# Effects of Yields, Shade, and Varieties on Size of Coffee Beans[1]

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## INTRODUCTION

Although coffee-bean size is not an important quality factor in the United States or local market, bean size is of major importance in Europe, where up to 20 percent of the Puerto Rican crop is sold at premium prices. As a result, Island coffee producers have recently become concerned over the apparent reduction in bean size; this has followed the introduction of new, high-yielding varieties and the use of intensive-management practices, including growing coffee in full sunlight.

This paper presents the results of studies on the effects of yields, varieties, and use of shade trees on size of coffee beans under typical conditions in the Coffee Region of Puerto Rico.

## MATERIALS AND METHODS

### EFFECT OF YIELDS

Four-year-old coffee trees of the Red Bourbon variety growing in full sunlight with intensive management at an elevation of 2,500 feet near Jayuya were used in this study. Forty trees were divided into 10 groups of 4 trees each similar in size and growth habit. To obtain a wide range of yields, one tree in each group was allowed to bear a full crop. Approximately 25, 50, and 75 percent, respectively, of the berries were removed from the other three trees soon after fruit set. Yields produced by each tree were determined, and representative samples of berries from each were carefully processed.

### EFFECT OF SHADE AND VARIETIES

Berries were obtained from seven varieties of coffee growing under intensive management in full sunlight and in about 30-percent shade provided by trees at Jayuya. The varieties were replicated four times both in full sunlight and under shade. Individual plots consisted of eight trees in a row.

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[1] This paper reports the results of field trials carried out cooperatively by the Soil and Water Conservation Research Division, Agricultural Research Service, USDA, the Agricultural Experiment Station of the University of Puerto Rico, and the Soil Conservation Service, USDA.

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A sample of berries was taken from each plot of the 6-year-old, heavily bearing trees at the height of the picking season.

The berries obtained in both studies, conducted in 1963–64, were weighed, depulped, and demucilaged. The beans were dried in the sun to a moisture content of 12 to 14 percent, and the parchment was removed. The beans were passed through sieves used to grade coffee commercially, and the proportion of beans in each size group was determined.

