man, and sold 1,683 quarts of milk per cow at an average price of 9.8 cents per quart with a total value of milk of \$160 per cow. They averaged \$4,692 labor income. Since milk sold at about the same price per quart, this difference in labor income may be explained by the fact that this group had a better rate of production per cow, a much higher number of cows, and a better labor efficiency than small herds. The lower labor income in the middle group can be explained by the fact that the production per cow was the smallest in this group and the price of milk per quart the lowest, and consequently the value of milk sold per cow.

The receipts from sugar cane were about equal in the three groups which showed that this factor remaining about constant for the three groups, the efficiency of the labor as measured by the quarts of milk handled per man increased as the number of cows increased. Receipts from sugar cane include those obtained by the landlord and tenant for both cash sales and benefit payments from the Agricultural Adjustment Administration.

Relation of Rate of Production to Farm Earnings

Milk production per cow: The relation between milk production per cow and labor income is close. It is important to get a high milk production per cow to get a high output of milk per man and thus lead to a good labor income. This is especially true when labor is high priced.

The lower-third group had an average milk production per cow of 1,028 quarts and an average labor income of \$1,661. In this group the average quarts of milk handled per man was 5,100 quarts and the value of milk sales per cow amounted to \$81 at an average price of 8.4 cents per quart (table 24).

TABLE 24. RELATION OF MILK PRODUCTION PER COW TO FARM EARNINGS AND OTHER FACTORS

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Milk production per cow			
	Lower third	Middle third	Upper third	Average
	Average per farm			
Number of farms.....	20	20	20	60
Milk production per cow (quarts).....	1,028	1,448	2,177	1,629
MEASURE OF FARM EARNINGS:				
Labor income.....	\$1,661	\$2,253	\$3,792	\$2,569
SIZE OF BUSINESS:				
Number of cows.....	68	75	100	81
Total milk production (100 quarts).....	703	1,087	2,174	1,321
Gross receipts.....	\$13,524	\$14,825	\$25,800	\$18,050
DIVERSITY OF BUSINESS:				
Value of milk sales.....	\$5,506	\$10,382	\$19,985	\$11,958
Receipts from sugar cane.....	\$6,288	\$2,176	\$2,044	\$3,503
Per cent receipts from sugar cane were of total...	46	15	8	19
LABOR EFFICIENCY:				
100 quarts of milk per man.....	51	102	126	95
OTHER FACTORS:				
Feeds purchased.....	\$1,117	\$2,436	\$4,823	\$2,792
Value of milk sold per cow.....	\$81	\$138	\$200	\$147
Feed purchased per cow.....	\$16	\$32	\$48	\$34
Average price of milk (cents).....	8.4	10.0	9.7	9.5

The middle-third group had an average production per cow of 1,448 quarts of milk and a labor income of \$2,253. On these farms the amount of milk handled per man averaged 10,200 quarts, and the value of milk sales per cow was \$138 at an average price of 10 cents per quart.

In the group with the highest milk production per cow, they averaged 2,177 quarts and a labor income of \$3,792 per farm. Milk handled per man averaged 12,600 quarts and the value of the milk

sold per cow averaged \$200, sold at an average price of 9.7 cents per quart.

The difference in milk production per cow may be partly explained by the amount of feed purchased per cow. The farms having the lowest production fed the least amount of concentrates (\$16 per cow) while the second group fed twice as much (\$32 per cow) and the third group having the highest milk production per cow fed three times the amount fed by the lowest group or \$48 per cow. The upper-third group was more specialized in the production of milk as may be shown by the percentage which the receipts from sugar cane were of the total receipts. In this group this percentage amounted to 8 per cent while in the lower-third group it was 46 per cent. It is assumed that the low-production group devoted about half of its time in the care and management of the dairy herd and about half of the time in the production of sugar cane, while the group having the highest milk production per cow devoted about all of its time in the care and management of its dairy herd.

