

Original Research Article

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Evaluation of Physiochemical Characters in Sweet Potato

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ABSTRACT

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Present investigation entitled ‘Evaluation of Physiochemical Characters in Sweet Potato’ was carried out in Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur to evaluate the physiochemical variation in sweet potato germplasm”. In this research, sixteen diversified sweet potato germplasm were evaluated under randomized block design with three replications. The result revealed significant differences among germplasm for TSS, acidity, total carotenoids and total antioxidants.

Introduction

Sweet potato (*Ipomoea batatas* L.), an auto hexaploid species ($2n=6x=90$) belonging to the Convolvulaceae family, is native of tropical America and normally propagated by asexual means (Veasey *et al.*, 2007). The exact location of its botanical origin is unknown but Central America is considered the primary diversity center, while South America (Peru, Ecuador) is considered the secondary center of diversity (Zhang *et al.*, 2000), as also is the Brazilian territory (Austin, 1988). Sweet potato is an important food crop cultivated throughout the tropics and warm temperate regions of the world for

its edible storage roots. The flesh colour of the roots varies from different shades of white, cream, yellow to dark-orange depending upon the pigment present. In the orange-fleshed sweet potato (OFSP) the major carotenoid present is β -carotene, which is a precursor of vitamin A (Vimla *et al.*, 2011).

Therefore, sweet potato has a significant role to play in the fight against vitamin A deficiency (VAD). VAD is of public health significance in developing countries, causing temporary and permanent eye impairments and increased mortality, especially among children, pregnant and lactating women (Bovell-Benjamin, 2007).

Sweet potato keeps an important place among other root and tuber crops not only for its considerable amount of nutrient, but also for phytochemicals in its root and leaves (Ji *et al.*, 2015). Also, it has advantage of high yielding, drought tolerance and wide adaptability to various climate and farming systems over the world. A lot of variability exists among sweet potato germplasm for phytochemical character and nutritive composition which can be utilized for attaining tuber with high nutritive value. Keeping all these facts in view, the present investigation was conducted to evaluate selected improved genotypes for total soluble solids, acidity, total carotenoids and antioxidants.

Materials and Methods

The experiment was carried out at the AICRP Tuber Crops field, Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur during 2011-2012. The experimental material comprises with sixteen diversified sweet potato germplasm and evaluated under randomized block design with three replications. Total soluble solids, acidity, total carotenoids and total antioxidants were determined after crop was harvested.

Crop was raised as per standard practices according to the package of practices for the region. The primary nursery was raised at the field of AICRP on Tuber Crops in the month of July-August. Cuttings taken from primary nursery and secondary nursery were also raised. Cuttings were taken from secondary nursery for experiment purpose. Five hundred kg FYM was applied at the time of preparation of the nursery. The vines were planted at a spacing of 30 cm on ridges formed 60 cm apart. Only the middle of vine with nodes was buried to 5-10 cm depth keeping both ends exposed. The crop was fertilized with FYM @

10 tons ha⁻¹ as basal dose, nitrogen, phosphorus and potassium as per recommended dose which is 100:50:50 kg NPK ha⁻¹, respectively. Half dose of nitrogen and full dose of phosphorus and potassium were applied at the time of planting while remaining half dose of nitrogen was applied one month after planting along with first weeding and earthing up.

To maintain sufficient moisture for proper establishment of the crop, a light irrigation after transplanting was applied. Sweet potato is tolerant to drought but continuous long phase of drought reduces the tuber yield. So irrigation was given 15-20 days interval. After proper establishment, sweet potato starts growing vigorously.

Therefore vines were lifted at nodes 30 days after planting to prevent rooting and to facilitate better tuber development at the basal end. First hoeing and weeding was done after 30 days of transplanting and second after 40 days of first weeding to keep plots weed free.

