



Assessment of sweet potato (*Ipomoea batatas*) accessions for growth, yield and quality traits

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Sweet potato (*Ipomoea batatas* Lam.) is a dicotyledonous herbaceous perennial vegetable crop grown as an annual. This can be grown on marginal soils and withstand drought conditions, has high yield potential with relatively short growing season and adaptable to a wide ecological range. It is ranked seventh most important food crop in the world and is a rich source for vitamin A, calcium, ascorbic acid and provides more edible energy than other staple foods (194 MJ/ha/day; Woolfe 1992). These characteristics make this crop appealing to farmers with limited resources (Low *et al.* 2001, Andrade *et al.* 2009). It is grown rain-fed and irrigated crop and yields more in winter (*rabi*) than rainy (*kharif*) seasons. There is minor information available on varietal response to seasons in sweet potato. Hereby, study was conducted to evaluate the performance of sweet potato genotypes in two growing seasons for growth, tuber yield and quality.

The present study was carried out at the Department of Vegetable Science, Tamil Nadu Agricultural University,

Coimbatore, Tamil Nadu during 2021–2022. The experimental site was situated at 716 m amsl, in latitude 28°N and longitude 79.5°E. The experimental field had a homogenous contour and connected with drip irrigation. A randomized block design with four replications and six sweet potato accessions were studied. The field experiment was conducted in two growing seasons, viz. December 2021–March 2022 and March–June 2022. About 120 plants were grown on a plot of 6 m × 2.4 m. The characters of the four replications for the six accessions were determined by means except harvest index, which was measured by the ratio of biological yield to the economic yield. Quality traits were biochemically analyzed from the tubers. The recorded observations were subjected to an analysis of variance using the software package AGRES 7.01.

The observed differences among the six accessions studied for agronomic, yield and quality characters were found highly significant in the pooled analysis. The accession Ib 73 recorded the maximum vine length of 247.94 cm,

Table 1 Mean performance of sweet potato genotypes for vine length and tuber characters (pooled data of 2 seasons)

Genotype	Vine length (cm)	Leaf area index	Harvest index	Tuber length (cm)	Tuber girth (cm)	Number of tubers per vine	Single tuber weight (g)
Sree Arun	145.82	4.01	30.57	10.57	12.37	2.32	50.93
Sree Kanaka	175.64	4.19	44.69	18.39	13.11	3.03	146.51
Bhu Krishna	227.34	3.19	31.48	9.96	10.13	2.04	57.13
CO 5	229.43	4.53	38.15	17.79	11.90	2.85	131.45
Ib 73	247.94	5.66	66.24	20.11	13.74	4.85	195.28
Ib 74	119.43	4.94	57.85	20.97	16.23	3.41	187.58
Mean	190.93	4.42	44.83	16.30	12.91	3.08	128.14
LSD (P=0.05)	11.65	0.24	2.48	1.40	1.01	0.21	18.79

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and Ib 74 recorded the minimum vine length (Table 1). During first season (December–March), short day conditions prevailed and thus the crop received less sunlight when compared to second season (March–June). In the second

Table 2 Mean performance of sweet potato genotypes for yield traits (pooled data of 2 seasons)

Genotype	Tuber yield per vine (kg)	Tuber yield per plot (kg)	Tuber yield per hectare (tonnes)	Weevil infestation (%)	Marketable tuber yield per hectare (tonnes)
Sree Arun	0.17	10.63	8.626	16.47	7.24
Sree Kanaka	0.43	20.57	17.781	18.64	14.30
Bhu Krishna	0.11	8.99	7.194	12.82	6.26
CO 5	0.29	20.33	16.973	16.73	14.10
Ib 73	1.04	28.88	22.414	10.95	20.09
Ib 74	0.94	26.83	22.104	15.10	18.58
Mean	0.50	19.37	15.849	15.12	13.43
LSD (P=0.05)	0.01	0.36	0.437	0.58	0.36