The Relation of Labor Efficiency to Farm Earnings

Hundred quarts of milk per man: On strictly dairy farms, the number of quarts of milk produced per man is a very good measure of efficiency; but when you have such a combination as dairy and sugar cane farming the results are distorted due to the fact that sugar cane growing, being an intensive crop, needs a great deal of labor and thus increases materially the man equivalent of a farm, with the resulting decrease in efficiency when measured by the amount of milk handled per man. In the group of farms in which there were 30 farmers reporting sales of sugar-cane this was the case.

In the lower-third group, as to milk produced per man, the amount of milk handled per man was about 4,000 quarts with an average labor income of \$2,001 per farm. Besides, they cared for 6.0 net *cuerdas* in crops and 5.6 animal units per man. This group had an average of 58 cows per farm and 110 net *cuerdas* in crops and \$8,270 receipts from sugar cane. They were specialized in the production of both sugar cane and milk (table 25.)

TABLE 25. RELATION OF 100 QUARTS OF MILK PER MAN TO FARM EARNINGS AND OTHER FACTORS

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	100 quarts of milk per man			
	Lower third	Middle third	Upper third	Average
	Average per farm			
Number of farms.....	20	20	20	60
100 quarts of milk per man.....	40	96	166	95
MEASURE OF FARM EARNINGS:				
Labor income.....	\$2,001	\$1,366	\$4,340	\$2,569
SIZE OF BUSINESS:				
Number of cows.....	58	57	129	81
Man equivalent.....	18	9	14	14
Total milk production (100 quarts).....	732	860	2,372	1,321
Gross receipts.....	\$16,960	\$11,167	\$26,022	\$18,059
DIVERSITY OF BUSINESS:				
Receipts from sugar cane.....	\$8,270	\$1,430	\$808	\$3,573
Value of milk sales.....	\$6,195	\$7,897	\$21,781	\$11,353
LABOR EFFICIENCY:				
Net <i>cuerdas</i> in crops per man.....	6.0	4.4	3.2	4.7
Animal units per man.....	5.6	9.6	12.2	8.7
OTHER FACTORS:				
Labor expenses.....	\$4,727	\$2,106	\$4,366	\$3,733
Feed purchased.....	\$1,512	\$1,994	\$5,070	\$2,772
Farm expenses.....	\$10,259	\$6,954	\$15,315	\$10,843

In the middle-third group the amount of milk handled per man was about 9,600 quarts and an average labor income of \$1,366. Although they handled 9.6 animal units per man they also cared for 4.4 net *cuerdas* in crops. Cows per farm averaged 57 and the net *cuerdas* in crops per farm averaged 39 while the receipts from sugar cane amounted to \$1,430.

The upper-third group averaged about 16,600 quarts of milk per man and a labor income of \$4,340 per farm. In this group, each man handled 12.2 animal units and 3.2 net *cuerdas* in crops. The average number of cows for these farms was 129 and the net *cuerdas* in crops was 46. The receipts from sugar cane amounted to only \$808 per farm.

The efficiency as measured by net *cuerdas* in crops handled per man decreased as the efficiency measured by 100 quarts of milk per man increased. The lower-third group had much more land in sugar cane in which they were highly specialized while the upper-third group was highly specialized in milk production. This can be shown too by the animal units per man which increased as the 100 quarts of milk per man increased.

The higher labor income in the third group has been due to the large size of business as measured by the number of cows (129), the

high milk production per cow (1,837 quarts), and consequently high value of milk sold per cow (\$169), and increased efficiency (16,600 quarts per man). The combination of these factors brought about a higher labor income for this group.

Relation of the Diversity of the Farm Business to Farm Earnings

Percentage of income from crops sold: The proportion of total receipts furnished by crops was nothing for the lower third group, 14 per cent in the second group and 58 per cent in the last group when the farms were sorted by the percentage of the income from crops sold (table 26).

