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EXPLORING THE POTENTIAL OF LOCAL AND EXOTIC SWEET POTATO LEAVES AS VEGETABLES

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Abstract

An experiment was conducted at farmer's field of Dashpara village of Sylhet Sadar upazila during 2016-2017 to find out nutritional status of the leaves of four local and four exotic lines of sweet potato. d. The lines and variety were Local-1, Local-2, Local-5, Local-8, Exotic-1, Exotic-2, Exotic-3, Exotic-4 and BARI SP-4.The experiment was conducted by in a Randomized Complete Block Design. Crude protein, crude fat, crude fiber, total ash, moisture and carbohydrate were determined by proximate analysis whereas elemental nutrients, total sugar, starch, vitamin C, phenolic compounds and tannins were determined by the procedure outlined by Association of Analytical Chemists' (AOAC). Ninety days old fresh leaves were collected from the experimental field for chemical analysis. Results revealed that the highest percent of carbohydrate (by difference), crude protein, crude fat, total ash and energy were in Exotic-2 (65.47), Local-2 (26.59), Local-5 (3.63), BARI SP-4 (8.35) and Local-1 (370.4 Kcal 100 g^{-1}), respectively. The highest percent of crude fiber, total sugar and starch were recorded in Local-8 (17.79), Local-2 (5.63) and Local-8 (36.42), respectively. The Local-1 contained the highest amount of phenolic compounds and tannins while vitamin C was in Local-5 and Local-8. It was also observed that sweet potato leaves of Local-1, Local-5 and Local-8 contained appreciable levels of iron, zinc, calcium, magnesium, potassium and phosphorus. It can be concluded that the leaves of Local-1, Local-5, Local-8, Exotic-1 and Exotic-2 could be suitable for vegetables and can be included as supplement our daily nutrient requirements.

Introduction

Sweet potato is one of the diversified root crops supplying huge energy as well as vitamins and minerals. Leaves are rich in vitamin B, beta-carotene, iron, calcium, zinc and protein (Islam, 2014). Fresh leaves contain vitamin A on an average of 1600 IU $100g^{-1}$ (Bhuiyan *et al.*, 2008). Leaves are very nutritious compared to leaves of cassava, amaranth, mushrooms, taro and pumpkin (Oduro *et al.*, 2008). It grows well in marginal lands namely char lands, homestead areas, the valley of low hills, newly accreted lands and even problematic soils namely saline belts, acidic soils. It requires a low amount of fertilizers and agricultural inputs with low management practices. Sweet potato is perennial and its rapid growing tops (leaves and tender vines) can be harvested several times in a year; their annual yield is much higher than many other green vegetables (Islam, 2006).

The present study area is the north-eastern part of Bangladesh. There are 396,951 ha of land remains uncultivated during Rabi and Kharif seasons in Sylhet region (DAE, 2014). During summer and rainy season, vegetable production is very limited. The price of different vegetables is relatively high due to low production and availability in this region. People are mostly dependent on import vegetables from other parts of Bangladesh; hence they have limited chances to take sufficient vegetables. Consequently, people especially women and children are suffering from hidden hunger especially micronutrient deficiency. About 57% poor people of Sylhet region are living in food insecurity (BDSH, 2014). Moreover, adverse climatic conditions like heavy rainfall, high humidity, seasonal flooding along with soil acidity etc. are the obstacles for the r crop production in this region. In this context, cultivation of sweet potato in the summer and rainy seasons may help to produce leafy vegetables readily available in the markets for the consumers. Furthermore, there are several indigenous sweet potato genotypes are available in the region. Though some of them are being cultivated by farmers' sporadically around the river banks, valley areas and homestead areas; but the nutritional quality assessment as vegetables has not yet done.

Knowledge of the phenolic components and antioxidant activity of sweet potato greens may increase the awareness of the food industry as well as consumers in utilizing sweet potato greens for functional food. Considering the above facts, the research work was taken to estimate the nutrients composition of leaves of nine sweet potato genotypes, to estimate total sugar, starch, crude fiber, vitamin C content, phenolic compounds, tannins, and mineral nutrients and to establish their suitability as vegetables.