season, the crop received more sunlight that made the crop to acquire high temperature and resulted in more vegetative growth. Wijewardana *et al.* (2018) also reported differential response of crop to varied temperatures on vine length. Temperature had a significant impact on the growth of the sweet potato vine, which is consistent with the findings of Gajanayake *et al.* (2014). However the genetic makeup of the cultivar might also influence the vine length. The same trend was confirmed with the findings of Rahman *et al.* (2015) in sweet potato. The accession Ib 73 (5.66) recorded more leaf area index and maximum harvest index of 66.24. The variety Bhu Krishna (3.19) recorded less leaf area index and Sree Arun recorded the minimum harvest index. The maximum leaf area index in Ib 73 might be due to highest vine length with more number of leaves. The minimum leaf area index in Bhu Krishna might be due to small number of leaves. There is a positive correlation between harvest index and yield. This finding is in accordance with the findings of Anshebo (2002).

The values of the tuber characteristics of the crop differed significantly among the accessions studied. Tuber length is an important yield contributing character. The data revealed that, the accession Ib 74 recorded maximum tuber length of 20.97 cm and Bhu Krishna recorded minimum tuber length (Fig 1). Among the genotypes, the accession Ib 74 recorded the maximum tuber diameter of 16.23 cm and Bhu Krishna recorded minimum tuber diameter. The accession Ib 73 recorded more number of tubers per vine (4.85) and less number of tubers/vine was recorded in Bhu Krishna. Single tuber weight is another yield contributing character and the accession Ib 73 recorded maximum single tuber weight of 195.28 g (Table 2). Among the entries evaluated, Ib 73 recorded higher tuber yield per vine, per plot and per hectare (1.04 kg, 28.88 kg, 22.41 tonnes/ha) respectively. There was an increase in number of tubers, tuber length, tuber girth and tuber yield per plant during the first season, might be due to more translocation of photosynthates to sinks (economic parts) from source (above ground vegetative parts) which ultimately resulted in the increased tuber yield per hectare (Badu *et al.* 2007, Tiwari *et al.* 2021).

During the period of investigation, the weevil infestation



Fig 1 Tuber size of sweet potato accessions based on scale. A, Ib 74; B, Ib 73; C, Sree Kanaka; D, CO 5; E, Sree Arun; and F, Bhu Krishna.

ranged from 8.26–15.82% during first season and 13.63–21.45% in the second season. Less weevil infestation of 10.95% was recorded in the accession Ib 73 (Table 2). The maximum infestation during second season might be due to rainy environment which could have favoured the weevil population. Similar result was also reported by Mishra *et al.* (2006) in sweet potato. Among the accessions, minimum infestation was observed in Ib 73. It might be due to the nature of the vine quality which is thin and firm with more latex content. The maximum infestation was observed in Sree Kanaka in both the seasons. It might be due to the thick fleshy vine with low latex content. The maximum marketable yield was recorded in Ib 73 with 20.09 tonnes/ha and Bhu Krishna recorded the minimum yield of 6.26 tonnes/ha (Table 2). Yield is the genetical character and differs with respect to cultivar (Yooyongwech *et al.* 2014). There is a significant difference among the genotypes for the quality characters. The differences among the accessions with respect to quality parameters might be because of the inherent characteristics of the sweet potato tubers. Most of the quality traits are less likely to be influenced by environmental effects (Table 3).

Table 3 Mean performance of sweet potato genotypes for quality traits (pooled data of 2 seasons)

Genotype	Dry matter (%)	Total soluble solids (^o brix)	Starch (g/100 g)	Protein content (g/100 g)	Total sugar (g/100 g)	β-Carotene (mg/100 g)	Crude fiber (%)
Sree Arun	29.58	11.76	22.12	1.81	5.54	0.76	2.17
Sree Kanaka	22.26	10.03	15.93	2.06	5.29	1.51	1.86
Bhu Krishna	22.54	8.39	17.01	1.51	5.43	0.06	2.35
CO 5	24.41	8.11	18.24	1.60	5.29	1.18	1.97
Ib 73	32.11	7.11	19.12	2.22	4.23	0.65	1.19
Ib74	25.18	8.66	15.14	2.39	5.94	0.72	1.53
Mean	26.01	9.01	17.93	1.93	5.29	0.81	1.84
LSD (P=0.05)	0.80	0.10	0.26	0.05	0.19	0.02	0.04