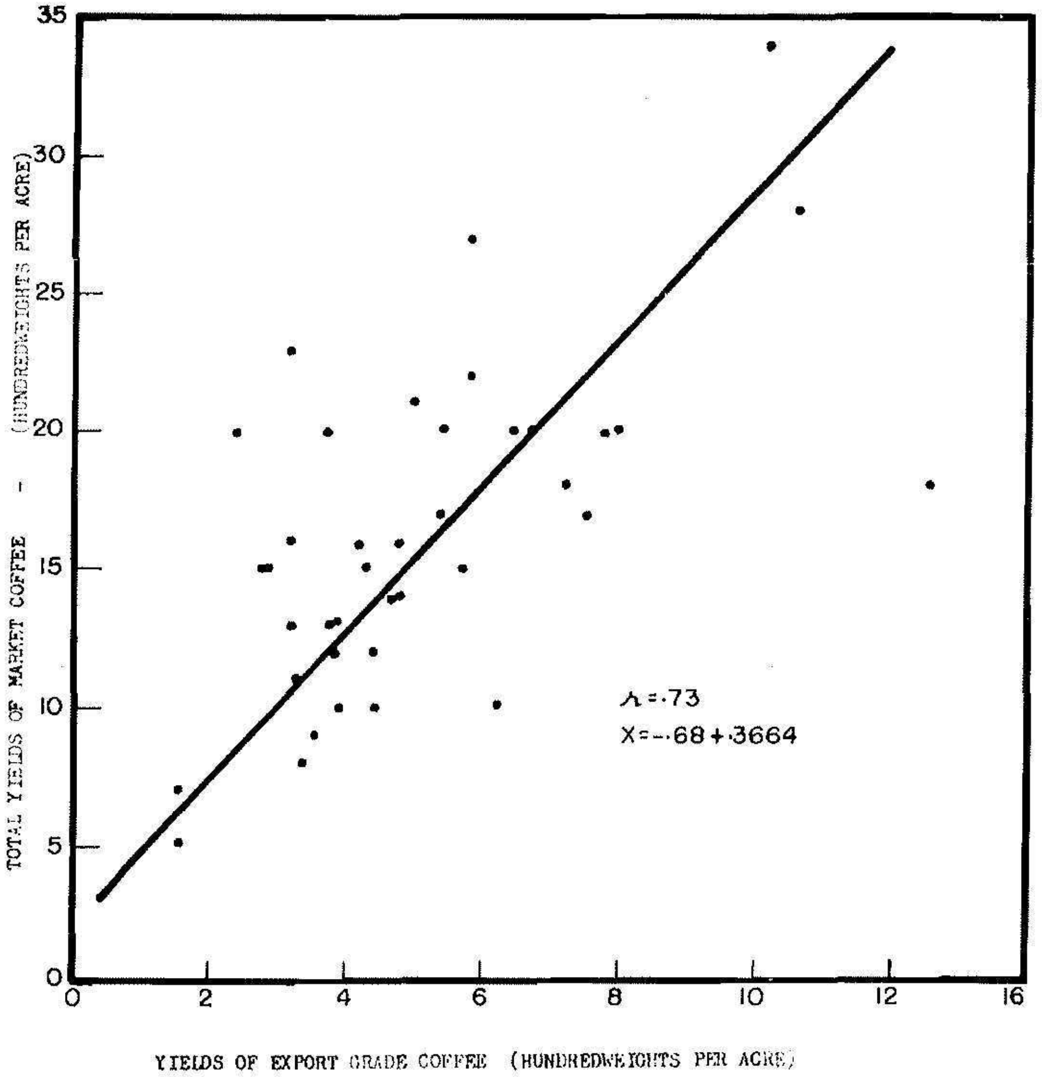

FIG. 1. The relationship between total yields produced by Bourbon variety coffee and yields of export-grade beans.

## RESULTS AND DISCUSSION

Yields of export-grade beans (>17/64 inch in thickness) increased as total yields increased (fig. 1). For example, about 300 pounds of export-grade coffee were produced at the 10-hundredweight yield level, compared with 680 pounds at the 20-hundredweight yield level. However, the proportion of export-grade beans was slightly higher at yield levels below 10 hundredweights per acre, but was not affected as yields increased beyond this level. The proportion of commercial-grade beans (>15/64 inch in thickness) was not appreciably affected by yields, averaging about 80 percent.

