

Performance of Selected Sweet Potato Germplasms under Egyptian Conditions.

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Abstract: Sweet potato (*Ipomoea batatas*) is a promising crop in Egypt for both local consumption and export market. The aim of this work was to introduce, evaluate and select a number of promising sweet potato cultivars under Egyptian conditions. Nine sweet potato germplasm materials, namely CIP- 440189, CIP- 199026.1, CIP-400011, CIP- 400004, CIP- 420009, CIP-199015.14, - CIP-199004.2, CIP-440093 and CIP-1999062.1 were tested under Egyptian conditions. The evaluation was based on high yield, flesh colour and nutritional value (Beta- carotene, starch, mono sugar and total soluble sugar). Results showed that the four sweet potato germplasm, namely, CIP-199004.2, CIP-440189, CIP- 440093 and CIP- 199026.1 are promising cultivars and gave the highest yield, beta carotene, starch, mono sugar and total soluble sugar in comparison with others sweet potato germplasm.

Key words: *Ipomoea batatas*, evaluation, yield, chemical composition, Egypt.

INTRODUCTION

Sweet potatoes are grown on about 8.2 million hectares world wide, yielding about 102 million tons; with an average yield of about 12.1 ton/ha (FAOSTAT, 2010). They are mainly grown in developing countries, which account for over 95% of world production. Sweet potato is low input requirements, ease of production and ability to produce under adverse weather and soil conditions. The cultivated area of sweet potato in Egypt was about 10 thousand ha in 2009, yielding about 265 thousand ton. Egyptian consumers mostly prefer sweet types (FAOSTAT, 2009).

Sweet potatoes generally have cream to orange flesh color, dry weight ranges from 17.7% to 26.3%, and starch ranges from about 13.0% to 22.0% (Picha, 1987).

Sweet potato (*Ipomoea batatas* L.) ranked seventh in world crop statistics, just after cassava. Its roots are rich in carbohydrates and vitamin A and its leaves are rich in proteins. It can produce more edible energy per hectare and per day than wheat, rice or cassava. Sweet potato root qualified as an excellent source of vitamin A (in the form of beta-carotene) especially in the orange flesh color varieties, a very good source of vitamin C, and a good source of copper, dietary fiber, manganese, vitamin B6, potassium and iron (Baybutt and Molteni, 2000).

The root of sweet potato is a major staple food widely consumed in developing countries and ranks as the third most important starchy food, after cassava and potato in the world (FAO, 2006).

Several researchers demonstrated the effect of sweet potato germplasm and genotype on root yield and plant chemical constituents of many species. The CIP germplasm collection contains not less than 5500 accessions of *I. batatas* originating from 57 different countries (Zhang et al., 2000). CIP is distributing internationally elite cultivars in vitro or as seeds and an important number of cultivars are now available for testing. Additional priorities for sub-Saharan Africa include improved control of the sweet potato weevil and cultivars with high β -carotene content, other priority needs are the conservation and characterization of genetic resources, pre-breeding and cultivars with high starch yield (Fuglie, 2007).

Selecting new cultivars in an environment with adverse conditions seems to be an efficient and practical way of identifying cultivars with good environmental adaptability (Janssens, 1984, 1988). In Ethiopia, a study was conducted to determine root yield stability and the nature and magnitude of G x E interaction and has also shown significant variation among genotypes (Tekalign, 2007). Stability of the genotype over environments was

estimated by using different stability parameters. Total storage root yield varied depending on genotype and environment/.

A great interest has recently been focused on sweet potatoes especially, the yellow and orange flesh sweet potatoes, which are characterized with their high contents of Beta carotene .Beta carotene is one of the most widely investigated constituent of fruits and vegetables (Tavani and Vechia,1995).

The objective of this study was to introduce new sweet potato germplasm materials, evaluate them and select the promising genotypes under Egyptian conditions.

MATERIALS AND METHODS

The experiment was carried out in the two successive seasons 2009 and 2010, Nine newly germplasm sweet potato were namely 440093, 400011, 199015.14, 199004.2, 199062.1, 99026.1, 440189, 400004, and 420009, were selected from fourteen cultivars delivered from the International Potato Centre (CIP),Lima and Peru, to the Agricultural Genetic Engineering Research Institute (AGERI).

Table 1: The colours of skin and flesh of roots of the tested genotypes are presentend in Table (1).

CIP.NO.	Skin color	Flesh color
Abees (local variety)	Red	Orange
440093	Red	Cream
400011	Red	Cream
199015.14	Cream	Orange
199004.2	Red	White
199062.1	Dark Orange	Orange
199026.1	Cream	Orange
440189	Dark cream	Dark Orange
400004	Cream	White
420009	Red	White

The planting materials were tested in comparison with one local cultivar (Abees) under Egyptian conditions in sandy soil at Agro food farm in the newly reclaimed areas at Nubaria region, Egypt. Sweet potato transplants were set up into the field on 15th of May 2009 and 2010 seasons under drip irrigation system with all agricultural managements required for crop production as usually recommended.

Standard agricultural practices for sweet potato production were carried out according to the recommendations of the Egyptian Ministry of Agriculture. Roots were harvested at 120 days after transplanting and the highest productive genotypes were selected for yield and quality.

