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Effect of Time of Planting and Age at Harvest on Marketable Yield and Quality of Four Tanier Cultivars¹

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ABSTRACT

An experiment was initiated in April 1972 at the Isabela Substation to evaluate the effect of season of planting and age at harvest on yield and tuber quality of four tanier cultivars.

Bimonthly plantings were made from April 1972 to February 1973. Cultivar Kelly was harvested at 8 and 10 months of age, whereas Blanca del País, Morada, and Rascana were harvested at 10 and 12 months.

The best planting dates appeared to be from April through August. A sharp reduction in marketable yield was evident for all cultivars planted after this period. For all planting dates the best yields were obtained when both Rascana and Morada were harvested at 12 months of age. Yields of Blanca del País, the standard tanier for the Isabela area, were inferior to those of the other cultivars with the exception of Kelly.

In general all cultivars were favored by the 2-month delay in harvest. However, Rascana was most favored by this delay, which significantly increased the number of marketable tubers.

Planting dates and age at harvest had no effect on tuber internal quality. Although the delay in harvest somewhat softened the texture, cooked tubers were rated "acceptable" by a tasting panel.

INTRODUCTION

Taniers, *Xanthosoma* spp., are currently the second most important starchy root crop grown in Puerto Rico. During 1973-74, production was estimated at 12,020 metric tons with a farm value of \$4.3 million. Although this represents an increase of 6% over the previous year, some

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3,796 metric tons were imported to meet local demand. Imports were made throughout the whole year but declined during the December through March period.

According to Barrett (1) and to Winters and Miskimen (4), local tanier farming can be a year-round operation. They suggest January through April as the best planting season. However, taniers are usually planted from the beginning of spring until almost the end of summer. The crop is usually harvested anytime after 8 months from planting, depending on such factors as cultivar, prevailing weather conditions, and market price.

Considering the limited information available on tanier response to time of planting and the scarcity of produce during the off-season, an experiment was designed to evaluate the effect of planting dates and age at harvest on yield and tuber quality of four commercially grown cultivars of very good quality and excellent consumer acceptance.

MATERIALS AND METHODS

The experiment was initiated in April 1972 at the Isabela Substation in a Coto clay (Oxisol) with a pH of 6.0. The treatments included were: six bimonthly plantings, four tanier cultivars, and two harvesting intervals arranged in a split-plot design with nine replications.

The main plots were 10.97 m by 7.30 m. The planting distance was 91.5 cm and 45.8 cm between rows and plants, respectively. There were 48 plants/cultivar/subplot surrounded by border rows.

The experimental field was plowed to a depth of about 19 cm and then harrowed twice. Subsequently, before each planting these operations were repeated in all the unplanted plots.

Taniers were planted during the first week of April, June, August, October, and December 1972 and February 1973. The varieties studied were Kelly, Blanca del País, Morada, and Rascana. Kelly, a well-known early-maturing commercial tanier was harvested at 8 and 10 months of age, whereas, the others were harvested at 10 and 12 months. Pieces of rhizomes, with at least two germinal buds, weighing 57 to 113 g each, were used as planting material. Before planting, the seed pieces were dipped into a fungicide solution of 5 g each of Dexon and Benlate (Benomyl)³ per 3.79 l of water. Thereafter, the seed was hand planted in the bottom of the furrow.

Weeds were controlled with preemergence applications of Ametryne at the rate of 4.48 kg/ha in 189.5 l of water, immediately after each planting. Afterwards, weeds were removed by hand as necessary.

³Trade 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.

Two months after each planting, a 10-10-10 fertilizer was applied at the rate of 56.7 g/plant.

Data on rainfall distribution and average maximum and minimum air temperatures prevailing at the Isabela Substation throughout the experimental period were recorded. To compensate for insufficient rainfall during dry periods, overhead irrigation was applied once a week.

