Sweet Potato Clones Adapted for Libyan Agriculture

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Five experiments were conducted from 1971 to 1973, on the adaptability of some introduced clones of sweet potato. An average yield of marketable enlarged roots of 7.4–21.2 t/ha was produced by clone American from USA, 24.3–26.6 t/ha by clone Kahera Hybrid, and 14.5–29.6 t/ha by clone Mabrooka. The last two clones were introduced from Egypt.

The most variable clone in weight of vine, number of roots, or yield was Mabrooka, and the least variable was Kahera Hybrid. Within a given clone, the yield showed the highest degree of variability. A nonsignificant correlation existed between vine weight and number of roots. A positive correlation was found between vine weight and yield in two clones, and between number of roots and yield in all clones.

The sweet potato has always been an important food crop. However, the sweet potato crop is not popular among Libyan farmers. The enlarged roots offered for sale are of inferior quality. They are elongated and not uniform in shape. The skin surface is ridged and tan coloured. The flesh is whitish, almost tasteless when boiled, and has a high fibre content. The vegetable breeding program at the University of Tripoli has included the improvement of this crop since 1969. A few enlarged roots of some clones bred in Egypt, Japan, and the United States were introduced and asexually propagated for the first 2 years. Some of these clones were discarded early because of poor growth of vines, low yield of enlarged roots, or the production of only thick and non-marketable roots. Perennial plots were established for promising clones to obtain stem cuttings for use as planting material in clonal evaluation tests.

Little work has been done on sweet potatoes in Libya, although recommended cultivars were reported by Mazzocchi and Thrower (1962). The aim of this study was to screen introduced clones, and possibly recommend one or more clones for food and industry.

Materials and Methods

A total of five experiments were conducted from 1971 to 1973 at the University of Tripoli. The soil was a sandy loam (pH 7.5–8.5). Stem cuttings, 20–25 cm long, were planted 30 cm apart in rows 60 cm wide. The experimental plot unit varied from 2 to 8 m^2 (excluding guard rows). The crop was grown as a summer crop under irrigation. Mean air temperature

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had a minimum range of 13–22 °C and a maximum range of 23–32 °C. The fertilizer (NPK, 60, 120, 120 kg/ha) was applied 2–3 weeks after planting, and 1 month later as a side dressing.

Clonal Productivity

Four clones, namely, Yabany from Japan, America from the U.S., and Kahera Hybrid and Mabrooka from Egypt were tested in a randomized block design. The test in 1971 was conducted at Green Hill Project (recently reclaimed land) using six replications. Planting was on 7 June 1971 and harvesting (43 284 plants/ha) occurred 37 weeks later. In 1972, planting was done on 16 May 1972 and after 31 weeks 47 667 plants/ha were harvested. In 1973, the planting was conducted on 21 May 1973, harvesting 31 weeks later yielded 50 500 plants/ha. Four replications were used in both 1972 and 1973. The vines at harvest were cut close to the soil surface. Enlarged roots of marketable size, with a minimum diameter of 3 cm, were weighed. Analysis of variance was applied to the data, and coefficients of variation were computed for each characteristic.

Effect of Planting Date and Harvesting Period

This test was conducted in 1972. It included two clones (Mabrooka and Yabany), three planting dates 18 May, 1 June, and 15 June), and two harvesting periods (after 26 and 30 weeks). A split plot design was followed using three replications. The number and weight of enlarged roots were recorded.

Determination of Dry Matter

Samples of enlarged roots produced in the 1973 test were used to determine the dry matter content of three clones (American, Kahera Hybrid, and Mabrooka). A sample was drawn from each root by a piercing tool that punctured the root transversely in the middle and near both ends. Four replicated samples, each having a fresh weight of 30–35 g, represented a given clone. They were dried to constant weight at 90 °C in an oven for several days. The dry matter content was the dry weight calculated as a percentage of the original weight of the portion used. The test was repeated 20 days later. Cooked and baked roots of the tested clones were described for flesh colour, texture, and general acceptability.

Correlation Between Characters

American, Kahera Hybrid, and Mabrooka clones tested in 1973 were harvested after 27 weeks. A 30-plant sample for each clone was used. Three characteristics: fresh weight of the vine, and number and weight of enlarged roots, were correlated on a per-plant intraclonal basis. Simple and partial correlation coefficients were determined. The coefficient of determination (r^2) was computed for each significant partial correlation coefficient (r). The yield of a sweet potato plant, expressed as weight of enlarged roots, is generally considered to have two component traits. These are the number of enlarged roots and the mean weight per root. A simple correlation between the two components was determined on a single plant basis within each of the three tested clones.

Results and Discussion

Clonal Productivity

The Kahera Hybrid clone produced the highest yield (26.6 t/ha in 1971). All clones tested in 1972 and 1973 gave yields which were not significantly different. Variation in yield was from 26 to 67%. The lowest coefficient of variation was encountered in 1973 where the mean yield was 18.5, 18.5, and 25.1 t/ha for clones American, Mabrooka, and Kahera Hybrid, respectively. Yabany clone was discarded after 1972 on account of its comparatively poor vegetative growth.

