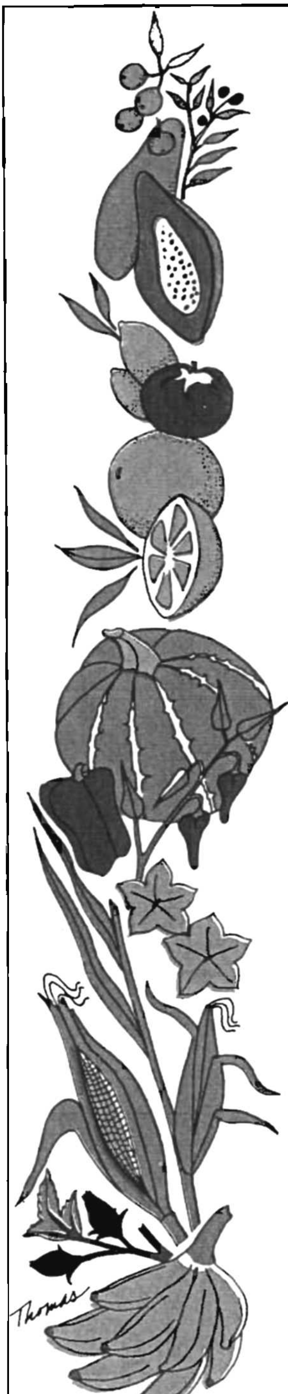

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SCREENING SWEET POTATO GERMPLASM FOR HIGH DRY MATTER

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ABSTRACT

Sweet potato is an extremely valuable crop for people in tropical regions. It is a high energy food source and unlike many other root crops, is an excellent source of vitamins and minerals. Sweet potato is one of eight crops identified by National Aeronautics and Space Administration (NASA) for bioregenerative studies. One of the objectives of the sweet potato breeding program at Tuskegee University is the selection of high yielding cultivars with high dry matter content. Such cultivars can be made available to the Caribbean region as an alternate high energy crop requiring minimal inputs. To identify such cultivars, field screening of over 300 breeding lines were evaluated over a two year period. Selections made from these trials were further evaluated for their adaptability in the Tuskegee University-NFT system. A dry matter content of 25% or more was the major criterion used for selection. Initial planting sources were seeds derived from ten accessions. After the initial screening ten lines were evaluated in replicated trials in the first year. These lines were placed in advanced replicated trials in the second year for further evaluations. Results of the first year data showed dry matter content ranged from 28.8 - 40.9%, with yields ranging from 8.4-37.2 Mt/ha. In the second year, yields were higher ranging from 13.87-58.06 Mt/ha. From these evaluations all lines except K-123.20, which showed very poor yields, were recommended for testing in the TU-NFT system.

INTRODUCTION

The sweet potato is ranked fifth among all major food crops in total production and economic value (Gregory et al., 1988). In most of tropical regions it represents a significant source of energy (Bouwkamp, 1985; Wolfe, 1992). This high energy source is mainly attributed to its ability to accumulate large amounts of dry matter (Takagi and Opena, 1988).

Generally, there exists no correlation between yield and dry matter content (Kuo and Chen, 1992). However, with the sweet potato recently selected by NASA as one of several crops identified as a potential food source for long-term space missions, the dry matter content of the sweet potato is of concern in bioregenerative studies. Such concerns have resulted in the need to screen sweet potato germplasm for their dry matter content and to further evaluate these selected lines in the TU-NFT system. Germplasm identified from this study will have application not only for bioregenerative systems but will also be beneficial to the Caribbean community as an alternate high energy crop that will require minimal inputs to maintain high yields. This study was initiated to evaluate sweet potato germplasm in the field for high dry matter content and yield.

MATERIALS AND METHODS

Field evaluations were conducted over a two year period at the Tuskegee University Agricultural Experiment Station in Tuskegee, Alabama. Seeds of ten accessions resulting in 300 breeding lines were initially evaluated in the field. Eight of these lines were selected based on the dry matter content and yield were evaluated in replicated field trials. Dry matter selection criterion was based on a dry matter of 25% or higher. A complete randomized design was used with four replications.

Sweet potato vine cuttings were planted 18 cm apart on 75 m rows, 1m apart. All plots received a preplant application of 56 Kg N, 60 Kg P, and 112 Kg K/ha. Four weeks after planting ammonium nitrate was applied at 38 Kg N/ha. Six weeks later muriate of potash was applied at the rate of 112 Kg K/ha. In both years plants were grown under rainfed conditions. Plants were harvested 120 days after planting. At harvest, roots were graded and weighed according to present USDA standards. For dry matter determination, 50g samples were taken from five randomly selected roots from US #1 grades and dried at 70C for 48 hours. Analysis of variance was conducted at the five percent probability level and, where F test warranted it, LSD was calculated.

RESULTS AND DISCUSSION

Table 1 shows the results of sweet potato yields in the first year. Total yield for all genotypes evaluated ranged from 6.4-37.2 Mt/ha with AC 87.8.16 producing the highest yield. The highest yield of jumbos were produced by AC 85.42.10, an indication that this might be an early maturing cultivar. Greatest amounts of US#1 roots were produced by AC 87.8.16 and this was significantly greater than those produced by all other genotypes except J8 17.