At each harvest, data on marketable yields, number of marketable tubers, and mean tuber weight were recorded. Subsequently, samples were subjected to texture and sensory evaluations at the Food Technology Laboratory. Tubers were peeled and cut into slices about 1.2 cm thick. Texture, in random slices, was measured by using a Food Technology Corporation electrical recording and indicating press with a 5,000-lb proving ring and the range set at 1,500 lb. The plunger was adjusted to 1-min stroke; a time \times force curve was recorded; the maximum force applied was read directly from the chart; and the area under the curve was determined using a planimeter. A standard shear cell packed with 50 g of sample was used for each determination. The sample was placed in the cell with the fiber perpendicular to the path of the knives.

For the sensory appraisal, samples were cooked and evaluated by a taste panel. The product was rated according to a 5-point hedonic scale (2), where + 2 stands for "very acceptable" and -2 for "not acceptable".

RESULTS AND DISCUSSION

It was evident from the yield attributes that tanier responded to variations in time of planting. The best planting dates for all cultivars were April, June, and August. After August a sharp yield reduction was registered (fig. 1).

This could probably be attributed to variations in weather patterns, mainly daylength and temperature. Figure 2 shows the changes in maximum and minimum air temperatures, daylength, and rainfall throughout a crop planting-to-harvest cycle. Long daylength and high temperature prevailed during the initial stage of growth in April, June and August plantings. Subsequently, these plantings were favored by short daylength and low nocturnal temperature. On the contrary, an inverse relationship between climatic conditions and initial plant growth and further development is evident for October, December and February plantings. Mean daylength and nocturnal temperature for the planting period of April to August 1972 were 12.9 hr of daylight and 20.7° C, whereas for the October to February 1973 plantings they were 11.4 hr and 19.4° C.

In potatoes (3), growth and development of the plant is divided into three stages, i.e., emergence and leaf and stem growth, tuber initiation,