Materials and Methods

Conduction of field experiment and collection of samples

The experiment was conducted at farmer's field of Dashpara village of Sylhet Sadar upazila during November 2016 to March 2017. Nine sweet potato genotypes namely Local-1, Local-2, Local-5, Local-8, Exotic-1, Exotic-2, Exotic-3, Exotic-4 and BARI SP-4 were used as planting materials. The experiment was conducted in a Randomized Complete Block Design (RCBD). The experimental field was fertilized with manures and fertilizers as per soil test based (STB) of FRG (2012). Cowdung, Urea, TSP, MoP, Gypsum, Solubor, Zinc sulfate (Hepta), Magnesium sulfate and Dolomite were applied @ 5000, 224, 186, 165, 28, 2, 9, 79 and 988 kg ha^{-1}, respectively. Before final land preparation, half of urea and MoP, full of other fertilizers and cow dung were applied. Rest of Urea and MoP were applied as side dressing at 35 days after planting during earthing - up operation. Soil reaction (pH) was corrected by dolomite application prior to 15 days of planting.

The unit plot size was of 4.8 m × 4.2 m with a block to block distance 1.0 m and plot to plot distance 0.6 m. Raised beds were prepared and cuttings of sweet potato vines were planted in lines maintaining row to row 60 cm and plant to plant 30 cm. Weeding was done as and when necessary. Irrigation was done at 30 and 60 days after planting (DAP).

Organoleptic properties of tops (leaves and tender vines) were evaluated at field. After 90 days of planting, unfolded leaves of sweet potato were collected into poly bags from the experimental field with proper tagging and brought them into the laboratory. Leaves were washed with distilled water and left them sometimes to drip out excess moisture. After that fresh weight was taken with electric balance. Weighed samples were dried at 60 °C in an oven (Gallenkamp hot box) for 24 hours (Anita *et al.*, 2006), cooled and then dry weight and moisture percent were calculated. They were ground properly and preserved in a plastic pot with labeled for chemical analysis.

Methods of analysis of nutrients

Moisture percent of ground leaves were further assayed by Perten Instruments AB (DA7200) digitally prior to chemical analysis. Nitrogen percent was determined by Micro-Kjeldahl method as stated by Sadasivam and Manickam (1997) following digestion, distillation, and titration. Protein percent was calculated by multiplying the nitrogen percent with 6.25. Crude fat was determined by Foss Soxtec 2046 apparatus (Soxtech Extractor) using petroleum ether (b.p. 40-60 °C) with a known weight of the sample after completing boiling, rinsing and exhaustive extraction steps. Total ash was determined by incineration of a known sample in a muffle furnace (Nabertherm Trade Mark, Germany) at 550 °C for 24 hours as per Ranganna (1991). The carbohydrate content was determined by subtracting the moisture, crude protein, crude fat and total ash percentage from the total dry matter (100) as described by Law (2002). The calorific value was estimated by summing the multiplied values for crude protein, crude fat and carbohydrate (excluding crude fiber) by their respective Atwater factors (4, 9 and 4, respectively, Merrill and Watt, 1973).

Total sugar and starch content were determined calorimetrically with anthrone reagent based on the method of McCready *et al.* (1950). Glucose content was found out in the sample using the standard graph and multiplied the value by a factor 0.9 to arrive at the starch content. Crude fiber was obtained from the loss in weight on ignition of dried residue (550 °C for 6 hours) remaining after digestion of fat free samples with 1.25% each of sulphuric acid and sodium hydroxide solutions under specified condition. The Folin-Ciocaltue method (Singleton and Rossi, 1965) as described by Makkar (2003) was used to determine total phenolics. Tannic acid was used as standard and the results obtained were expressed as mg Tannic acid equivalent $100g^{-1}$ dry matter. Tannins were determined according to Makkar (2003) with some modifications using the formula: Tannins (mg Poly ethylene glycol equivalent $100g^{-1}$) = Total phenol before using tannic acid -Total phenol after using Poly ethylene glycol (PEG).