TABLE 26. RELATION OF PERCENTAGE OF RECEIPTS FROM CROPS TO FARM EARNINGS AND OTHER FACTORS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Percentage of receipts from crops			
	Lower third	Middle third	Upper third	Average
	Average per farm			
Number of farms.....	20	20	20	60
Percentage of receipts from crops.....	0	14	58	21
MEASURE OF FARM EARNINGS:				
Labor income.....	\$3,404	\$1,665	\$2,639	\$2,569
SIZE OF BUSINESS:				
Net <i>cuerdas</i> in crops.....	37	58	100	65
Number of cows.....	106	82	56	81
Total milk production (100 quarts).....	1,928	1,301	735	1,321
Gross receipts.....	\$21,914	\$16,177	\$16,059	\$18,050
DIVERSITY OF BUSINESS:				
Crop sales.....	\$3	\$2,212	\$9,291	\$3,835
Receipts from sugar cane.....	0	\$1,570	\$8,938	\$3,503
Value of milk sales.....	\$18,918	\$11,762	\$5,193	\$11,958
LABOR EFFICIENCY:				
100 quarts of milk per man.....	158	105	43	95
Net <i>cuerdas</i> in crops per man.....	3.0	4.7	5.9	4.7
RATES OF PRODUCTION:				
Milk production per cow (quarts).....	1,827	1,594	1,309	1,629
Milk sales per cow.....	\$179	\$144	\$92	\$147

When sorted on the basis of "the percentage of receipts from crops" the farms which received no income from the sale of crops had the best net returns. This would tend to show the advisability of a high degree of specialization in dairy production. When the farms were sorted on the basis of size, however, as in table 22, the larger, somewhat more diversified farms had the best returns. From these data it would seem as though some diversity is desirable on dairy farms in this region. This is particularly true on the larger farms and on farms where the soil and markets provide favorable

conditions for crop production. In addition, this diversity might help to avoid what might be called "local over-production", which might too seriously affect the local prices of dairy products.

Although this table indicates that milk sales per cow decreased as the percentage of income from crops increased, table 22 indicates that some farms at least had a high income per cow along with a diversified farm program.

Relation of Age of the Farm Operator to Farm Earnings

The average age of the operator on these farms was 44 years. The youngest operators who averaged 32 years of age had the second highest labor income or \$2,823 per farm (table 27). The older men having an average of 57 years of age had the lowest labor incomes, or \$1,609 per farm. The middle-aged farmers, who averaged 44 years, made the highest labor incomes (\$3,178), turned over their capital faster, handled more cows, and so produced more milk and used more capital than the other two groups composed of younger and older farmers, respectively.

TABLE 27. RELATION OF AGE OF THE FARM OPERATOR TO FARM EARNINGS AND OTHER FACTORS

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Age			
	Lower third	Middle third	Upper third	Average
	Average per farm			
Number of farms.....	19	22	19	60
Age.....	32	44	57	44
MEASURE OF FARM EARNINGS:				
Labor income.....	\$2,823	\$3,178	\$1,609	\$2,569
SIZE OF BUSINESS:				
Capital invested.....	\$55,424	\$68,797	\$47,998	\$57,976
Number of cows.....	76	104	60	81
Gross receipts.....	\$17,006	\$22,896	\$13,483	\$18,050
DIVERSITY OF BUSINESS:				
Receipts from sugar cane.....	\$3,453	\$2,531	\$4,673	\$3,503
Value of milk sales.....	\$11,294	\$16,717	\$7,112	\$11,958
OTHER FACTORS:				
Capital turnover.....	3.3	3.0	3.6	3.2

It appears that the labor incomes of younger farmers are higher than those of older farmers. For one thing, older farmers had the smallest-sized business which may account for their lower labor incomes, although they had more sugar cane as measured by the receipts from sugar cane, which ought to compensate somewhat for the smaller size of business. One probable explanation why the youngest

farmers had a smaller size of herd is that they are building up their herds, and who knows if in 10 or 12 years they would have the same number of cows as the middle-third group. Another probable explanation why the older farmers have less cows is that a great deal of attention and care is needed for the dairy herd and usually working at very inconvenient hours. For this reason they may tend to reduce their herds. At the same time they may increase their sugar cane which is more convenient to work, although at the present Puerto Rico has a quota for sugar cane production and thus limits the number of acres or tons of sugar cane to be produced by individual farmers.