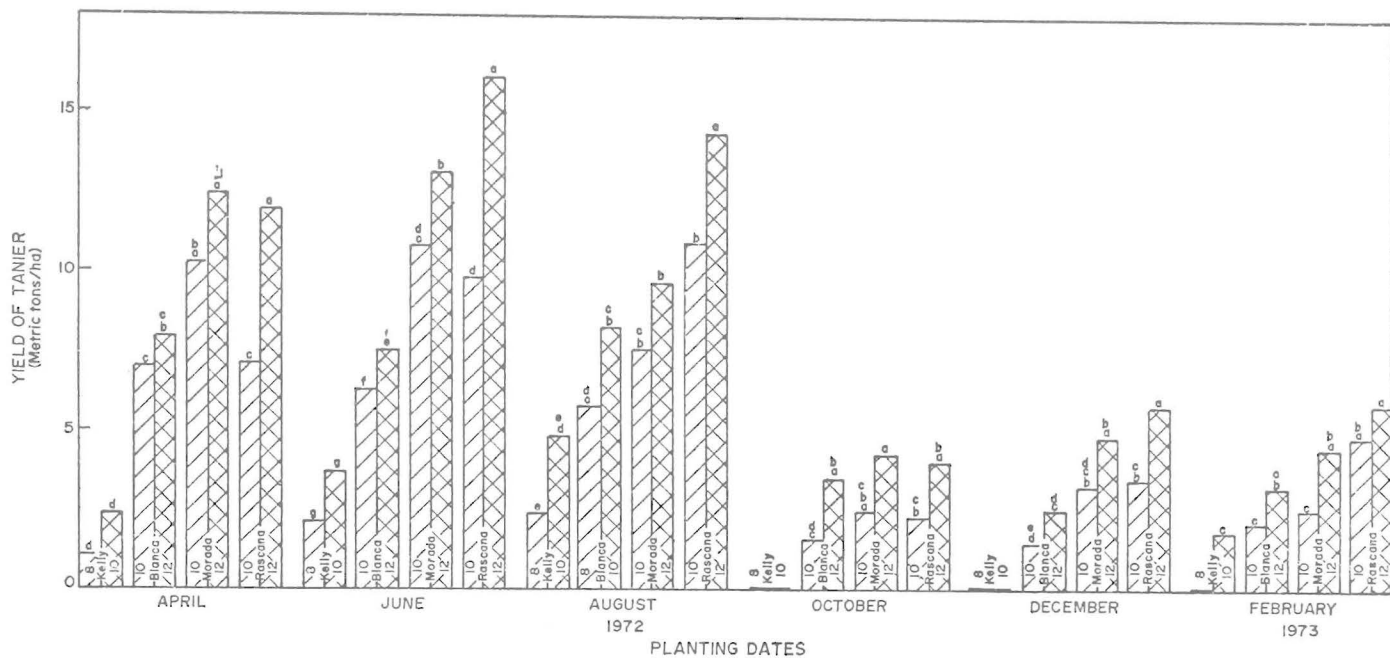


FIG. 1.—Estimated marketable yield of four tanager cultivars planted every 2 months and harvested at 8, 10, or 12 months of age. Values followed by the same letter are not significantly different at the 5% level of probability.

and tuber enlargement. The first stage is favored by long daylength and high temperatures. On the other hand, tuberization is linked very strongly to both short daylength and low night temperatures. If similar responses occur in tanier, then this might explain the effect of seasonal planting observed in this crop.

Within each planting date there were significant differences among the combined treatment of cultivar and age at harvest for marketable yields, number of marketable tubers, and mean tuber weight.

For all planting dates the highest marketable yields were obtained when the Rascana and Morada cultivars were harvested at 12 months of

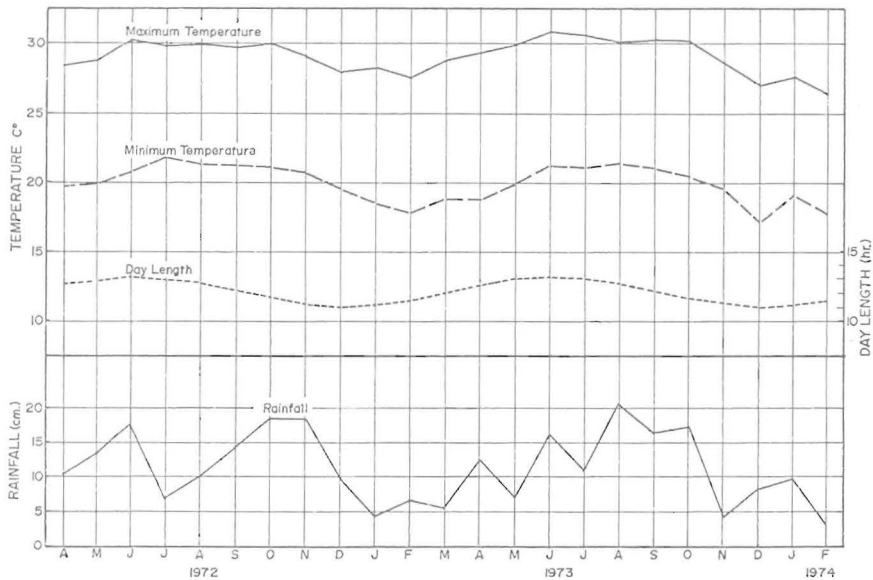


FIG. 2.—Monthly rainfall distribution and average maximum and minimum air temperatures recorded from April 1, 1972, to February 11, 1974, at the Isabela Substation. Monthly daylength for Puerto Rico was calculated from Publ. Climatol., Drexel Inst. Technol., Centerton, N.J. 10(3): 232, 1957.

age (fig. 1). Estimates for Rascana throughout six successive bimonthly plantings (April 1972 to February 1973) were as follows: 12.0, 16.1, 14.3, 4.0, 5.7, and 5.8 metric tons/ha, respectively (fig. 3-D). Weight differences in Rascana, harvested at 10 months of age, were 5.0, 6.2, 3.5, 1.7, 2.2, and 1.1 metric tons/ha less for each corresponding planting date. On the other hand, yields of Morada, for the same planting dates, were as follows: 12.4, 13.2, 9.6, 4.2, 4.7, and 4.5 metric tons/ha (fig. 3-C). Yield differences in the same cultivar, harvested at 10 months of age for the respective planting dates, were 2.2, 2.5, 1.7, 1.8, 1.4, and 1.7 metric tons/ha less.