The experimental design was a randomized complete block design (RCBD) with three replications. The experimental plot consisted of 5 rows each of 75 cm width and 8 m length. The plot area was 30 m².The distance between plants was 25 cm

Data recorded:

Yield:

Root diameter, root number/plant and root yield/plant were determined. Total yield was calculated as ton fed⁻¹ (Fed.= 4200 m²) at 120 days after planting.

Chemical composition:

Percentage of each of cartenoids, dry matter, starch and total soluble sugar were determined according to standard methods described by FAO (1980).

Statistical analysis:

Data of experimental was statically evaluated using the analysis of variance as outlined by Gomez and Gomez (1984) based on MSTATC program. The differences between means were compared using Duncan's multiple rang test (Duncan1995).

RESULTS AND DISCUSSION

Date reported in Table (2) show that there were significant differences among the tested sweet potato germplasm in all characters under this study, i.e., root number/plant, root length and yield .The highest root number/plant was produced in both seasons was obtained by CIP-199004.2 and CIP-440189without significant differences between them. The root length was significantly affected by the newly introduced germplasm in

both seasons; the highest root length was produced by CIP-440189. The differences among sweet potato germplasms contribute to many factors. The highest yield was obtained from CIP 199004.2 in both seasons. These results are in agreement with Lebot (1986) and Lewthwaite and Triggs (2000) who reported that sweet potato cultivars varied significantly in total yields. They contribute the increasing in total yield due to the increase in root weight and depends on leaf photosynthesis. Also, Sasaki *et al.* (2005) suggested that the canopy type might affect the NAR (Net Assimilation Rate) of each cultivar. The transport of assimilates from the leaves to the root stalk is a process influenced by storage root growth, as storage root cells must be formed and expand before they can store assimilates. As well as, the final yield depends on the rate of increase and the duration of growth. All these characteristics vary significantly among the tested cultivars (Table 3).

The mean value of dry matter percentage of sweet potato germplasm varied significantly. The CIP- 440093 and CIP- 400011 germplasms were characterized with the highest mean value for the dry matter in both seasons.

It could be concluded that the most productive germplasm was CIP-199004.2 followed, in decreasing order by CIP- 440189, CIP- 440093 and CIP- 199026.1 .

Table 2: Effect of CIP sweet potato germplasm materials on yield and quality (combined data of two seasons).

Treatments	Roots No. /plant	Root length(cm)	Root yield (ton/fed.)	Dry matter (%)
CIP.NO.				
Abees(local Variety)	4.0 g	14.13 f	13.50 i	16.97 g
440093	5.0 f	15.90 bc	17.53 c	29.77 a
400011	7.0 e	14.80 de	15.53 g	28.67 b
199015.14	7.0 e	15.61 c	15.65 f	26.48 c
199004.2	11.0 a	16.10 b	19.86 a	24.93 de
199062.1	8.0 d	14.65 e	14.53 h	25.93 cd
99026.1	10.0 b	15.96 bc	16.70 d	26.38 c
440189	11.0 a	16.87 a	18.20 b	22.37 f
400004	9.0 c	15.00 de	12.86 j	24.57 e
420009	8.0 d	15.11 d	16.20 e	22.57 f

The values in the column having the same letter(s) are not significantly different at P= 0, 05 using LSD test.

Concerning chemical composition of roots (Table 3), the studied components, i.e. carotenoids, starch, mono and total soluble sugars were significantly influenced by the evaluated sweet potato germplasms. As for carotenoid percentage the highest values were found in roots of CIP-440189 followed by CIP-99026.1, CIP-199004.2 and CIP-440093 germplasms. Whereas, CIP- 199015.14 and 440093 germplasm gave the highest value of starch percent in both seasons. Mono sugar and total soluble sugar were significantly affected by sweet potato germplasm in both seasons and their in both seasons were obtained by CIP-440189, whereas, CIP-440093 gave the lowest in values. The differences among the tested sweet potato germplasm materials contribute to the sweet potato genotype. Dark orange flesh roots are rich sources of β -carotene, the most active pro vitamin A carotenoid, while yellow/orange roots supply moderate amounts of β - carotene (Woolfe, 1992). K'osambo *et al.* (1998) and Teow *et al.* (2007) reported significant variations in respect to β -carotene content among sweet potato genotypes, and orange flesh had higher β -carotene content than white flesh.

Table 3: Effect of germplasm on root chemical composition of sweet potato (combined data of two seasons).

Treatments	Carotenoides %	Starch %	Mono sugar%	Total soluble sugar %
CIP.NO.				
Abees(local Variety)	1.577 b	65.62 d	3.803 a	6.203 b
440093	1.587 b	70.19 a	2.853 f	5.293 g
400011	1.397 cd	68.72 b	3.203 d	5.493 f
199015.14	1.437 c	70.02 a	3.003 e	5.487 f
199004.2	1.597 b	69.10 b	3.603 b	5.943 c
199062.1	1.417 cd	68.09 c	2.963 e	5.453 f
99026.1	1.717 a	69.34 b	3.413 c	5.843 d
440189	1.767 a	67.64 c	3.843 a	6.673 a
400004	1.407 cd	66.02 d	2.913 ef	5.243 g
420009	1.377 d	66.22 d	2.903 ef	5.703 e

The values in the column having the same letter(s) are not significantly different at P= 0, 05 using LSD test.

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