Relation of Farm Tenure to Farm Earnings

Twenty-nine farmers were full owners and 21 were tenants or part owners. There was not much difference in labor incomes between full owners and part owners. Although the full owners had less capital invested they handled less cows, but the differences are not significant. Both groups had the same percentage return on capital which was 10 per cent (table 28).

TABLE 28. RELATION OF TENURE TO FARM EARNINGS AND OTHER FACTORS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Tenure		
	Full owners	Tenants and part owners	Average
	<i>Average per farm</i>		
Number of farms.....	29	31	30
MEASURE OF FARM EARNINGS:			
Labor income.....	2,631	2,511	\$2,569
Labor earnings.....	3,086	3,013	3,048
Return on capital.....	5,719	5,941	5,834
Per cent return on capital.....	10	10	10
SIZE OF BUSINESS:			
Number of cows.....	77	85	81
Capital invested.....	\$54,811	\$60,936	\$57,976

Method of Milk Marketing and Farm Earnings

Method of milk marketing: There were 14 retailers, 30 wholesalers, and 16 wholesalers-retailers of the farms studied (table 29). The average labor income for these groups were \$2,565 for the retailer, \$2,236 for the wholesaler, and \$3,196 for the wholesaler-retailer. It might have been expected that the retailer would have had a better income; this was not the case. Although the average price

of milk on the "retail farms" was higher, these farms had fewer cows, a smaller volume of business and thus lower net returns than on wholesaler-retailed farms. In favor of the wholesaler-retailers is the fact that they had a larger business, better milk production per cow, and better efficiency which accounted, no doubt, for the better labor income.

The wholesaler, although selling a little more milk per cow than the retailers, the difference in price of 4.6 cents per quart resulted in a much lower value of milk sold per cow (\$65 lower). The retailers and wholesalers had about the same number of cows but the total receipts from milk sales averaged about \$5,000 less for the wholesaler. There was only about \$1,000 difference in gross receipts and \$329 in labor income, however, since the wholesalers received a greater proportion of the farm income from sugar cane.

TABLE 29. RELATION OF METHOD OF MILK MARKETING TO FARM EARNINGS AND OTHER FACTORS

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Method of milk marketing			
	Retail	Wholesale	Both	Average
	Average per farm			
Number of farms.....	14	30	16	60
MEASURE OF FARM EARNINGS:				
Labor income.....	\$2,565	\$2,236	\$3,196	\$2,569
SIZE OF BUSINESS:				
Number of cows.....	75	74	101	81
Man equivalent.....	12	14	16	14
Gross receipts.....	\$17,023	\$15,900	\$22,980	\$18,050
DIVERSITY OF BUSINESS:				
Value of milk sales.....	\$13,610	\$8,629	\$16,754	\$11,958
RATES OF PRODUCTION:				
Milk sold per cow (quarts).....	1,447	1,474	1,707	1,546
Value of milk sold per cow.....	\$182	\$117	\$166	\$147
OTHER FACTORS:				
Milk sold retail (100 quarts).....	1,081		937	502
Milk sold retail, value.....	\$13,610		\$10,640	\$6,013
Milk sold wholesale (100 quarts).....		1,084	784	751
Milk sold wholesale, value.....		\$8,629	\$6,114	\$5,945
Milk sold retail (price per quart).....	12.6¢		11.4¢	12.0¢
Milk sold wholesale (price per quart).....		8.0¢	7.8¢	7.9¢
Average price per quart.....	12.6¢	8.0¢	9.7¢	9.5¢
Per cent milk—retailed.....	100		54	40
wholesaled.....		100	46	60

Value of milk sold per cow: The value of the milk sold per cow averaged \$74 in the lower-third group, \$121 in the second group, and \$200 in the third group. Their average labor incomes were \$1,710, \$1,497, and \$4,499, respectively (table 30).