Blanca del País is considered to be the standard cultivated tanager in the Isabela area. Although it produced acceptable yields during the April, June, and August plantings, in general these yields were lower than those obtained with Rascana and Morada harvested at the same age (fig. 3-B). Kelly was not well adapted to the conditions prevailing at Isabela. In all plantings, plant growth was normal but failed to produce marketable yields during October, December, and February plantings when harvested at 8 months of age. A similar situation developed when October and December plantings were harvested at 10 months of age (fig. 3-A).

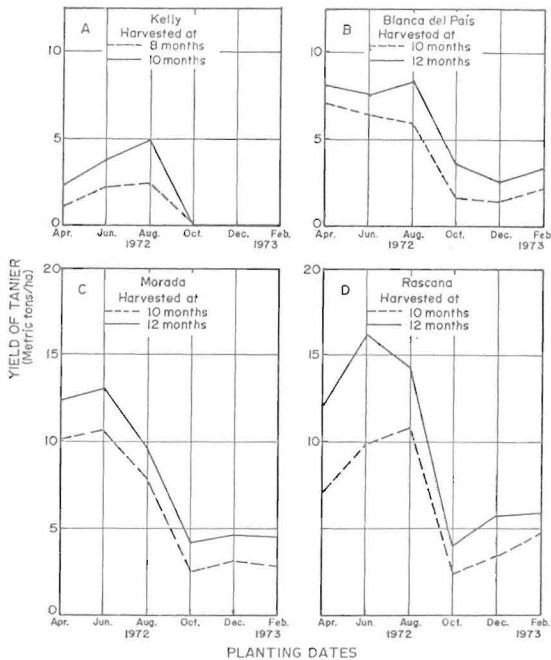


FIG. 3.—Effect of planting dates and age at harvest on marketable yield of four tanager cultivars.

Undoubtedly, Rascana was most favored by the 2-month delay in harvest. Except for the February planting, differences between the two harvesting intervals were significant at the 5% level of probability (fig. 1). In general, prolonging the age at harvest from 8 to 10 months for Kelly and from 10 to 12 months for Blanca del País, Morada, and Rascana increased marketable yields. However, differences were conditioned by both planting date and cultivar.

As expected from the marketable yield data, the largest number of

marketable tubers in all cultivars were produced from the April, June, and August plantings. Then, a sharp drop in tuber production occurred in subsequent plantings (table 1). When all plantings are considered, Rascana was the more prolific cultivar when harvested at 12 months of age. In all plantings, except those in February, this cultivar-harvest treatment significantly outyielded the other treatments at the 5% level of probability. In the February planting, the Rascana 12-month-harvest treatment did not produce significantly more tubers than its counterpart harvested at 10 months of age. Although the other cultivars were also favored by the 2-month delay in harvest at all planting dates, the October planting was the only planting where tuberization in Morada and Blanca del País was significantly affected by prolonging harvesting age.

With respect to marketable tuber size as expressed by mean tuber weight, the heavier tubers were produced when either Morada or Blanca del País were harvested at 10 or 12 months of age. In all plantings Morada tubers were significantly larger than Rascana tubers harvested at the same age (table 1). Except for the June planting, 12-month-harvest, and the October and December plantings, 10-month-harvest treatments, tubers of Blanca del País were significantly heavier than those of Rascana harvested at the same age. The differences were significant at the 5% level of probability. On the other hand, the comparison between harvesting intervals within each cultivar demonstrated that in most cases the delay in harvest did not significantly favor tuber size.

Planting dates apparently did not have any significant effect upon tuber internal quality as based on texture and sensory evaluation. However, the 2-month delay in harvest softened the texture somewhat. Mean texture values of the tubers harvested at either 8 to 10 months or 10 to 12 months of age were as follows: Kelly, 683 and 615; Blanca del País, 530 and 510; Morada, 573 and 522; Rascana, 600 and 561 lb/in² of pressure, respectively. It is evident that both Blanca del País and Morada have a softer texture than Kelly and Rascana. On the other hand, the mean rating value obtained in the sensory evaluation tests of the combined cultivar and age-at-harvest treatments was + 1. This index is equivalent to an "acceptable" product in the hedonic rating scale.

