

Economic Impact of Recommended Cultural Practices on Coffee Production¹

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ABSTRACT

A comparison among 26 innovative and 135 traditional coffee growers indicated that innovators had more schooling, larger farms, bigger coffee plantings, and utilized recommendations more fully and followed them more closely than traditional farmers. Consequently, farmers using recommended high-output practices obtained an average yield of 1278 kg/ha and a net profit of \$1590.88/ha, while traditional farmers produced 275 kg/ha, with a net loss of \$738.48.

INTRODUCTION

Coffee production in Puerto Rico amounted to 9526 metric tons (t) in 1978-79.³ Gross income generated from this commodity amounted to \$37.4 million, equivalent to 21% of the farm value of all crops produced locally (\$181.4 million), and 7% of the Island's total gross agricultural income (\$546.6 million). Compared with 1977-78 this production reflects a reduction of 2,404 t. Although a small increase in price of \$2.88/t was registered at the farm level, gross income was reduced by \$9.40 million. Yields averaged 212 kg/ha of unhulled coffee, reflecting a reduction of 20% from those obtained in 1977-78 (table 1).

Per capita coffee consumption in 1977-78 averaged 5.2 kg, while total consumption amounted to 17,365 t. Since total production was not enough to match local consumption it was necessary to import 7,103 t from foreign countries (table 2). In other words, although prices have increased noticeably since 1976-77, local production is still insufficient to meet local demand.

Low yields per hectare have been the most serious problem of the coffee industry throughout the years. Average production has been around 207 kg/ha for the last 50 years. This low output is insufficient to cover costs of production. The best alternative to increase farmer's income is to improve yields by adopting the modern cultural practices recommended by the Agricultural Experiment Station. This study was conducted to determine the effect that said practices had on coffee yields and to compare the economic outcome of innovators versus traditional coffee growers.

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MATERIALS AND METHODS

Two groups of coffee growers were considered for this study. One group consisted of 26 farmers growing coffee in full sunlight, utilizing all or most of the cultural practices recommended by the Agricultural Experiment Station. Farmers were selected and interviewed in 1979 for information about their farm operation in calendar year 1978. The other group comprised 135 farmers growing coffee under shade, utilizing the traditional cultural practices generally followed in the Coffee Region of Puerto

TABLE 1.—*Coffee: Area Harvested, Production, Yields per Hectare, Farm Price and Total Value, Puerto Rico, 1940-41 to 1978-79*

Year	Area harvested	Production	Yield per hectare	Farm price	Total farm value
	<i>Thousand hectares</i>	<i>Metric tons</i>	<i>Kg/ha</i>	<i>\$/metric ton</i>	<i>\$'000</i>
1940/41	— ¹	7,363	—	321.88	2,370
1945/46	—	6,841	—	628.27	4,298
1950/51	59	7,802	124	1,076.90	8,402
1955/56	63	14,016	222	1,207.91	16,930
1960/61	63	11,794	188	1,261.32	14,876
1965/66	63	13,608	217	1,269.69	17,278
1970/71	51	15,422	302	1,478.60	22,803
1971/72	51	10,886	213	1,469.13	15,993
1972/73	51	12,247	240	1,465.42	17,947
1973/74	51	13,699	267	1,466.75	20,093
1974/75	51	10,478	205	1,464.97	15,350
1975/76	51	11,431	224	1,574.67	18,000
1976/77	51	8,709	171	2,031.12	17,689
1977/78	45	11,930	265	3,921.96	46,789
1978/79 ²	45	9,526	212	3,924.84	37,388

¹ Figures not available.

² Preliminary figures.

Source: Office of Agricultural Statistics, Commonwealth Department of Agriculture.

Rico. Farmers were interviewed in 1977 for information about their farm operation during calendar year 1976.

Multiple regression analysis was conducted to determine the variation in yield/ha that was accounted for by several independent variables; age and education of farmers, farm size, area in coffee, and the utilization of cultural practices such as fertilization, liming, pruning, chemical weeding, insect and disease control, use of recommended varieties and planting distance. In addition, cost of production analysis was done to ascertain to what extent the use of cultural practices recommended by the Agricultural Experiment Station increased the farmer's income.