Dry matter content is an important criterion for sweet potato variety selection. The total dry matter production and efficiency of allocation of dry matter towards tubers is an important factor that determines storage root yield. The pooled analysis data confirmed that the accession Ib 73 recorded more dry matter content of 32.11% and the accession Sree Kanaka recorded less dry matter content. White fleshed accession Ib 73 had high dry matter content over orange fleshed CO 5 and Sree Kanaka, which corroborates that the white fleshed varieties were more preferable than orange fleshed varieties by farmers as the dry matter content was positively correlated with yield (Solankay *et al.* 2015, Mello *et al.* 2021). Dry matter content might depend on the genetic variations, physiological factors and soil moisture content, etc (Senanayake *et al.* (2013). It was observed that high soil water level during second season might have reduced the dry matter content. The dry matter content ranged from 22.26–32.11%. Increased dry matter production was due to accumulation of starch, total soluble solids (TSS) and other metabolites in the tubers. Sree Arun recorded more TSS of 11.76^obrix.

Starch content ranged from 15.08–22.12 g/100 g. More photosynthates were partitioned towards storage roots than to fibrous roots due to reduced night temperature in first season (December–March) which encouraged increased conversion of sucrose to starch in the storage roots. Eguchi *et al.* (2003) also observed that reduced night temperature had a positive effect on starch content of tubers. The variety Sree Arun recorded maximum starch content of 22.12 g/100 g and the accession Ib 74 recorded the minimum starch content. Ib 74 recorded more protein content of 2.39 g/100 g. The variation among the protein content might be due to genetic divergence. However, Ib 74 with 5.94 g/100 g recorded more total sugar content and Ib 73 recorded less total sugar content 4.23 g/100 g. The total sugar content among the genotypes was ranged from 4.23–5.94 g/100 g. Sree Kanaka recorded maximum reducing sugar content of 1.91 g/100 g and Ib 73 recorded the minimum reducing sugar content. Sree Kanaka recorded more β-carotenoid content of 1.51 mg/100 g and the presence of dark orange flesh represented the higher carotene content with a positive correlation with colour value. The maximum crude fiber content was found in Bhu Krishna with 2.35% and minimum in Ib 73.

Among the genotypes evaluated, Ib 73 performed well for yield contributing traits in both the seasons under Coimbatore conditions. The same accession Ib 73 with low TSS and less total sugar content would be a better replacement for potatoes for culinary purpose, and could be used for diabetic patients owing to its low sugar content. Hence, it could be recommended for intensive cultivation to the farmers to get more income from unit area.

SUMMARY

From the study it was noticed that winter sweet potato crop (first season) recorded higher tuber yield due to more utilization of photosynthates, and optimum temperatures for tuberisation and tuber bulking. Second season crop (summer to early monsoon crop) recorded higher vegetative growth which was due to more sunlight and higher temperatures during the crop period which promoted vegetative growth. The pooled analysis of two season's data revealed that genotype Ib 73 recorded higher tuber length, number of tubers per vine, single tuber weight, tuber yield/vine and marketable tuber yield per hectare, maximum dry matter content, which had a positive correlation with tuber yield. Less weevil infestation percentage was recorded in Ib 73, it might be due to the characteristic feature of thin vine with more latex content. One of the important quality parameters is β-Carotene content in the tuber, which was recorded maximum in the variety Sree Kanaka, thus it may be recommended for the alleviation of malnutrition in children. However, Ib 73 excelled other genotypes in terms of yield and cooking quality characters with low TSS and total sugar content, hence it can be recommended for commercial cultivation among the farmers by replacing potatoes for culinary purpose.

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