In order to protect the vines against incidence of sweet potato weevil (*Cylas formicarius*) which cause serious damage to tubers, sprays with Fenithrion (0.05%) at monthly intervals was done. The crop was harvested manually 120 days after planting. Proper care was taken to minimize the losses during harvesting. Light irrigation 2-3 days before harvesting of tubers was given for easier digging.

Total Soluble Solids (TSS)

To determine the characteristic sample for measuring TSS, tuber flesh from three places were taken and mixed. Juice was obtained from this characteristic sample. Then the TSS content of juice was directly measured by the "Zeiss" Hand Refractometer (0-30 °B) and value obtained were corrected at 20 °C (A.O.A.C., 2007).

Acidity (%)

The acidity of tuber flesh was determined by diluting the known volume of pulp with distilled water and titrating the same against standard N/10 sodium hydroxide solution, using phenolphthalein as an indicator. The appearance of light pink colour was taken as the end point. The acidity was expressed in terms of per cent acidity (A.O.A.C., 2007).

$$\text{Acidity (\%)} = \frac{0.0064 \times \text{Volume of NaOH used} \times 100}{\text{Volume of sample taken}}$$

Total carotenoids (mg 100g⁻¹ fresh weight)

Flesh was cut into small pieces longitudinally and mixed with 80 per cent aqueous acetone for 2 hours at 50°C using an orbital shaker. Then it was filtered through Whatman paper. Filtrate was kept at -20°C prior to analysis. Five ml of sample extract was mixed with 5 ml distilled water and 1 ml of mix (hexane/acetone/methanol) (50/25/25 v/v). Sample was kept at centrifuge @ 3000 rpm for 10 min. The absorbance of upper layer was measured at 450 nm. Total carotenoids of the sample were calculated as mg 100g⁻¹ (Thimmiah, 1999).

$$\text{Total carotenoids } (\mu\text{g } 100 \text{ g}^{-1}) = \frac{A \times \text{Volume of extract}}{A^x \times \text{Sample weight}}$$

A = Absorbance

A^x = Absorbance coefficient (2505)

Total antioxidants (mg 100g⁻¹)

Five gram tuber was extracted with 20 ml of 60 per cent methanol (0.1% HCl) and kept overnight. Then it was centrifuged at 10,000 rpm for 15 min at 10°C. The supernatant was taken for analysis. Hundred µl of methanolic extract was mixed with 3 ml of solution (1.2 M sulphuric acid, 46 mM sodium phosphate and 8 mM ammonium molybdate) and was incubated for 90 min at 95°C in water bath. It was then allowed to cool down at room

temperature. Reading of plant sample was read using spectrophotometer at a wavelength of 695 nm and ascorbic acid was taken as standard. Standard curve was plotted with the absorbance readings of standard and plant sample which gave value of total antioxidant in mg 100g⁻¹ (Thimmiah, 1999).

Results and Discussion

TSS and Acidity

There were highly significant differences among germplasm for TSS which ranged from 2.20 (°B) to 4.10 (°B) being minimum in 'ST-14' and maximum in 'Sree Ratna'. Likewise, highly significant differences were exhibited among germplasm for acidity. Results were supported by Ali *et al.*, (2015a) and Ali *et al.*, (2015b) (Table 1 and 2).

Total carotenoids (mg 100g⁻¹ fresh weight), total antioxidants (mg 100g⁻¹ fresh weight)

The study revealed significant differences for total carotenoid in sweet potato germplasm. Total carotenoids ranged from 0.55 (mg 100g⁻¹ fresh weight) to 4.27 (mg 100g⁻¹ fresh weight) being minimum in 'POL-19-8-10' and maximum in 'CIPSWA-2'. Kathabwalika *et al.*, (2016) also reported similar results. The variations within genotype would be a result of genetic make-up of the cultivars in the synthesis of the carotenoids (Rodriguez-Amaya and Kimura, 2004). Some genotype produces more beta-carotene than others due to the difference in their genetic makeup. Saikia *et al.*, (2009) also reported carotenoids content in orange fleshed sweet potato cultivars. Onwueme (1978) and Lila Babu (1988) reported that sweet potato contains 1-12 mg carotene 100g⁻¹ of tuber. According to Ezell and Wilcox (1946) and Vimla *et al.*, (2011) cultivar differences, seasonal changes, stage of maturity, storage time and conditions after harvest etc., are responsible for variation in β-carotene content among clones (Table 3).