TABLE 30. RELATION OF VALUE OF MILK SOLD PER COW TO FARM EARNINGS AND OTHER FACTORS
60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Value of milk sold per cow			
	Lower third	Middle third	Upper third	Average
	Average per farm			
Number of farms.....	20	20	20	60
Value of milk sold per cow.....	\$74	\$121	\$200	\$147
MEASURE OF FARM EARNINGS:				
Labor income.....	\$1,710	\$1,497	\$4,499	\$2,569
SIZE OF BUSINESS:				
Number of cows.....	60	67	116	81
Gross receipts.....	\$12,438	\$12,324	\$29,388	\$18,050
DIVERSITY OF BUSINESS:				
Value of milk sales.....	\$4,411	\$8,106	\$23,356	\$11,958
Receipts from sugar cane.....	\$6,300	\$2,525	\$1,682	\$3,503
RATES OF PRODUCTION:				
Milk sold per cow (quarts).....	970	1,447	1,898	1,546
OTHER FACTORS:				
Labor expenses.....	\$3,279	\$2,642	\$5,279	\$3,733
Feed purchased.....	\$978	\$2,018	\$5,380	\$2,792
Feed purchased per cow.....	\$16	\$30	\$46	\$35
Average price of milk (cents).....	7.6	8.4	10.6	9.4

The figures in this table indicate that a fairly high degree of specialization on these dairy farms is associated with the higher farm earnings. Although the middle-third group had a better milk production per cow, a better price, a few more cows, and a much higher value of total milk sales, their labor income was smaller than the lower-third group. For one thing, the total labor and feed expenses for the middle-group were larger than for the lower-third, while the receipts from sugar cane were much lower. Consequently, having less total receipts and more expenses, it is only natural that their labor incomes should be lower than the lower-third group. The increased production per cow was accompanied by an increase in expenses for feed purchased.

The advantages of the upper-third group are such that their labor income is much higher than the first two groups. These advantages are a higher milk production per cow, a better price of milk, larger size of herd, and a better efficiency which combinations resulted in high labor incomes.

EFFECT OF A COMBINATION OF FACTORS ON FARM EARNINGS

Relation of different factors above and below average to labor income: Farms were sorted on different factors above and below the average for all farms and the results are shown in table 31.

TABLE 31. RELATION OF DIFFERENT FACTORS ABOVE AND BELOW AVERAGE
TO LABOR INCOME

60 DAIRY FARMS, PUERTO RICO, 1935-36

Factor	Below average	Average	Above average	Below average	Average	Above average
	<i>Labor Income</i>					
Total cuerdas in farm.....	127	248	473	\$1,475	\$2,569	\$4,601
Number of cows.....	45	81	148	1,498	2,569	4,558
Milk sales per cow.....	\$97	\$147	\$199	1,540	2,569	4,479
Milk production per cow (quarts).....	1,203	1,629	2,122	1,871	2,569	3,691
100 quarts of milk per man.	48	95	152	1,558	2,569	3,515
Per cent income from crop sales.....	5	21	54	2,565	2,569	2,575

Those farms which were above the average in total *cuerdas* in farm had an average of 473 *cuerdas* and a labor income of \$4,601, while those below had 127 *cuerdas* and a labor income of \$1,475.

Farms below average in number of cows had 45 cows and a labor income of \$1,498, while those above average had 148 cows and a labor income of \$4,558.

The value of milk sales per cow for those farms below average was \$97 and their labor income \$1,540 per farm. Those above average in value of milk sales per cow had a value of milk sales of \$199 per cow and \$4,479 labor income per farm.

The value of milk sales per cow for those farms below average was \$97 and their labor income \$1,540 per farm. Those above average in value of milk sales per cow had a value of milk sales of \$199 per cow and \$4,479 labor income per farm.

Farms below average in milk production per cow averaged 1,203 quarts per cow and a labor income of \$1,871 per farm, while those above average produced 2,122 quarts per cow and a labor income of \$3,691 per farm.

The 100 quarts of milk handled per man on farms below average for this factor was 4,800 quarts per man and labor income of \$1,558

per farm, while those above average handled 15,200 quarts per man and a labor income of \$3,515 per farm.