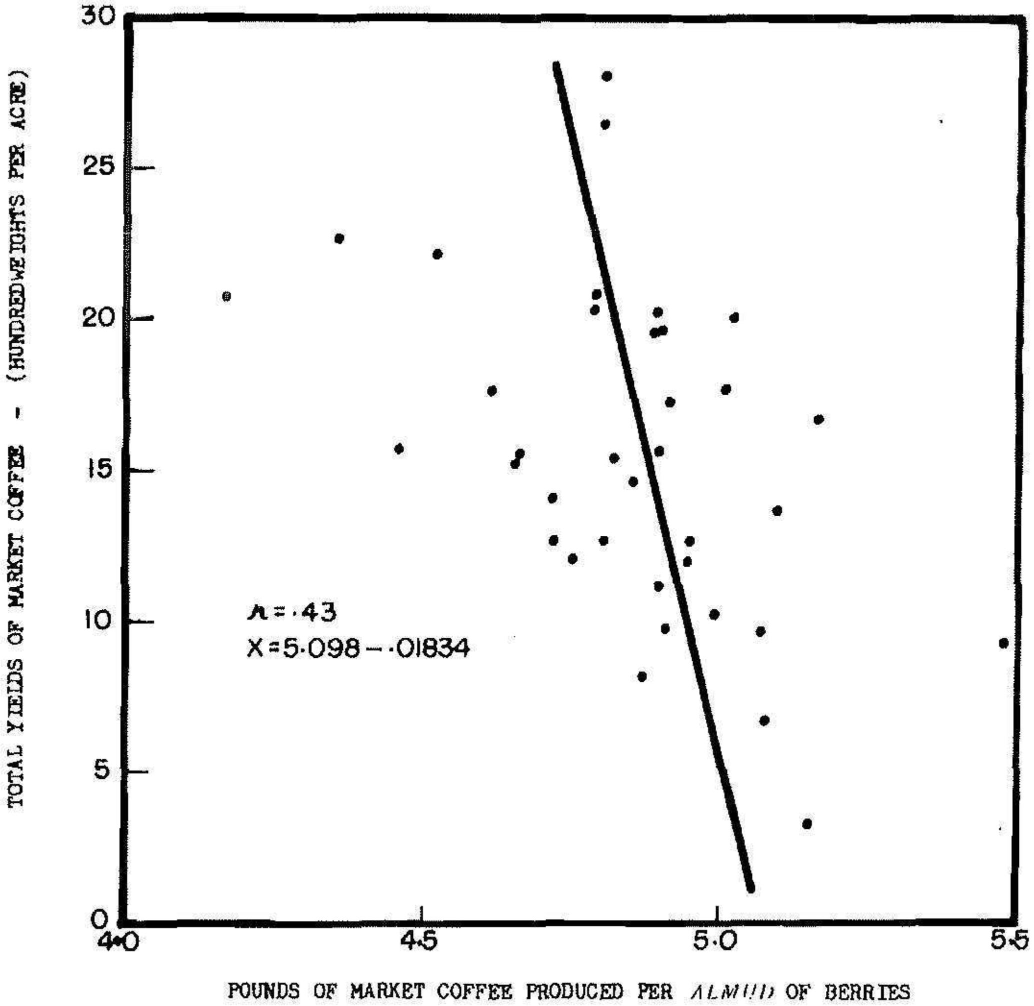

FIG. 2. The relationship between total yields and pounds of market coffee produced per *almud* of coffee berries.

Pounds of processed coffee produced per *almud*[3] of berries tended to decrease slightly with increasing yields (fig. 2). For example, at the 5-hundredweight yield level each *almud* yielded an average of about 5 pounds of coffee

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[3] Unit used for measuring coffee in Puerto Rico; it equals 20 liters, or 28 pounds, of berries.

compared to only 4.7 pounds at the 20-hundredweight yield level. Since pickers are paid and coffee berries are purchased on this basis, this trend is important to farmers and buyers of unprocessed berries.

Table 1 shows that, with the exception of the Caturra and Yellow Bourbon varieties, yields of export-grade beans were higher in full sunlight because of the higher total yields produced. Conversely, with the exception of Red Bourbon, a higher proportion of export-grade beans was produced by all varieties under shade, an average of 57.5 percent, rather than in full sunlight, 48.6 percent. Shade had no appreciable effect on the proportion of commercial-grade beans.

TABLE 1.—*The effect of shade and varieties on size of beans*[1] *produced by intensively managed coffee at Jayuya, P. R.*

| Variety | Proportion of export grade beans grown in—[2] | | Proportion of commercial-grade beans grown in—[3] | | Yields of export-grade beans grown in— | |
|---|---|---|---|---|---|---|
| | Sun | Shade | Sun | Shade | Sun | Shade |
| | *Percent* | *Percent* | *Percent* | *Percent* | *cwt./acre* | *cwt./acre* |
| Mundo Nuevo | 63.8 a[4] | 65.8 b | 89.3 | 88.2 | 19.6 a[4] | 13.7 |
| Puerto Rico 401 | 59.8 ab | 73.9 a | 90.1 | 89.8 | 16.5 a | 13.3 |
| Red Bourbon | 41.8 c | 39.9 d | 86.9 | 83.7 | 11.4 b | 10.2 |
| Yellow Bourbon | 38.7 c | 59.0 bc | 84.5 | 88.0 | 10.3 b | 13.4 |
| Kent | 55.6 b | 60.3 bc | 89.2 | 89.7 | 17.0 a | 10.0 |
| Caturra | 43.0 c | 57.9 c | 85.4 | 88.6 | 9.3 b | 12.0 |
| Pacas | 37.7 c | 45.9 d | 83.1 | 87.7 | 8.9 b | 7.1 |
| Average | 48.6 | 57.5 | 87.0 | 88.0 | 13.3 | 11.4 |
| LSD$^{05}$ | 7.6 | 7.4 | n.s. | n.s. | 4.9 | n.s. |

[1] Air-dry (12- to 14-percent moisture) market coffee (parchment removed).

[2] Retained on sieves with perforations of $^{17}/_{64}$ inch.

[3] Retained on sieves with perforations of $^{15}/_{64}$ inch.

[4] Varieties having one or more letters in common do not differ significantly.

In full sunlight the Mundo Nuevo, Kent, and Puerto Rico 401 varieties produced the highest proportion and yields of export-grade beans. Under shade, these varieties and the Yellow Bourbon produced the highest proportion of export-grade beans. There was no significant varietal difference in yields of export-grade coffee produced under shade trees. There were no significant varietal differences in the proportion of commercial-grade beans produced either in shade or in full sunlight.

Since sizes can be separated by sieving, yields of top-grade beans are more significant than their proportion in the total yield. As shown above, yields of export-grade beans increase sharply with total yields, are slightly