Table.1 Detail of germplasm and their source

S. No.	Name	Source
1	CIPSWA-2	World Potato Regional Centre, New Delhi
2	CO-3-4	CTCRI, Thiruvananthapuram
3	Gauri	CTCRI Regional Centre, Bhubaneswar
4	Gautam	CTCRI Regional Centre, Bhubaneswar
5	H-109-2	Navsari Agricultural University, Navsari
6	Navsari Local	Navsari Agricultural University, Navsari
7	Pol-19-8-10	CARI, Port Blair
8	Samrat	CTCRI, Thiruvananthapuram
9	SI-1	Navsari Agricultural University, Navsari
10	Sree Arun	CTCRI, Thiruvananthapuram
11	Sree Nandini	CTCRI, Thiruvananthapuram
12	Sree Ratna	CTCRI, Thiruvananthapuram
13	Sree Vardhini	CTCRI, Thiruvananthapuram
14	ST-10	CTCRI, Thiruvananthapuram
15	ST-14	CTCRI, Thiruvananthapuram
16	SV-71	BCKV, Kalyani

Table.2 TSS (°B) and acidity (%) in sweet potato tubers

Genotype	TSS (°B)	Acidity (%)
CIPSWA-2	2.77	0.13
CO-3-4	2.50	0.32
Gauri	2.67	0.45
Gautam	2.70	0.38
H-109-2	3.03	0.26
Navsari Local	3.20	0.32
POL-19-8-10	2.90	0.26
Sree Nandini	3.30	0.26
Sree Vardhini	3.81	0.19
Samrat	3.20	0.44
SI-1	3.50	0.19
Sree Arun	2.50	0.13
Sree Ratna	4.10	0.13
ST-10	3.60	0.32
ST-14	2.20	0.32
SV-71	3.80	0.26
Mean	3.10	0.29
Range	2.20-4.10	0.13-0.45
SEm±	0.11	0.01
CD (P=0.05)	0.33	0.03
CV (%)	6.30	5.27

Table.3 Total carotenoids (mg 100g⁻¹ fresh weight) and total antioxidants (mg 100g⁻¹ fresh weight) in sweet potato tubers

Genotype	Total Carotenoids (mg 100g ⁻¹ fresh weight)	Total Antioxidants (mg 100g ⁻¹ fresh weight)
CIPSWA-2	4.27	0.23
CO-3-4	0.82	0.27
Gauri	3.45	0.23
Gautam	1.56	0.24
H-109-2	3.94	0.28
Navsari Local	1.04	0.18
POL-19-8-10	0.55	0.21
Samrat	0.63	0.31
SI-1	2.49	0.19
Sree Arun	3.52	0.25
Sree Nandini	0.76	0.26
Sree Ratna	0.85	0.21
Sree Vardhini	0.87	0.19
ST-10	1.01	0.28
ST-14	2.60	0.25
SV-71	1.17	0.19
Mean	1.84	0.24
Range	0.55-4.27	0.18-0.31
SEm±	0.09	0.009
CD (0.05)	0.26	0.03
CV (%)	8.38	6.60

Result of this study also showed significant differences among sweet potato germplasm for total antioxidants which ranged from 0.18 (mg 100 g⁻¹ fresh weight) to 0.31 (mg 100 g⁻¹ fresh weight). High phenolic content in sweet potato germplasm might be responsible for significantly higher antioxidant activities (Ji *et al.*, 2015).

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