Vitamin C was determined as stated by AOAC Official Method (2012). Vitamin C was extracted by 3% metaphosphoric acid and acetic acid solution maintaining 1:200 ratio followed by titration with 2, 6 Dichlorophenol indophenol. For colored sample the ratio of sample and extractants was 1:400. For estimation of P, K and elemental nutrients, samples were digested with di-acid mixture (HNO_3:$HClO_4$ = 5:1) at 120-200 °C for 2 hours for achieving transparent solution as per Fang (1991). After cooling, the digested samples were filtered using Whatman No. 42 filter paper and diluted.

Phosphorus concentration was determined colorimetrically by spectrophotometer using ammonium molybdate-ascorbic acid solution blue color method (Peterson, 2002). Potassium (K), calcium (Ca) and magnesium (Mg) concentration was determined by atomic absorption spectrophotometer using $LaCl_3$ solution, whereas iron (Fe) and zinc (Zn) concentration was determined directly by atomic absorption spectrophotometer as stated by Yoshida *et al.* (1976).

Duncan's Multiple Range Test (DMRT) was followed by using MSTATC package.

Results and Discussion

Assessment of organoleptic properties of tops (leaves and tender vines)

Tops of Local-1, Local-5, Local-8, Exotic-1, Exotic-2 and Exotic-4 were green (Table1). Tops of Local-2, Exotc-3 and Exotic-4 were purple. Soft and succulent tops were observed in Local-1, Local-5, Local-8, Exotic-2, Exotic-3 and Exotic-4 genotypes, while Local-2, Exotic-1 and BARI SP-4 had soft-hard tops. Petioles (stalk of leaves) of all of the genotypes were green. Long, thick and soft petioles were in Exotic-4 where Exotic-1 had long, thick and soft-hard petioles. Medium, thick and soft petioles were in Local-1, Local-8, Exotic-2 and Exotic-3. Local-2 had short, thick and soft-hard petioles. Local-5 and BARI SP-4 had short and soft petioles. These variations are perhaps due to genetic as well as environment.

The above results agree with the observations of Islam (2006), where he added that sweet potato tops, could serve as an additional leafy green vegetable. Acceptable tops should be tender, glabrous and purplish. Those eating tops prefer the top 10 cm of tips including both stem and leaves. Tips with the largest number of leaves with petioles less than 4/10 of an inch (1 cm) long are considered desirable because they are tender and good for vegetables. Petiole length varies widely with genotype and may range from approximately 10 to 40 cm (Huaman, 1992).

Table 1. Organoleptic properties of tops of nine sweetpotato genotypes

Genotypes	Color of tops	Softness of tops (Tender leaves and vines)	Petiole color	Thickness and softness of petiole
Local-1	Green	Soft and succulent	Green	Medium, thick, soft
Local-2	Purple	Soft-hard	Green	Short, thick, soft-hard
Local-5	Green	Soft and succulent	Green	Short, thick, soft
Local-8	Green	Soft and succulent	Green	Medium, thin, soft
Exotic-1	Green	Soft-hard	Green	Long, thick, soft-hard
Exotic-2	Green	Soft and succulent	Green	Medium, thick, soft
Exotic-3	Purple	Soft and succulent	Green	Medium, thin, soft
Exotic-4	Green	Soft and succulent	Green	Long, thick, soft
BARI SP-4	Purple	Soft-hard	Green	Short, thin, soft

Nutritional assessment of leaves

Moisture (%)

The highest moisture percent in fresh leaves were in Exotic-3 (84.43) followed by Local-8, Exotic-1, Exotic-2 and BARI SP-4, and the lowest was in both Local-1 (80.82 %), Local-2 and Local-5 (Table 2). The highest moisture percent in sample powder was in Local-5 (8.13) and the lowest in Local-1 (6.56). The above results were supported by several authors. Anita *et al.* (2006) reported moisture content from 82.21 to 87.48%, whereas USDA (2009) reported from 80 to 88% and Oduro (2008) from 80.16-88.20%. Foods with high moisture content are more prone to perishability (Fennema and Tannenbaum, 1996). Several authors have reported that the application of fertilizer reduces the moisture content in the sweepotato. The low moisture content signifies a high dry matter content and, thus, more carbohydrates and, consequently, a higher energy content (Gichuhi, 2014).