There was no significant difference for farms below and above average in percentage of income from crop sales.

The results shown in this table point out the necessity of being above average in at least one of these factors if they are to obtain high financial returns from their businesses. Large businesses accompanied by good rates of production and efficiency are likely to make the best labor incomes.

Effect of combination of factors on labor income: All farms above average in any one of the following factors: total *cuerdas* in farm, number of cows, man equivalent, value of milk sales per cow, milk production per cow, 100 quarts of milk handled per man and percent income from crop sales, had on the average labor incomes from about one and a-half times as great to about twice as great as the average of all farms (table 32). The highest labor income was obtained by those farms above average in total *cuerdas* in farm, amounting to \$4,601 per farm; the lowest labor income by those above average in percentage of income from crop sales, amounting to \$2,575 per farm.

Groups of farms above average in two factors had labor incomes about two and a-half times as large as the average for all farms.

The groups of farms above average in three factors had labor incomes about two and one-half to three times as large as the average labor income for all farms.

The groups of farms above average in four factors had their labor incomes about three times as large as the average for all farms. The

TABLE 32. EFFECT ON LABOR INCOME OF HAVING DIFFERENT FACTORS ABOVE AVERAGE

60 DAIRY FARMS, PUERTO RICO, 1935-36

Item	Number of farms	Average in item	Average for all farms	Labor income
				<i>Dollars</i>
Average for all farms.....	60			2,569
ABOVE AVERAGE IN ONE FACTOR:				
Total <i>cuerdas</i> in farm.....	21	473	248	4,601
Number of cows.....	21	148	81	4,558
Man equivalent.....	21	26	14	4,416
Value of milk sales per cow.....	21	199	147	4,479
Milk production per cow (quarts).....	23	2,122	1,629	3,691
100 quarts of milk per man.....	31	152	95	3,515
Per cent income from crop sales.....	22	54	21	2,575
ABOVE AVERAGE IN TWO FACTORS:				
Number of cows and milk production per cow.....	11			6,749
Number of cows and milk sales per cow.....	12			6,526
Number of cows and 100 quarts of milk per man.....	14			6,027
Number of cows and total <i>cuerdas</i> in farm.....	15			4,895
Milk sales per cow and 100 quarts of milk per man.....	15			5,750
ABOVE AVERAGE IN THREE FACTORS:				
Number of cows, milk production per cow and milk sales per cow.....	9			6,416
Number of cows, milk production per cow and 100 quarts of milk per man.....	10			6,504
Number of cows, milk sales per cow and 100 quarts of milk per man.....	10			7,461
ABOVE AVERAGE IN FOUR FACTORS:				
Number of cows, milk production per cow, milk sales per cow, and 100 quarts of milk per man.....	8			7,118
Number of cows, milk production per cow, 100 quarts of milk per man, and man equivalent.....	6			8,214
Number of cows, milk sales per cow, 100 quarts of milk per man, and man equivalent.....	7			8,550
ABOVE AVERAGE IN FIVE FACTORS:				
Number of cows, milk production per cow, milk sales per cow, 100 quarts of milk per man, and man equivalent.....	6			8,214

best combination of factors was supplied by number of cows, value of milk sales per cow, 100 quarts of milk handled per man and man equivalent, their labor income amounting to \$8,550 per farm.

The highest labor income for any farm was \$10,565. If this fact is kept in mind by the reader while analyzing table 32, the importance of these combinations of factors can be realized more readily.

One of the most important factors while in combination with others in this study, although not so significant alone, is the quarts of milk handled per man. It was not so significant alone because of the sugar cane grown in these farms. Those farms above average in this factor made a labor income of \$3,515 per farm, but when combined with number of cows the labor income was increased to \$6,027 per farm or to \$5,750 per farm when combined with value of

milk sales per cow. Farms with number of cows and value of milk sales per cow above the average and that handled more quarts of milk per man than the average made labor incomes of \$7,461.