RESULTS AND DISCUSSIONS

Results indicated that the independent variables included in the analysis explained 86% ($R^2 = 0.86^{**}$) of the variation in yield of coffee per hectare. Besides, it was found that all variables (except age of farmers and pruning of coffee trees) were significantly correlated to production per hectare.

There were marked differences between farmers using the recommended cultural practices (innovators) and those utilizing conventional practices (traditional farmers). Although the mean age was practically

TABLE 2.—*Coffee: Total Supply, Distribution and Probable Consumption, Puerto Rico, 1950-51 to 1977-78*

Year	Initial inventory	Total production	Imports	Total supply	Exports	Final inventory	Probable consumption	Per capita consumption
<i>Metric tons of unhulled coffee</i>								
1950/51	6,963	7,802	1,468	16,233	5	5,069	11,159	5.0
1955/56	—	14,016	2,287	16,303	5,817	—	10,486	4.7
1960/61	2,059	11,794	361	14,214	142	1,695	12,377	5.2
1965/66	955	13,608	2,625	17,188	2,843	918	13,427	5.2
1970/71	1,654	15,422	2,877	19,953	200	3,047	16,706	6.1
1971/72	3,047	10,886	5,638	19,571	175	2,180	17,216	6.1
1972/73	2,180	12,247	4,839	19,266	214	1,616	17,436	6.0
1973/74	1,616	13,699	3,936	19,251	188	1,767	17,296	5.8
1974/75	1,767	10,478	8,745	20,990	165	2,121	18,704	6.1
1975/76	2,121	11,431	7,463	21,015	269	661	20,085	6.4
1976/77	661	8,709	7,633	17,003	117	485	16,401	5.0
1977/78	485	11,930	7,103	19,518	124	2,029	17,365	5.2

Source:

1. Imports and Exports of raw and semi-roasted coffee—P.R. Consumer Service Administration.

2. Imports and Exports of other types of coffee—P.R. Planning Board.

3. Total Production and Inventories—P.R. Department of Agriculture.

the same for both groups (51.5 vs 49.9 years), innovators averaged 12.3 years of schooling, while traditional farmers averaged only 4.7 years. Farm size averaged 88.9 hectares in the first group and 7.2 in the latter while the areas devoted to coffee (area harvested) were 4.7 and 2.6 hectares, respectively. Innovators used 4.5 times more fertilizer, 27.3 times more lime and 3.8 times more Disyston than traditional farmers. Besides, while all innovators planted the coffee varieties recommended by the Agricultural Experiment Station, only 47% of the traditional farmers planted these cultivars. The following tabulation indicates the percentage of farmers in both groups utilizing the different cultural

practices:

<i>Cultural practice</i>	<i>Innovators</i>	<i>Traditional farmers</i>
	<i>Percentage of users</i>	
Use of proper planting distance	88.5	24.2
Use of lime	26.9	.7
Use of fertilizers	100.0	91.1
Use of herbicide	50.0	3.7
Insect and disease control	96.2	57.7

These figures show that although innovators are still not using 100% of the recommended practices their participation is higher than that of traditional farmers. Besides, the former follow recommendations more closely. For example, all the innovators used the amounts and analyses

