

# Effect of Planting Season on Yields of Eight Short-Grain Varieties of Rice Under Irrigation<sup>1, 2</sup>

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## ABSTRACT

The productivity of eight short grain varieties of rice planted every 3 months over a one-year period was determined under irrigation at Gurabo, at 80 m of elevation and mean annual temperature of 26.7° C and 1,524 mm of annual rainfall. Caloro and Colusa varieties from California had the lowest average yields for the year and were outyielded by the Spanish varieties Girona, Bahía, and Amposta, which produced 6,160 kg/ha of unhulled rice. All varieties had similar yields in September and December plantings. Amposta, Dosel, and Girona were the highest yielders in March plantings, and Amposta, Balilla, Bahía, Girona, and Nano Sollana in June planting. September plantings produced the lowest average yields (4,581 kg/ha) of unhulled rice and June planting the highest (7,045 kg/ha). Average yield for all varieties and all seasons was 5,678 kg/ha of unhulled rice. Time required to produce a crop varied from 81 days for June planting to 117 days for December planting. Results show that three high yielding plantings of these varieties can be grown yearly in similar areas in Puerto Rico when irrigation is available.

## INTRODUCTION

Puerto Rico consumes about 180,000 tons of rice yearly valued at \$70 million, but none is grown locally. About 65% of the rice consumed in Puerto Rico is of the short grain type imported from California.

Little research has been conducted in Puerto Rico on the productivity of different rice varieties as affected by season of the year and none with short grain types. Abruña and Lozano<sup>4</sup> studied the effect of season of the year on the productivity of 13 varieties of rice of medium and long grain types over a one-year period at Gurabo, with intermittent flooding. The semidwarf, late maturing, long-grain Sinaloa variety had the highest yields, averaging 5,499 kg/ha (4,910 lb/acre) of unhulled rice per planting. Yields of the 13 varieties tested were not markedly or consistently affected by season of the year. That experiment showed that two plantings with a total yearly production of about 11.2 t/ha (5 tons/acre) of

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<sup>2</sup> This paper covers work carried out cooperatively between the Agricultural Research Service, USDA, and the Agricultural Experiment Station, College of Agricultural Sciences, Mayagüez Campus, University of Puerto Rico, Río Piedras, P.R.

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<sup>4</sup> Abruña, Fernando and Lozano, José, Effects of Season of the Year on Yields of 13 Varieties of Rice Growing in the Humid Region of Puerto Rico, *J. Agr. Univ. P.R.*, 58(1): 11-17, 74.

unhulled rice can be grown with irrigation in the humid region of Puerto Rico.

This work studied the productivity of eight short-grain varieties of rice planted every 3 months over a one-year period at Gurabo under intensive management and intermittent flooding.

#### MATERIAL AND METHODS

The experiments were conducted at the Gurabo Substation, located about 80 m (250 ft) above sea level with a mean annual temperature of about 26.7° C (80° F). Annual rainfall is about 1,524 mm (60 in) with a marked dry season generally extending from November through March.

Soil is Toa silty clay, a Mollisol with 3.8% of organic matter and pH of 5.8. Total exchange capacity is 29 meq/100 g of soil with 18 meq of exchangeable bases.

Eight short grain varieties were tested: Amposta, Bahía, Balilla, Dosel, Girona, Nano Sollana, Caloro, and Colusa. Caloro, Colusa, Balilla, and Amposta are of the pearl type. Caloro and Colusa were developed in California and the others in Spain. Plantings were in September, December, March, and June 1974-75 in a randomized block design with 4 × 4 m plots and were replicated five times.

Seeds were planted in rows 20 cm (8 in) apart at the rate of 112 kg/ha (100 lb/acre) and irrigated by intermittent flooding. One hundred and twelve kg/ha (100 lb/acre) each of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O were applied to all plots, half at planting time and the remainder 30 days later.

Plots were sprayed twice with Diazinon<sup>5</sup> to control insects and protected from birds by plastic netting installed after the rice headed. Rats were controlled by using poison baits. Propanil at the rate of 16.8 l/ha (1½ gal/acre) diluted in 200 l (50 gal) of water was applied to control weeds when they developed their second pair of leaves.

When grain reached about 20% moisture content it was harvested, threshed, and dried to 12% moisture before weighing.

