Planting dates and yields of four sweet potato clones in Puerto Rico[1]

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ABSTRACT

Four clones of sweet potato were planted in Isabela, Puerto Rico, each month in 1984, and after 4 months 6 measurements of yield were taken (number, weight/root, total weight of commercial sized roots, and total roots). Clones differed significantly with respect to all measurements, and significant differences were also found among months for all measurements. There were significant interactions between month and clone with respect to 4 of the 6 measurements. The 6 measurements were distributed over months bimodally for 2, and irregularly for 4 measurements. The measurements were not related to months by regression analysis. Differences among the 4 clones may be due to different responses to daylength, rainfall, temperature, and light intensity. It was concluded that sweet potato clones differ with respect to response to planting dates, and each clone merits separate evaluation.

INTRODUCTION

Although sweet potatoes can be produced throughout the year in the tropics, yields vary, apparently with season. Sweet potatoes are photoperiod sensitive and the majority will flower during short days (6). According to Badillo, (1) most cultivars produced best when planted from September to November in Puerto Rico, and thus matured in February–March. Apparently, short days stimulate storage root growth. Long days increased branch length, reduced branch number, promoted leaf expansion, and delayed senescence in one study (6). However, some cultivars appeared to be day neutral.

Gollifer (2), in Papua New Guinea, found vine and root yields to be negatively correlated for 5 successive years. Smallest yields occurred after periods of heavy rains when vines were growing vigorously. He also found a positive correlation of vine weight with rainfall, and of solar radiation with storage root production. There was a negative correlation of root weight with rainfall. Mannan and Rashid in Pakistan, (4), found sweet potatoes to yield best in October to March, when temperatures were moderate, skies were clear, and rainfall was low to moderate. Poor production was obtained from April to September when temperatures were high, the sky cloudy, and rainfall very frequent.

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Haynes et al. (3) suggested that the best environment for sweet potatoes in the tropics is one with very frequent rains at planting and during establishment, and abundant sunshine during the period of growth of the storage root. Both excess water and lack of oxygen in the soil are believed to be associated with poor storage root production. Thus, well-drained soil is preferred.

Martin (in press) found that month of planting affected 11 characteristics of growth and morphology. Several characteristics regressed on months by lineal, quadratic, or cubic regression, showing that they varied with season. Four external factors—short days, heavy rainfall, high temperature and cloudiness—were believed responsible for most variations.

In this study the same plantings reported by Martin (in press) are analyzed for effects of months of planting on yield measurements.

MATERIALS AND METHODS

Plantings were made at Isabela, Puerto Rico, in a Coto clay (Oxisol). Four sweet potato clones were used: "Miguela," a local, white-fleshed, medium sweet cultivar recommended in Puerto Rico; "Gem," a dessert type that was developed in the United States but is very well adapted to Puerto Rico; SPT-8 and SPV-46, lines selected at the Tropical Agriculture Research Station, Mayagüez, P. R. Sweet potatoes were planted monthly for 12 months, each variety in plots of 3 lines of 25 plants in replicated complete blocks with 4 replications. Cuttings were spaced 30 cm in rows 100 cm apart. The fields were fertilized at the rate of 950 kg/ha with 6-6-12 mineral fertilizer placed in holes in the soil between plants 2 weeks after planting. Weeds were suppressed initially by 19 L/ha of chlorambem (3-amino-2,5-dichlorobenzoic acid) applied after planting and followed by light irrigation. Later, weeds were controlled by light hoeing as necessary.

Days were shortest December 21 (about 11 hours) and longest June 21 (about 13 hours). The rainy season corresponded to approximately June to December. Driest months were January to March. Plantings were irrigated as needed during dry weather. The hottest season was from July to October, and the coolest from December to March.

Four months after planting, the roots were harvested and yield measured (table 1). The roots were divided into two groups depending on size. Commercial roots were considered to be 3.8 cm in diameter or more. Commercial and non-commercial roots were counted and weighed. The results were subjected to analyses of variance and regression analysis.

RESULTS

Table 2 shows the results of the analysis of variance for 6 yield mea-

TABLE 1.—*Yield measurements of four sweet potato clones observed in harvests of monthly plantings*

No.	Yield measurement	Scale	Explanation
1	Number of storage roots of commercial size	No.	Counted
2	Number of storage roots smaller than commercial size	No.	Counted
3	Total number of storage roots	No.	Counted
4	Weight of commercial sized roots	Kg	Weighed
5	Weight of non-commercial sized roots	Kg	Weighed
6	Total weight of roots	Kg	Weighed

TABLE 2.—*Summary of differences in months and clones found by analysis of variance for 6 measurements of yield, 4 clones, and 12 months of plantings*