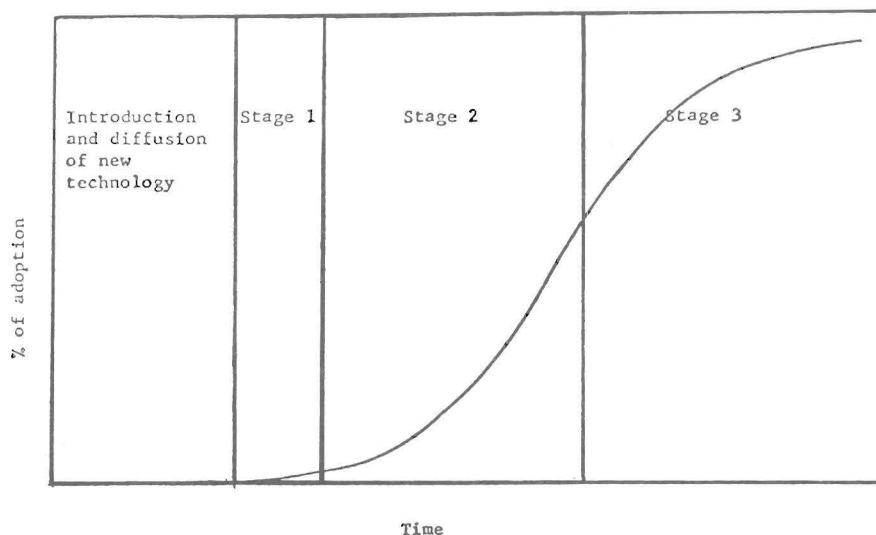


FIG. 1.—S-shaped productivity growth curve.

of fertilizers recommended, while traditional farmers used only one-fifth of the quantity recommended and the fertilizer analyses were not necessarily the proper ones. The final outcome of utilizing the recommendations of the Experiment Station was that 26 innovators produced nearly 5 times more coffee per hectare than 135 traditional farmers (1278 vs. 275 kg/ha).

Cost and return analysis showed that innovators had an average cost of production amounting to \$3,815.59/ha. Average gross income was \$5,406.47/ha; thus there was a net profit of \$1,590.88/ha⁴. On the other

⁴ González-Villafañe, E. and Espinet-Colón, G., 1980. Análisis Económico de la Producción de Café al Sol en Puerto Rico, Agri. Exp. Stn., Univ. P.R. Publ. 138.

hand, traditional farmers had an average cost per hectare of \$1,858.37, a gross income of \$1,119.89 and net loss of \$738.48⁵.

Generally, when a technological package is recommended to commercial farmers, its initial impact on total farm productivity is small because only a limited number of farmers, usually those more educated, with higher incomes and self-motivated, adopt these new practices⁶. As these early innovators benefit, others are attracted and productivity then grows at an exponential rate. Eventually, the growth rate levels off or diminishes as the potential of the new technology is fulfilled. Therefore, theoretically, productivity grows along an S-shaped curve (fig. 1).

At present, the technological package recommended by the Agricultural Experiment Station has been adopted by a limited number of coffee farmers. It is therefore logical to infer that we are in stage 1 of the S-shaped productivity curve. The results of this study have shown that those farmers who adopted the new technology have increased yields as well as net earnings but the effect on total productivity has been small. Our main effort should be toward reaching stage 2 of the curve by convincing conventional growers of the benefits of using the new practices. New incentives and programs as well as the efforts of Agricultural Extension Agents may contribute to this endeavor.

RESUMEN

Se efectuó una comparación entre 26 productores de café que habían adoptado todas o la mayor parte de las recomendaciones de la Estación Experimental Agrícola para la siembra de café al sol con 135 agricultores que seguían el sistema tradicional de siembra. Se encontraron marcadas variaciones entre uno y otro grupo. Los que seguían las recomendaciones tenían mayor instrucción escolar, fincas más grandes, siembras de café más extensas, y no solamente un porcentaje mayor usaba las prácticas de avanzada, sino que las seguían más al pie de la letra. Por lo tanto, éstos lograron una producción de 1,278 kg/ha y una ganancia neta de \$1,590.83. Los agricultores tradicionales obtuvieron un rendimiento medio de 275 kg/ha y tuvieron una pérdida de \$738.48/ha.

⁵ Zapata-Acosta, J., Muler-Manzanares, L., Carro, V., Droz-Lube, E. and Troche-Ducot, J. L., 1980. La Explotación y Administración de Fincas Pequeñas en el Area de Desarrollo Rural de Adjuntas, Agri. Exp. Stn., Univ. P.R. Publ. 134.

⁶ Lu, Y.-C. and Quance, L., 1979. Agricultural Productivity: Expanding The Limits, Agric. Info., Bul. 431, USDA, Washington, D.C.