#### RESULTS AND DISCUSSION

Table 1 shows no significant difference in the average productivity for the year among the six Spanish varieties, although highest yields, averaging 6,160 kg/ha of unhulled rice (5,500 lb/acre) per planting were produced by Amposta, Bahía, and Girona. Caloro and Colusa had the lowest average yields, being significantly outyielded by Girona, Bahía, and Amposta.

<sup>5</sup> Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico or an endorsement over other equipment or materials not mentioned.

There was no significant difference in yields between varieties in September and December plantings. Amposta, Dosel, Colusa, and Girona had the highest yields in the March planting. Amposta, Balilla, Bahía, Girona, and Nano Sollana were highest in the June planting.

December and March plantings had similar yields, averaging 5,533 kg/ha (4,940 lb/acre) of unhulled rice. September planting, 4,581 kg/ha (4,090 lb/acre), averaged the lowest of unhulled rice. June planting,

TABLE 1.—Effect of season on yield of eight short-grain rice varieties at Gurabo

Variety	Yields of unhulled rice produced when rice was planted during month indicated—									
	September		December		March		June		Average	
	Kg/ ha	Lb/ acre	Kg/ ha	Lb/ acre	Kg/ ha	Lb/ acre	Kg/ ha	Lb/ acre	Kg/ ha	Lb/ acre
Amposta <sup>1</sup>	5,320	4,750	5,902	5,270	5,790 ab <sup>3</sup>	5,170	7,874 a	7,030	6,227 a	5,560
Bahía <sup>1</sup>	4,816	4,300	6,339	5,660	5,622 bcde	5,020	7,739 ab	6,910	6,126 ab	5,470
Balilla <sup>2</sup>	4,704	4,200	4,816	4,300	4,995 bcdef	4,460	7,392 abcd	6,600	5,477 abc	4,890
Dosel <sup>2</sup>	4,491	4,010	5,768	5,150	5,690 abcd	5,080	6,294 d	5,620	5,555 abc	4,960
Girona <sup>2</sup>	5,208	4,650	5,264	4,700	6,474 a	5,780	7,582 abc	6,770	6,137 ab	5,480
Nano-Sollana <sup>2</sup>	4,749	4,240	5,499	4,910	4,872 def	4,350	6,854 abcd	6,120	5,499 abc	4,910
Caloro <sup>1</sup>	3,517	3,140	5,848	5,221	4,570 f	4,080	6,350 cd	5,670	5,074 c	4,530
Colusa <sup>1</sup>	3,819	3,410	5,399	4,820	5,734 abc	5,120	6,294 d	5,620	5,309 c	4,740
Average	4,581	4,090	5,600	5,000	5,466	4,880	7,045	6,290	5,678	5,070
Average number of days from planting to harvest		95		117		99		81		98

<sup>1</sup> Varieties producing a "Pearl" type grain.

<sup>2</sup> Varieties producing translucent type grain.

<sup>3</sup> Values with one or more letters in common do not differ statistically ( $P = .05$ )

with 7,045 kg/ha (6,290 lb/acre) of unhulled rice, averaged the highest yields. Average yields for all varieties and seasons was 5,678 kg/ha (5,070 lb/acre) of unhulled rice per planting.

Time required to produce a crop varied from 81 days for the June planting, which had highest yields, to 117 days for December planting. Average for all seasons and varieties was 98 days. The Spanish varieties require about 170 days to mature in Spain.

A 26 ha (65 acre) commercial planting of Girona at Vega Baja produced an average of 5,712 kg/ha (5,100 lb/acre) of unhulled rice. The rice was milled, polished, and sold in Puerto Rico. Milling qualities were good, with yields of about 60% of whole grain of very good appearance and little chalkiness. This variety is resistant to lodging because in Puerto Rico it grows only to a height of about 1 m.

Table 2 shows the yields at different seasons of the ratoon<sup>6</sup> crop of varieties studied. Fair yields, averaging 2,542 kg/ha (2,270 lb/acre) of unhulled rice were obtained from the ratoon of seed crops harvested in April and August, but low yields were obtained from the ratoon crops harvested in September and January. Ratoons produced a crop in an average of only 58 days.