		F value[1]				
No.	Measurement	Month	Clone	Inter-action	Block	Distribution of month
1	No. commercial roots	6.3<	95.6<	1.5 NS	0.8 NS	Irregular
2	No. non-commercial roots	8.6<	19.4<	1.8*	0.7 NS	Irregular
3	No. total roots	6.4<	34.1<	1.6 NS	1.7 NS	Irregular
4	Wt. commercial roots	6.8<	24.2<	1.9*	0.6 NS	Bimodal
5	Wt. non-commercial roots	38.5<	73.6<	3.2<	3.4 NS	Irregular
6	Wt. total roots	9.8<	6.5**	2.7**	0.9 NS	Bimodal

[1]Significant differences are indicated as follows: * means significant at ($P<0.05$); ** means highly significant at ($P<0.01$); < means very highly significant at ($P<0.001$); NS = nonsignificant.

surements. Very highly significant differences were found associated with clones and months of planting. The interaction of clone and month was significant in the case of 4 of the 6 measurements. There were no significant differences in blocks (replications). More variation was caused by clones than by months.

The number of roots produced varied according to clone and month of planting. The total number of roots, the number of commercial roots, and the number of non-commercial roots did not appear to be related in any easily observed way to season (fig. 1a, b, c). When clones are compared (fig. 2), it can be seen that some characteristically produced more tuberous roots than others. Clone SPV-46 produces large numbers of small roots. Furthermore, more roots were produced in some months than in others. Abrupt shifts in numbers of storage roots sometimes occurred, affecting all varieties, as in the case of August (high), Sep-

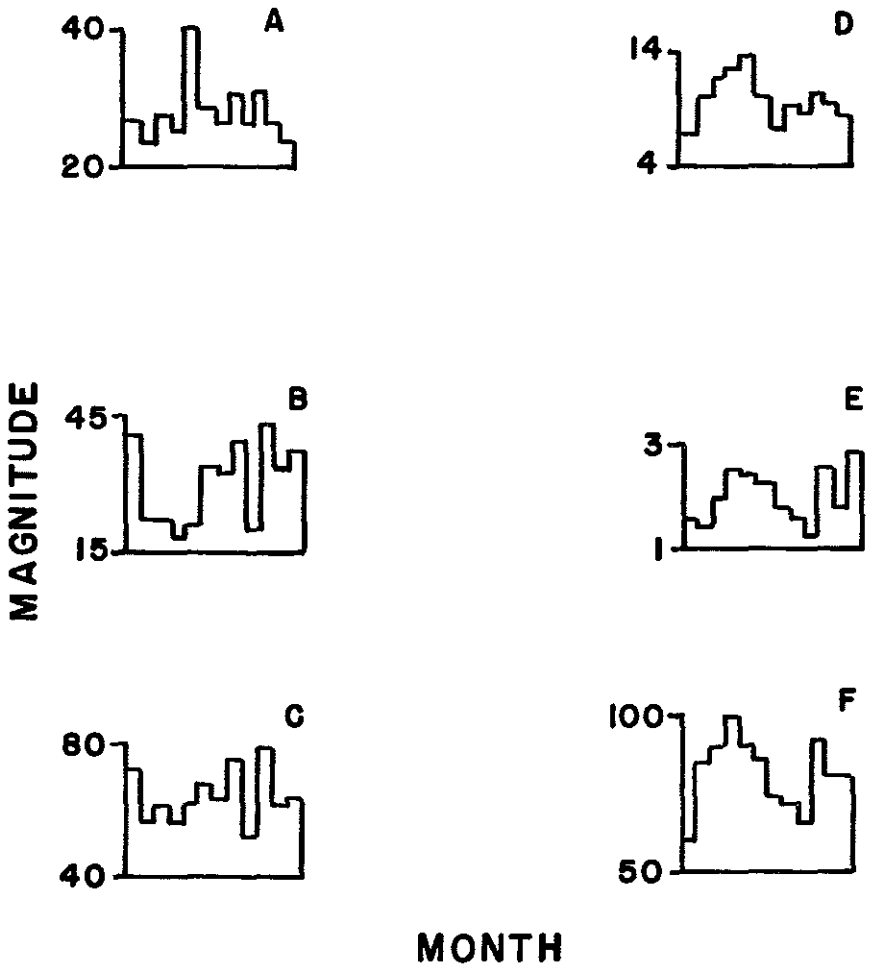

FIG. 1.—Monthly distribution of 6 measurements of yield of sweet potato (means of 4 clones). A—Number of commercial roots; B—Number of non-commercial roots; C—Number of total roots; D—Weight of commercial roots; E—Weight of non-commercial roots; F—Weight of total roots.

tember (medium), October (high), etc., (fig. 2, upper third). These differences did not seem to be related to season of the year, and thus day length, but could have been related to weather (short term fluctuations in temperature, cloudiness, and rainfall).