Dry matter content of the breeding lines showed a range of 28.8-40.9%. Highest dry matter content was obtained from J8.17. Biomass PX.2, AC 87.8.16 and AC 87.7.7 all of which were significantly higher than that of J6.5, K-123 and J6.23. K-123 contained the lowest dry matter content.

From results of the first year evaluation, all genotypes except K-123 were recommended to be tested in the TU-NFT system. Although the dry matter content for this genotype was above the 25% selection criterion, this we believe did not compensate for its low yields.

In the second year, breeding lines evaluated in advanced replicated trials showed genotypic differences in total production of storage roots (Table 2). The overall total storage root production was higher than the previous year for all lines evaluated. J6.23, an orange flesh genotype yielded the lowest amounts of storage roots with canners contributing the greatest proportion to total production. In contrast J6.5 which is also an orange-flesh genotype, produced the highest yield of storage roots with canners and US#1 grades contributing equally to total production. The remaining genotypes (white flesh roots) showed no differences in total storage root production. Generally, more jumbo roots were produced by white-flesh genotypes compared to orange flesh with the latter producing more medium size sweet potato grades. All genotypes except J6.23 produced similar amounts of US#1 roots. While genotypic differences were shown for canner roots, the opposite was shown for unmarketable roots where all genotypes produced almost equal amounts of unmarketable roots. Dry matter accumulation ranged from 18.22-35.9% and was generally lower compared to the previous year. Although J6.5 produced the greatest amounts of storage roots, its dry matter content was significantly lower than white-flesh genotypes. Overall, white-flesh roots showed higher dry matter content than orange flesh roots.

In experiment II, genotypes also showed differences in total production of storage roots (Table 2). AC 83.3.13 was the highest producer followed by J6.102. However, AC 83.3.13 produced more jumbos and unmarketable roots than J6.102. Biomass PX.30 was the lowest producer in storage roots but accumulated the largest amounts in dry matter. The two highest producing genotypes showed the least accumulated dry matter. Genotypes evaluated in the second year were also recommended for testing for adaptability in the TU-NFT system.

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Table 1. Yield of eight sweetpotato breeding lines in replicated trials.

Breeding line	Total Yield	Jumbo	US #1	Canners	Culls	% Dry Matter
			----Mt/ha--			
J6.5	18.4bc	2.1b	9.3b	4.3ab	2.7a	30.5d
J8.17	20.50abc	0b	13.5ab	4.7ab	2.3a	40.9a
J6.23	14.0bc	0.4b	8.4b	3.6b	1.6a	35.5c
AC 87.7.16	16.5bc	2.0b	8.8b	3.5b	2.2a	39.0abc
AC 85.42.10	28.9ab	13.5a	10.9b	2.2b	2.3	36.6bc
AC 87.7.7	19.9bc	1.6b	12.4b	3.8ab	2.1a	39.2ab
AC 87.8.15	13.8bc	0.5b	7.0b	3.7b	2.6a	36.5bc
AC 87.8.16	37.2a	4.9b	25.2a	4.3ab	2.7a	39.8ab
Biomass PX.2	18.3bc	0.6b	9.6b	6.5a	1.6a	39.8ab
K 123.20	6.4c	0b	1.9b	0.9b	3.6a	28.8d

Table 2. Yield of eight sweetpotato breeding lines in advanced replicated trials.

Breeding line	Total Yield	Jumbo	US #1	Canners	Culls	% Dry Matter
			Mt/ha			
J6.5	58.06c	0a	28.41b	22.32b	7.33a	21.31a
J8.17	37.96abc	1.01ab	22.00b	8.29a	5.66a	35.99b
J6.23	13.87a	0a	0a	11.83ab	2.03a	18.22a
AC 87.7.16	36.90abc	6.51b	16.23b	11.92ab	2.24a	35.98b
AC 85.42.10	32.04ab	3.72ab	20.04b	4.23a	4.06a	33.64b
AC 87.7.7	39.00bc	0a	26.29b	12.09ab	1.61a	35.98b
AC 87.8.15	46.59bc	2.62ab	25.19b	11.41ab	7.36a	34.70b
AC 87.8.16	41.00bc	0a	21.31b	14.96ab	4.73a	34.16b

Table 3. Yield of ten sweetpotato breeding lines in replicated trials.

Breeding line	Total Yield	Jumbo	US #1	Canners	Culls	% Dry Matter
			Mt/ha			
AC 83.3.8	30.10ab	0a	21.19abc	6.99a	1.92a	29.79bcd
AC 83.3.13	86.36d	12.00b	36.86abc	15.34abc	22.15b	29.24abc
Biomass PX.10	58.73abcd	0a	12.40a	44.64d	1.69a	33.59cde
Biomass PX.25	55.69abcd	0a	16.12abc	33.26cd	6.31a	31.47cd
Biomass PX.27	50.28abcd	0a	24.24abc	19.50abc	6.54a	34.91de
Biomass PX.30	27.51a	0a	14.93ab	10.89ab	2.48a	36.69c
Biomass PX.33	69.58bcd	2.54a	37.72abc	26.46abcd	7.86a	29.6bc
Biomass PX.36	41.65abc	0a	32.72abc	26.46abc	7.86a	29.6e
J6.102	75.30cd	0a	64.03c	29.76bcd	6.09a	24.24a
J8.1	55.24abcd	1.8a	28.63abc	28.63abc	8.57a	24.94ab