TABLE 2.—Effect of season on ratoon crop of eight short-grain rice varieties at Gurabo

Variety	Yields of unhulled rice from ratoon crop following seed crop harvested on date indicated—									
	April 3		August 25		Sept. 16		January 20		Average	
	Kg/ha	Lb/acre	Kg/ha	Lb/acre	Kg/ha	Lb/acre	Kg/ha	Lb/acre	Kg/ha	Lb/acre
Amposta	616 d <sup>1</sup>	550	1,602 e	1,430	1,053	940	963 e	860	1,064 f	950
Bahía	2,621 abcd	2,340	2,397 bcd	2,140	986	880	1,658 abc	1,480	1,915 bcdef	1,710
Balilla	2,610 abcd	2,330	1,826 de	1,630	806	720	1,792 ab	1,600	1,758 bcdef	1,570
Dosel	4,234 a	3,780	3,405 a	3,040	1,702	1,520	1,557 abcd	1,390	2,733 a	2,440
Girona	1,366 bc	1,220	1,389 e	1,240	907	810	1,378 bcde	1,230	1,266 ef	1,130
Nano-Sollana	3,035 abc	2,710	2,811 ab	2,510	1,198	1,070	1,355 bcde	1,210	2,106 abcd	1,880
Caloro	2,565 abcd	2,290	2,733 abc	2,440	1,456	1,300	1,344 a	1,200	2,162 abc	1,930
Colusa	3,326 ab	2,970	2,722 abc	2,430	1,523	1,360	1,926 a	1,720	2,374 ab	2,120
Average	2,542	2,270	2,362	2,110	1,210	1,080	1,568	1,400	1,994	1,780
Average number of days between harvest of seed crop and ratoon crop		52		54		54		74		

<sup>1</sup> Values with one or more letters in common do not differ statistically ( $P = .05$ )

Dosel had the highest average production and the most consistently high ratoon yields, with highest average yields in April, August, and September crops.

Results show that, in spite of a seasonal effect, short-grain rice varieties, as well as long- and medium-grain ones, can produce three high yielding crops per year. In commercial plantings at Vega Baja three good crops of Girona variety were harvested successfully on the same land in less than 12 months.

#### RESUMEN

Se investigó el efecto de la época de siembra sobre el rendimiento de ocho variedades de arroz de grano corto sembradas en regadío cada 3 meses. El estudio, realizado en Gurabo, se prolongó por un año. Las seis variedades españolas arrojaron rendimientos medios similares durante el año. Las variedades Girona, Bahía y Amposta superaron en rendimiento a Caloro y Colusa, ambas de California.

<sup>6</sup> Crop produced by new shoots that sprout after harvesting.

En las siembras de septiembre y diciembre no hubo diferencia significativa en rendimiento de las distintas variedades. En las siembras de marzo, las variedades Amposta, Dosel y Girona fueron las que produjeron más. En las de junio, Amposta, Balilla, Bahía, Girona y Nano Sollana fueron las que más produjeron.

Las siembras de diciembre y marzo produjeron casi igual: 5,533 kg./ha. (4,940 libras por cuerda) de arroz en cáscara, en promedio. Los rendimientos más bajos se obtuvieron en la siembra de septiembre con un promedio de 4,581 kg./ha. (4,090 libras por cuerda) de arroz en cáscara y los más altos en la siembra de junio con un promedio de 7,045 kg./ha. (6,290 libras por cuerda). El rendimiento medio por cosecha para todas las variedades y épocas del año fue de 5,678 kg./ha. (5,070 libras por cuerda).

Una siembra comercial de 26 ha. (65 cuerdas) de la variedad Girona en Vega Baja produjo 5,712 kg./ha. (5,100 libras por cuerda) de arroz en cáscara. Este demostró tener muy buenas propiedades molineras y apariencia atractiva.

La siembra de junio produjo una cosecha sólo 81 días después de sembrada, mientras que la de diciembre tardó 117 días. El promedio para todas las variedades y épocas del año fue 98 días. Las variedades españolas tardan entre 5 y 6 meses en producir una cosecha en España.

Estos datos señalan que es factible lograr tres cosechas de arroz al año en Puerto Rico donde haya riego disponible. En siembras comerciales en Vega Baja se cosecharon tres siembras de la variedad Girona en menos de 12 meses.