Carbohydrate (%)

Carbohydrate content in leaves of sweet potato had significant variations in genotypes (Table 2). The highest carbohydrate percentage (by difference) was in Exotic-3 (65.47) followed by Exotic-2, Local-2 and Exotic-1. The lowest percentage (56.68) was in Local-5. Carbohydrate content in leaves of Local-1, Local-8 and BARI SP-4 were similar. Local-5, Local-8 and Exotic-4 contained lower percent of carbohydrate than check variety. The carbohydrate content in leaves are greater than the report of USDA (2009) and Uduro (2008) where carbohydrate ranged from 53 to 59%, and 53.29 to 59.01%, respectively. Except for Local-5 all of the genotypes performed better in carbohydrate content.

Crude protein (%)

Crude protein varied significantly from genotype to genotype (Table 2). The maximum protein percentage was in Local-8 (26.59) followed by Local-1 (6.31). Crude protein percentage among Local-5, Exotic-4 and Exotic-1 were similar. The lowest protein percentage was in Exotic-2 (19.97). All of the genotypes performed better over check variety except Exotic-2. The studied result agrees with the finding of USDA (2009) and Uduro (2008), while Anita *et al.* (2006) found protein in leaves of 24.9%. Protein levels in the leaves of sweetpotato are higher than in their respective storage roots, but the amount of leaves consumed by humans limits their total contribution (Low *et al.,* 2009).

Crude fat (%)

The highest crude fat percent was in Local-5 (3.63) followed by Local-1 (2.75), Exotic-2 (2.84) and Exotic-4 (2.82) (Table 2). The lowest fat percent was in Exotic-3 (2.05). Fat percent of Local-2, Exotic-1 and BARI SP-4 were statistically similar. Crude fat percent of Local-5, Local-1, Local-2, Exotic-2 and Exotic-4 was higher than that of check variety.

Table 2. Proximate analysis and energy in leaves of sweetpotato

Genotypes	Moisture in FL (%)	Moisture in DL (%)	Carbohydrate (%)	Crude protein (%)	Crude fat (%)	Total ash (%)	Energy (kcal $100g^{-1}$)
Local-1	80.82 b	6.56 e	61.22 c-e	25.20 ab	2.75 b	4.26 e	370.4 a
Local-2	81.27 b	6.73 de	63.14 bc	22.72 c	2.68 bc	4.73 de	367.5 ab
Local-5	81.24 b	8.13 a	56.68 f	24.38 bc	3.63 a	7.18 b	356.9 e
Local-8	82.64 ab	7.20 bc	59.48 e	26.59 a	2.35 cd	4.38 e	365.5 bc
Exotic-1	82.80 ab	7.00 cd	62.44 b-d	23.44 bc	2.63 bc	4.49 e	367.2 ab
Exotic-2	83.08 ab	7.50 b	64.43 ab	19.97 d	2.84 b	5.26 d	363.2 cd
Exotic-3	84.43 a	7.26 bc	65.47 a	20.66 d	2.05 d	4.56 e	362.9 cd
Exotic-4	83.10 ab	7.20 bc	59.40 e	24.44 bc	2.82 b	6.14 c	360.8 d
BARI SP-4	82.70 ab	7.50 b	60.92 de	20.60 d	2.63 bc	8.35 a	349.7 f
Mean	82.94	7.23	61.46	23.11	2.710	5.48	362.68
CV (%)	1.26	2.12	1.31	3.22	5.52	4.65	0.36

FL= Fresh leaves, DL = Dry leaves, BARI SP-4 was check variety. Figures with dissimilar letters in a column differ significantly at $DMRT_{0.01}$

Crude fat percent of the leaves of the studied genotypes were less than the finding of Anita *et al.* (2006) where they found 4.9% fat in leaves and greater than that of Uduro (2008) where he reported from 0.38-1.91% and USDA (2009) reported from 0.4 -2%. Variations may be genotypic as well as the methodology used in the fat determination.