The fluctuation of yield from season to season was evident in clones American and Mabrooka. A similar clonal trend has been found in reports from Malaysia, the Seychelles, and Trinidad. A better judgement of clones, however, can be achieved through a combined analysis of yields over several, perhaps 5 or more, years.

Neither the number of enlarged roots nor their weight was significantly affected by the interaction between clones, planting dates, and harvest periods. The two tested clones, namely Mabrooka and Yabany, differed with respect to both number and weight of enlarged roots. A greater number and a higher weight of roots were produced by Mabrooka. The average yield was 30.8 and 2.8 t/ha in Mabrooka and Yabany clones, respectively. The weight of roots was more variable than their number. It was generally observed that the vegetative

Table 1. Mean dry matter content, colour of skin, and flesh colour and texture of enlarged roots of different clones (University of Tripoli 1973).

Clones	Dry matter[a] (%)	Colour		Flesh texture[b]
		Skin	Flesh	
American	23.4	light tan	dark orange	soft
Kahera Hybrid	22.7	copper red	light orange	soft
Mabrooka	22.3	copper red	creamy white	firm

[a]Coefficient of variation 3.2%.
[b]Texture of the cooked flesh.

growth of sweet potato plants continues for about 10 months. The vines are usually killed by frost in late December or January. Thus, planting dates in August and September could be tested in addition to the current April–June planting.

The dry matter content varied from 22.1 to 23.4% on the average (Table 1). Clone American possessed a higher dry matter than either Kahera Hybrid or Mabrooka. A report from Nigeria (Anonymous 1973) indicated the existence of sweet potato clones having up to 45% dry matter. Results of the palatability test for all clones, their flesh characteristics, and yielding ability would favour their recommendation to Libyan farmers. Many citizens and students on the campus of the University of Tripoli showed great interest in using these sweet potatoes as food. The yield per hectare, obtained in the present tests, would encourage the production of sweet potato and the expansion of its area. FAO (1975) presented data on the world production of sweet potato. A yield as high as 23.3 t/ha was reported in Cook Islands in 1973; Egypt produced a yield of 17.9 t/ha. The yield of 12 or more tons per hectare was recorded in 18 countries.

Correlation between Characters

On an individual plant basis, the mean weight of the vines was 754, 734, and 1085 g in American, Kahera Hybrid, and Mabrooka, respectively. The mean number of roots was 3.5, 2.3, and 2.5 for the same clones. The average yield was 380 g in American, 510 g in Kahera Hybrid, and 404 g in Mabrooka. The most variable clone was Mabrooka, whereas Kahera Hybrid was the least variable. This was true for variation in each of the three characters studied. Values of the coefficient of variation ranged from 47.1 to 65.1% for vine weight, from 62.0 to 69.3% for number of enlarged roots, and from 62.0 to 96.0% for yield, i.e. weight of enlarged roots. Within a given clone, e.g. American or Mabrooka, the weight of roots showed the highest degree of variability, the weight of vine showed the lowest variation.

The recorded interclonal variation with regard to a specific trait and intercharacteristic variation within a clone, could be attributed to the genetic control of the various characters in different clones. The contribution of yield components to yield variability was not included in the present study. Lowe and Wilson (1975a, b) found that this contribution depended on the relation between yield and either tubers number, mean tuber weight, or both components. Their data showed a greater variation for the yield of marketable tubers, i.e. enlarged roots. The same conclusion was reached in the present investigation.

Values of the simple correlation coefficient between number of enlarged roots and mean weight per root were −0.184, −0.174, and −0.549 in clones American, Kahera Hybrid, and Mabrooka, respectively. The last value was highly significant, but other values were not significant. The negative correlation found in Mabrooka clone was also reported in different sweet potato material studied by Li (1965), and Lowe and Wilson (1975a, b). The degree of association between root number and mean root weight, however, was not clear. The yield would be affected by any significant association found between these two characteristics, which are generally considered the main components of yield. The mean weight per root was not involved in subsequent types of correlations.

Simple and partial correlation coefficients for vine weight, number of enlarged roots, and yield, i.e. weight of enlarged roots, were calculated. Values of the partial correlation coefficient indicated a nonsignificant correlation of vine weight with number of roots. A similar conclusion was reached by Li (1965). Vine weight

and yield were not correlated in the Kahera Hybrid clone, but they were positively correlated in other clones. Values of r were 0.462 and 0.827 in American and Mabrooka clones, respectively. The corresponding r^2 values were 0.213 and 0.684, indicating that 21.3 and 68.4% of the variation in yield of these clones can be ascribed to the effect of vine weight, keeping the number of roots constant.

Yield and number of roots showed highly significant, positive correlation in all clones. This finding is in accordance with that of Li (1965), and Lowe and Wilson (1975). The range of r values was from 0.650 to 0.705. Values of r^2 were 0.497, 0.423, and 0.438 in American, Kahera Hybrid, and Mabrooka clones, respectively. This indicates that from 42.3 to 49.7% of the variation in yield of the tested clones can be attributed to the effect of number of roots, keeping vine weight constant.

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