RESUMEN

Se establecieron siembras bimestrales durante abril, junio, agosto, octubre y diciembre de 1972 y febrero de 1973 con el propósito de evaluar el efecto de la época de siembra y de la edad a la cosecha sobre la producción comercial y la calidad de los tubérculos de cuatro variedades

TABLE 1.—Mean number and weight of marketable tubers per plot of four tanager cultivars planted every 2 months and harvested at 8, 10, or 12 months of age

Cultivar	Age at harvest	Planting dates											
		April 1972		June 1972		August 1972		October 1972		December 1972		February 1973	
	Months	No.	G	No.	G	No.	G	No.	G	No.	G	No.	G
Kelly	8	—	—	29.4 d	73.0 f	31.3 e	73.0 c	00.0	00.0	00.0	00.0	00.0	00.0
Kelly	10	33.1 f ¹	75.7 b	41.4 d	89.8 de	41.3 de	105.7 b	00.0	00.0	00.0	00.0	22.4 b	81.2 de
Blanca del País	10	49.8 ef	143.3 a	68.3 c	91.6 cd	46.6 de	142.4 a	14.7 d	93.0 abc	19.4 e	69.4 b	21.1 b	96.6 cd
Blanca del País	12	58.1 de	138.8 a	73.7 c	100.7 cd	49.4 de	156.5 a	27.1 bc	111.6 a	24.2 de	106.6 a	28.3 b	120.7 b
Morada	10	68.1 cde	148.8 a	80.1 c	133.8 b	56.1 de	138.8 a	23.6 cd	101.6 ab	34.7 de	94.8 a	25.4 b	109.3 bc
Morada	12	84.1 bc	151.5 a	83.8 c	156.9 a	66.6 cd	141.1 a	36.6 b	102.1 a	42.1 cd	108.0 a	30.7 b	144.7 a
Rascana	10	93.7 b	73.5 b	126.9 b	78.5 ef	134.4 b	78.5 c	34.2 bc	67.1 c	63.1 b	54.9 b	62.1 a	71.7 e
Rascana	12	149.4 a	80.7 b	170.9 a	95.7 cd	177.9 a	78.9 c	50.0 a	71.7 bc	86.2 a	64.0 b	66.9 a	76.7 de

¹ Values followed by the same letter are not significantly different at the 5% level of probability.

de yautía. Las variedades y las edades al momento de la cosecha estudiadas fueron las siguientes: Kelly, cosechada a los 8 y 10 meses; Blanca del País, Morada y Rascana cosechadas a los 10 y 12 meses.

Los resultados indican que la mejor época para la siembra de yautías es la comprendida en el período entre la primera semana de abril y la primera de agosto. Después de estos meses baja drásticamente el rendimiento. Las variedades que produjeron los rendimientos mayores fueron la Morada y la Rascana cosechadas a los 12 meses.

En general, todas las variedades se beneficiaron de la extensión del período de crecimiento. Sin embargo, la Rascana fue la más favorecida al aumentar significativamente el número de tubérculos comerciales. Aunque el retrasar la cosecha hace que la textura de los tubérculos sea algo más blanda, los factores de época de siembra y edad a la cosecha no afectaron significativamente los atributos de textura, apariencia, color y sabor de los tubérculos.

LITERATURE CITED

1. Barrett, O. W., Las yautías de Puerto Rico, P.R. Agr. Exp. Sta. Bull. 6, 15 pp., 1905.
2. Peryam, D. R., and Pilgrim, F. J., Hedonic scale method of measuring food preferences, Food Technol. 11 (9): 9-14, 1957.
3. Smith, O., Potatoes: production, storing, processing. The Avi Publishing Co., Inc., Westport, Conn., 642 pp., 1968.
4. Winters, H. F., and Miskimen, G. W., Vegetable gardening in the Caribbean Area, USDA, ARS, Agr. Handbook No. 323, pp. 77-9, 1967.