Total ash (%)

Total ash of the studied genotypes ranged from 4.26 (Local-1) to 8.35% (Local-5). BARI SP-4, Local-5 and Exotic-4 showed better in total ash content (Table 2). The above results comparatively lower to that of USDA (2009) and Anita *et al.* (2006); where they reported ash content from 8 to 11.6%. Several authors have observed an increased concentration of minerals in the sweet potato leaves and storage roots with the increased application of fertilizer (Agbede, 2010). The ash content of sweet potato varieties can be influenced by soil, climatic conditions, etc. (Abbasi *et al.*, 2011).

Energy (kcal 100 g dry leaves^{-1})

The leaves of Local-1, Exotic-1, Local-2 and Local-8 were performed better in energy producing (Table 2). The higher energy was recorded in Local-1 (370.4) followed by Local-2 (367.5) and Exotic-1 (367.2). The lowest energy was observed in BARI SP-4 (349.7). The results partially agree with the finding of Anita *et al.* (2006).

Total sugar (%)

Total sugar percent in leaves was influenced by genotypes significantly (Table 3). Among the genotypes, the highest total sugar percent was in Local-2 (5.63) followed by Local-8, Exotic-4 and BARI SP-4 while the lowest sugar percent was in Exotic-2 (2.06). Higher total sugar producing genotypes were Local-2, Local-8, Exotic-4 and BARI SP-4. Rest of the genotypes showed lower sugar content.

Starch content (%)

Starch content in leaves of nine genotypes varied from 13.48 - 36.42% with an average value of 23.92% (Table 3). The maximum starch percent was in Local-8 followed by Local-1 and Exotic-3. The lowest percent were in both Exotic-4 and BARI SP-4. According to USDA (2009), starch content in leaves of sweet potato was 29.05%.

Crude fiber (%)

Crude fiber content in leaves varied significantly among the genotypes having the maximum percent in Local-8 (17.79) followed by Local-1 (15.76) and the lowest in BARI SP-4 (11.16) (Table 3). Local-2, Exotic-2 and BARI SP-4 contained low crude fiber. The above results were higher than the report of Uduro (2008).

Vitamin C (mg 100 g^{-1}dry leaves)

Vitamin C content in dry leaves varied from 10.56 - 18.04 (Table 3). The highest amount of vitamin C was in both Local-8 and Local-5 followed by Exotic-4. The lowest amount was in Local-2. Higher vitamin C containing genotypes are Local-8, Local-5, Local-1 and Exotic-4. Variation in vitamin C in leaves may be due to genetic or harvesting period as well as determining procedure.

Phenolic compounds (mg TAE 100 g dry leaves^{-1})

Phenolic compounds acts as antioxidant. Its presence in leaves was significantly varied among the genotypes (Table 3). The maximum amount of phenolic compounds were in Local-1 (385.0) followed by Exotic-2. The lowest amount was in Local-8 (226.20). Greater amounts of phenolic compounds were in Local-1, Exotic-2, BARI SP-4, Exotic-1 and Local-2. Islam *et al.* (2002) classified sweet potato genotypes with regard to the total phenolic compounds into low (<500 mg), medium (>700 mg) and high (>900 mg) as Chlorogenic Acid (Ch A) equivalent 100g^{-1} of dry weight. He also stated that polyphenols concentrations are organ-dependent and designated its order as leaves> petioles> stems >roots, indicating. Ishiguro *et al.* (2004) added that sweet potato leaf contains high concentrations of polyphenols, when compared with the major commercial vegetables such as spinach, broccoli, cabbage and lettuce.