SUMMARY

Since the introduction of dairy breeds of cattle in Puerto Rico in 1911, a great improvement has been seen in the dairy industry. Especially has there been an increase in milk production per cow. From 1920 to 1935, the average increase in milk production per cow was 27 per cent and the increase in the number of cows milked about 23 per cent. The average milk production per cow in 1935 was 1,657 pounds of milk.

The most important kinds of pasture grasses in the Island are Guinea grass and Para grass. Of minor importance are Guatemala, Elephant, and Molasses grass. In 1929, there were 21,980 acres of the first two mentioned, and 6,713 acres of the last mentioned in addition to other grasses. Neither hay nor silage is fed to cows.

Of the total number of cattle in Puerto Rico in 1930, there were 4,144 purebred registered animals on farms which represent about 1.4 per cent of the total.

In 1935, there were 23,335 farms reporting cows milked or about 44 per cent of the total number of farms. According to the Census of Agriculture of 1935, there were 661 dairy farms in Puerto Rico, that is, farm on which milk was the principal source of income.

The average size of the farms studied was 248 *cuerdas*, with 65 net *cuerdas* in crops and 166 *cuerdas* in permanent pasture. The average farm capital was \$57,976. Of the 60 farms studied 29 farmers were full owners, 10 rented the land, and 21 were part owners of the land. The usual relationship existing between the landlord and tenant was the paying cash of the latter to the former for the rent of the land.

Sugar cane was the most important source of income of all the crops planted. Yields of the different crops in some instances were high, in other low, and about the average in others.

The average number of cows per farm included in this study was 81 with an average milk production of 1,629 quarts. The majority of the cows as well as the bulls had some Holstein-Friesian blood. Milk sales per farm amounted to 125,341 quarts sold with a total value of \$11,958 per farm at an average price of 9.5 cents per quart. This value represented 70 per cent of the total receipts. (See table

21.) There were 14 retailers, 30 wholesalers, and 16 wholesaler-retailers

The average expenses including unpaid labor, landlord's and operator's expenses but excluding rent, were \$9,859 per farm.

The average labor income on these farms was \$2,569 during 1935-36. Only 16 farmers or about 27 per cent of the total made negative labor incomes. The range in labor income was from \$2,551 to \$10,565.

The relation of total *cuerdas* in farm to labor income showed a consistent increase in labor income as the size of the farms increased. All other size factors increased as size of farm increased. (See table 22.)

When the farms were sorted into three groups on the basis of number of cows, the farms with the least number of cows had better labor incomes than did those in the middle group but less than the farms in the group with the largest number of cows. The lower production per cow and the lower price received for milk quite largely accounted for the lower average labor income of the formers in the middle-third group. The labor incomes on farms having the most cows averaged about 83 per cent higher than the average. (See table 23.)

Farms having the lowest-milk production per cow had the lowest labor income, while those having the best production per cow had the best labor incomes. Both the number of cows and value of milk sales per cow increased with increased production per cow. (See table 23.)

The amount of milk handled per man did not show as consistent relationship to labor income because of the fact that the farms with the lowest efficiency had much higher receipts from sugar cane than the other two groups. In the middle and in the upper-third groups where milk production was of most importance, the labor income of the farms with highest efficiency was about three times as high as the farms of the middle group. Not taking into consideration the sugar cane, the amount of milk handled per man shows a close relationship to labor income. (See table 25.)

When the farms were sorted on the basis of percentage of receipts from crops, those farms whose percentage receipts from crops were the lowest (0 per cent) had the highest labor incomes, but those having the highest percentage receipts from crops had the second highest labor income. (See table 26.)

The oldest farmers had the poorest labor incomes and the youngest the second best labor incomes. The middle-aged farmers had the best labor incomes due to the larger size of business. (See table 27.)

Difference in farm tenure did not affect significantly the labor income. (See table 28.)

Those farmers who sold their milk at wholesale had the poorest labor incomes and those who sold at both retail and wholesale had the best labor incomes due no doubt to a better production per cow, large business and better efficiency. (See table 29.)