The total weight of roots, as well as the weight of commercial roots, appeared to be bimodal (fig. 1 d, f). The modes (peaks of high production) corresponded to plantings made from February to July, and from October to December. However, when the distribution for the individual months

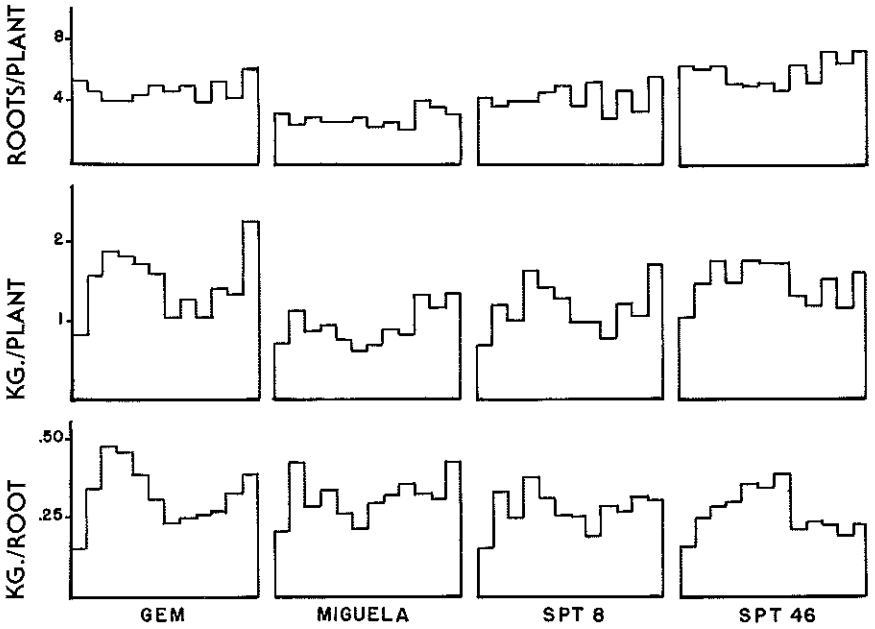

FIG. 2.—Monthly distribution of total number of storage roots (upper third); total weight of storage roots (middle third); and weight per storage root (lower third).

is taken into account (fig. 2, middle third), for three of the clones there was a slump in total weight of roots of plantings from July to September. The distributions show, however, monthly idiosyncracies (highs or lows) that apparently are not related to season. Clones were not all affected in the same manner by month of planting.

Mean storage root weights, calculated from root number and total weight, were distributed more or less bimodally for the 4 clones (fig. 2, lower third). This finding suggests definite seasonal effects. Mean root weights tended to decline in midsummer and in midwinter plantings. However, effects of individual months were also seen. During months when the number of storage roots was reduced (fig. 2, upper third) the mean weight per root appeared to be higher (fig. 2, lower third), perhaps as a partial compensation.

Number of storage roots and weight of roots were not related by regression to months, and the logical inference is that they are not related to a single seasonal effect.

DISCUSSION

Yield of sweet potato is a complex characteristic influenced by many factors. Among the factors of most importance are the phenotype of the clone, and climatic variations and weather. The understanding of these

influences should be useful to the plant breeder as well as the farmer. In the case of 4 clones used in this study, monthly plantings have not been useful in establishing clear trends related to seasonal fluctuations (climate). However, short term fluctuations, especially in terms of rainfall, temperature, and light intensity (weather conditions) may have accounted for some of the fluctuations. The 4 clones studied were different, especially with respect to number of storage roots produced. Mean root weight appeared to increase as storage root number decreased. It appears that each clone must be interpreted separately with respect to influence of season and weather, and experiments to reveal these differences must avoid possible differences due to handling procedures. It should then be possible to discuss effects of season and weather with respect to an individual clone.

RESUMEN

Época de siembra y el rendimiento de cuatro clones de batata[3] en Puerto Rico

Cuatro clones de batata se sembraron mensualmente en Isabela, Puerto Rico, en 1984. Después de cuatro meses se tomaron seis medidas de rendimiento. Los clones mostraron diferencias significativas con respecto a todas las medidas; también se encontraron diferencias significativas entre meses para todas las medidas. Dos de las medidas se distribuyeron sobre meses en forma bimodal y cuatro se distribuyeron irregularmente. Las medidas no estaban relacionadas por regresión con el mes de siembra. Se discuten las diferencias entre clones en términos del largo del día, lluvia, temperatura e intensidad de luz. Se concluyó que cada clon tiene que estudiarse independientemente en experimentos cuidadosamente diseñados para determinar los verdaderos efectos de la época de siembra.

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[3]*Ipomoea batatas* (L.) Lam.