Tannins (polyethylene glycol equivalent mg 100g^{-1} dry leaves)

The highest amount of tannins in leaves was in Local-1 (157.70) followed by Exotic-2, and the lowest amount was in Exotic-4 (46.47) (Table 3). Local-1, Exotic-2 and Local-2 and had comparatively higher tannins over check variety BARI SP-4. Tannins content in leaves of the genotypes are very low status. Tannins have both positive and negative effects on the human and animals.

Table 3. Total sugar, starch, crude fiber, vitamin C, phenolic compounds and tannins in leaves of sweetpotato

Genotypes	Total sugar (%)	Starch (%)	Crude fibre (%)	Vitamin C (mg 100g^{-1} dry leaves)	Phenolic compounds (mg TAE 100g^{-1})	Tannins (mg PEGE 100g^{-1})
Local-1	3.97 c	34.09 ab	15.76 bc	17.85 a	385.00 a	157.70 a
Local-2	5.63 a	24.19 c	13.74 d	10.56 e	291.60 d	89.13 c
Local-5	2.97 d	18.71 d	16.73 b	18.04 a	204.40 h	51.74 ef
Local-8	4.62 b	36.42 a	17.79 a	18.04 a	226.20 g	71.99 d
Exotic-1	2.60 d	17.61 d	15.38 c	12.15 cd	300.90 d	54.86 e
Exotic-2	2.06 e	26.46 c	14.73 cd	13.33 c	341.40 b	129.60 b
Exotic-3	3.75 c	30.71 b	15.07 c	11.18 de	266.70 e	48.63 ef
Exotic-4	4.51 b	13.48 e	15.68 c	15.68 b	255.50 f	46.47 f
BARI SP-4	4.70 b	13.61 e	11.16 e	12.55 c	316.50 c	82.90 c
Mean	3.87	23.92	15.12	14.376	287.59	81.44
% CV	4.40	6.11	2.78	3.65	1.53	3.90

TAE = Tannic acid equivalent, PEGE = Polyethylene glycol equivalent, Figures with dissimilar letters in a column differ significantly at $DMRT_{0.01}$

Leaf dry weight (g plant^{-1})

Leaf dry weight of sweet potato plant varied with genotypes (Table 4). The highest leaf dry weight was in Local-1 (35.22 g) followed by Local-8. The lowest leaf dry weight was in Exotic-3 (9.09 g). Leaf dry weight of Exotic-2 was 24.94 g followed by Exotic-4 and Local-2. Rahman *et al.* (2015) recorded foliage dry weights of sweet potato from 6.13 to 10.57 g at 150 DAP during summer and rainy season.

Iron (Fe)

Iron content in leaves varied from 198.9 to 443.9 ppm (Table 4). The highest amount was in Local-5 followed by Exotic-1 and Exotic-3 whereas the lowest was in Local-1 (198.9 ppm). Local-5, Exotic-3, Exotic-1 had a comparatively higher amount of iron than the check BARI SP-4. The above results partially agree with the report of USDA (2009) where it ranged from 96 - 230 ppm. These variations are probably due to genotypic make-up as well as fertilizer application to the crop.