Farms whose value of milk sold per cow was the highest had the best production per cow, best price for their milk, larger businesses and consequently higher-labor incomes. Those having the lowest value of milk sold per cow had the second highest-labor incomes. Their production per cow and price of milk was the lowest but their receipts from sugar cane were much higher than for the other two groups, which may account for their labor incomes being the second highest. (See table 30.)

When sorts were made on the basis of being above average in one or more important factors, the labor incomes were always highest in the group of farms above average in a particular factor such as total *cuerdas* per farm, milk production per cow, etc. The highest incomes, however, were obtained on farms which were above average in more than one factor such as a combination of the number of cows, value of milk sales per cow, hundred quarts of milk handled per man and man equivalent. Those farms being above average in these four factors made a labor income of \$8,550 per farm or about 233 per cent above the average. (See tables 31 and 32.)

RECOMMENDATIONS

On the basis of this study, there is a possibility for some dairy farmers to improve the organization of their businesses and to obtain higher returns. The following are some of the points in which some farms may be improved: (1) a large size of business, (2) a high-milk production per cow, (3) a high-labor efficiency, (4) a good price for milk, and (5) a uniform milk production during the year for those selling at retail and a higher production during the months of November to March inclusive for those selling wholesale to obtain the benefits of higher prices during that period.

There were many farmers who were below the average in at least one of these factors. They should study their farm businesses and see what is the weakest point or points and try to improve it to get

the highest returns possible. A combination of all of these factors in any farm will undoubtedly result in the greatest profits for the farmer.

Other recommendations which are worthwhile for dairy farmers to consider are:

1. To start a pasture improvement system in their farms (sixty-seven per cent of the land in these farms was in permanent pasture and 10 per cent in soilage crops). It is a well known fact that the greatest percentage of the land in permanent pasture is in pastures which are not cultivated or fertilized, being in its majority "grama", a non-cultivated grass. As a result of a pasture improvement system there would be no scarcity of it during the dry season and no doubt the feed bill would be reduced greatly.

2. To replace all grade bulls with purebred registered bulls of a good pedigree (seventy-eight per cent of the bulls on these farms were grades). If further improvement in the production of milk per cow is sought, it is a necessity for the farmer to keep only purebred registered bulls of a good pedigree. In general, the farmers overlook the fact that the bull constitutes at least 50 per cent of a dairy.

3. To improve the feeding methods of both cows and calves. Sometimes, a good and a poor cow are fed the same amount of concentrates, which of course is a mistake. A cow should be fed according to its production of milk as well as its weight. In general, it is wise to state that a cow should be fed one pound of concentrates for every 3 pounds of milk produced. For the farmers who are raising their calves for replacements they should be fed the right amount of feeds. A calf which is stunted during its early development will never recover from it. It will develop into a poorer cow than would have been the case if proper feeding had been followed.

4. To keep production as well as other records in their farms. The farmer should keep a production record in order to be able to select the best cows as well as their progeny and discard the poorest cows. This record will serve him for the purpose of feeding the right amount of concentrates to each cow.

A breeding record is essential too. The farmer will know when is the calf expected so that the cow be dried at the right time. He should avoid by all means the freshening of a cow while producing milk. It is necessary for him to keep the bull in a pen if he wants to accomplish this and avoid money losses.

5. To keep only good cows. The farmer should discard the poorest cows of his herd and keep only the best cows. It is a well known fact that a good cow may be more profitable than two poor cows. The cost of keeping a herd of 50 good cows producing the same total amount of milk than a herd of 100 poor cows is much less with a much higher profit in the enterprise.

6. To follow a disease control program in their farms. In general, the farmers lack the necessary knowledge about diseases and their control. In some cases they call the veterinarian when it is too late and a valuable cow may be lost. Make use of him at the right time. Separate a diseased cow from the rest of the herd, and if it may become a disease carrier by all means dispose of it—the sooner the better.

There is no doubt that if these recommendations are followed by any farmer it will result in a decrease in costs and a consequent increase in profits. If any farmer is profited by our suggestions our goal has been attained.

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