Table 4. Leaf dry weight and minerals content in sweetpotato leaves

Genotypes	Leaf dry	Iron	Zinc	Calcium	Magnesium	Potassium	Phosphorus

	weight (g plant^{-1}) at 90 DAP	ppm			%		
Local-1	35.22 a	198.9 f	51.10 a	1.052 e	0.373 a	2.561 b	0.344 c
Local-2	21.21 d	269.5 e	42.45bc	1.088 de	0.384 a	2.688 a	0.343 c
Local-5	12.81 f	443.9 a	36.51 d	1.280 a	0.371 ab	2.569 b	0.361 bc
Local-8	30.30 b	274.6 e	32.98 e	1.082 de	0.312 c	2.645 a	0.392 ab
Exotic-1	17.88 e	339.6 b	45.06 b	1.058 e	0.309 c	2.561 b	0.432 a
Exotic-2	24.94 c	296.1 d	45.14 b	1.104 d	0.347 b	2.401 c	0.399 ab
Exotic-3	9.09 g	340.0 b	44.84 b	1.254 ab	0.389 a	2.361 c	0.388 ab
Exotic-4	21.33 d	293.2 d	39.71cd	1.153 c	0.296 c	2.717 a	0.409 a
BARI SP-4	17.08 e	319.6 c	28.30 f	1.221 b	0.240 d	2.383 c	0.334 c
Mean	21.10	308.36	40.7	1.144	0.335	2.542	0.378
CV (%)	5.54	1.89	3.43	1.11	2.68	1.33	4.01

BARI SP-4 was check variety. Figures with dissimilar letters in a column differ significantly at $DMRT_{0.01}$

Zinc (Zn)

Zinc content was influenced by genotypes (Table 4). The maximum zinc was in Local-1(51.10 ppm) followed by local-2 (42.45 ppm). Exotic-1, Exotic-2 and Exotic-3 had similar amount of zinc. The lowest amount was in BARI SP-4 (28.30 ppm). Local-1, Exotic-1, Exotic-2, Exotic-3 and local-2 had higher amount of iron content.

Calcium (Ca)

Calcium content in leaves varied significantly (Table 4). The highest percentage was in Local-5 (1.280) followed by Exotic-3 and BARI SP-4 whereas the lowest percentage was in Exotic-1 (1.052) and Exotic-1. Local-5 and Exotic-3 were performed better than BARI SP-4. Anita *et al.* (2006) recorded calcium 0.29%. These variations seem to be genotypic.

Magnesium (Mg)

The maximum magnesium percent was in Local-2 (0.384) and Local-1 (0.373) followed by Local-5 (Table 4). The lowest percentage was in BARI SP-4 (0.240). Magnesium content ranged from 0.240 to 0.384% with average value of 0.335%. Local-2, Local-1, Local-5 and Exotic-3 were rich in magnesium. The above result agrees with Anita *et al.* (2006) .

Potassium (K)

Potassium content in leaves varied significantly (Table 4). Higher amount was in Exotic-4 (2.717 %) which was similar to Local-2 and local-8. The lowest amount of potassium was in Exotic-3 (2.361 %). Local-1, Local-5 and Exotic-1 contained a similar amount of potassium. The above results are more than that of USDA (2009) where potassium was 0.48%.

Phosphorus (P)

Phosphorus content in leaves varied significantly (Table 4). The highest amount of phosphorus (0.432%) was in Exotic-4 followed by Exotic-2, Local-8 and Exotic-3. The lowest phosphorus percent was in BARI SP-4 (0.334). The higher phosphorus containing genotypes are Exotic-4, Exotic-2, Local-8 and Exotic-3. The above results are more than that of USDA (2009) where it reported phosphorus of 0.054 %. It may be due to genetic makeup and phosphate fertilizer application to the crop.

Conclusion

The proximate analysis reveals that Local-1, Exotic-1, Local-2 and Local-8 are preferable genotypes. Considering of total ash, crude fiber, vitamin C and phenolic compounds, Local-1, Exotic-2 and Exotic-1 are performed better than check variety. Similarly, Local-5, Exotic-1 and Exotic-3 are preferable than check variety in respect to minerals content. Tannin content in leaves of sweet potato were very low than the harmful limit. Local-1 and Local-8 were performed better than rest of the genotypes on account of organoleptic properties and dry matter yield of leaves. Considering overall nutrient status, the studied genotypes may be ranked as Local-1> Exotic-2> Exotic-1> Local-5> BARI SP-4> Local-2> Exotic-3> Local-8> Exotic-4. It can be concluded that the leaves of Local-1, Local-5, Local-8, Exotic-1 and Exotic-2 may be suitable for vegetables.

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