Mineral status of sweet gourd in response to salinity at Barguna and Patuakhali districts

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Abstract: A study was conducted on salinity tolerance of sweet gourd in selected tidal areas of Barguna and Patuakhali district during July, 2013 to June, 2014. Vegetable and soils of different locations were taken under investigation. On the basis of soil salinity, Sonakata, Taltoli, Barguna was selected as saline area (EC value 7.9 dS m^{-1}) and Kadomtola, Dumki; Patuakhali was selected as non-saline area (EC value 1.19 dS m^{-1}). The soil and vegetable were analyzed for Phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), Sulphur (S), Soil pH and EC. In saline area comparatively lower amounts of Phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), Sulphur (S) were found in sweet gourd and sweet gourd leaf than that of non-saline area. Accumulation of different mineral constituents in sweat gourd was remarkably affected by salinity. The uptake of K, S and P in sweet gourd was increased with decrease of soil EC level. The discussed vegetable can grow in saline area with sufficient mineral composition though the amounts of these minerals were found lower than vegetable grown in non-saline area. Considering the findings achieved sweet gourd can tolerate moderate salinity (soil EC value up to7.9 dSm^{-1}) and might be recommended to grow commercially in the study area for nutritional security.
Key words: Salinity, minerals, sweet gourd.

Introduction

The human population is increasing day by day in Bangladesh. So the demand of food including vegetables is also increasing. Vegetables are good sources of vitamins and minerals. In southern part of Bangladesh vegetables are not grown to meet up the demand. Efforts should be made to grow vegetable like sweet gourd in coastal area. The relation of secondary anemia to an iron and copper deficiency is now well known (Elvehjem, 1929). Functional disturbances due to a deficiency of manganese and magnesium in the diet have been recorded recently (Orent and McCollum, 1931).

The per capita consumption of vegetable is not up to the mark particularly in the southern region of Bangladesh. The main cause of malnutrition is low availability and consumption of vegetables. In Bangladesh per capita vegetable consumption is only 28g as against the daily requirement of 200g (Chadha, *et al*., 1994). More than 30,000 infants become blind every year due to vitamin A deficiency. Traditional indigenous vegetables are the most economically efficient source of micronutrients in terms of both land required and production costs per unit. Promotion of production and consumption of such micronutrient (iron, calcium, vitamin A and ascorbic acid) rich foods will help to overcome the problem (Mwanri *et al*., 2011). Calcium, Cu, Fe, Mg, Mn, P, K, Na, Zn are present in most of the vegetable (Emsley, 2001). The farmers of southern coastal belt usually grow some indigenous vegetables like cucumber, tomato, spinach, broad bean, sweet potato, radish, sweet gourd, bottle gourd, red amaranth, aroids etc but there were no research data as regards to their status of mineral nutrients as affected by saline soils. Assessment of nutritive value particularly minerals of this vegetable grown under different levels of salinity is not yet performed. The salt tolerance of vegetable species like sweet gourd is important because the cash value of vegetables is usually high compared to field crops (Shannon and Grieve, 1998). The southern coastal area is facing disaster frequently. So suitable vegetable for this region should be identified and adopted for the nutritional security (Rahman, 2008).

The study was conducted to know the salt tolerance and status of minerals in sweet gourd and sweet gourd leaf.

Materials and Methods

The study was carried out during December 2013 to January 2014 in four vegetables fields of Barguna and three vegetable fields of Patuakhali district. Considering soil salinity, Sonakata, Taltoli, Barguna was selected as saline region and Kadomtola, Dumki, Patuakhali was selected as non-saline region. It is noted that the soils of Barguna contains high salinity in dry season but during the sampling period the soil at Sonakata, Taltoly, Barguna outside the embankment observed moderately saline (EC = 5.7 dS m^{-1}).Vegetable and soil samples from each vegetable field were collected. Six (Three for sweet gourd and four for sweet gourd leaf) composite soil samples were brought to the laboratory, processed and preserved for analysis of pH and EC. The pH of the soil was determined by glass electrode pH meter (Ghosh *et al.*, 1983 and Jackson, 1962). The electrical conductivity (EC) of soil was determined by conductivity meter (Tandon, 1995).

The collected vegetables samples were digested by di-acid mixture (HNO_3:$HClO_4$ =2:1). Taking 1gm plant part and 14-15 ml di-acid mixture in a 150 ml conical flask and conical flask was then placed on electric hot plate. Heating was then maintained at 180-200°c until white fumes were evolved. When the conical flasks were cooled at room temperature, 20- 30 ml distilled water was added in each conical flask. The solution was filtered and volume up to the mark in 100 ml volumetric flask. Thus the digestion was completed. Phosphorus was determined by Olsen's method (Olsen *et al.*, 1954). Exchangeable potassium was determined with the help of flame emission spectrophotometer (Ghosh *et al.*, 1983 and APHA, 2005). Sulphur was determined by turbidimetric method with the help of a spectrophotometer (Page *et al*., 1982). Calcium and magnesium was determined by complexometric method of titration using Na_2-EDTA as a complexing agent (Page *et al.*, 1982 and APHA, 2005).

Statistical analysis: The statistical analyses of the data obtained from chemical analyses of vegetables and soil samples will be performed. Correlation studies will be done following the statistical package for agricultural research as described by Gomez and Gomez (1984).

Results and Discussion

The soil physicochemical properties are given in Table 1. Different sampling areas showed different pH and EC Values. Highest pH (7.9) and EC (5.7 dSm^{-1}) were observed in Sonakata and the lowest pH (5.2) and EC (1.19 dSm^{-1}) was observed in Nilgonj and Kadamtala, respectively.

Table 1. pH and EC values different soils of vegetables fields at Barguna and Patuakhali district

Sl. No	Locations	Upzila	District	Soil pH	Soil EC (dSm^{-1})
01	Sonakata	Amtoli	Barguna	7.9	5.7
02	Nisanbari	Amtoli	Barguna	7.9	4.3
03	Nilgonj	Amtoli	Barguna	5.2	1.23
04	Latachapli	Khepupara	Patuakhali	6.5	1.71
05	Panjupara	Khepupara	Patuakhali	6.6	0.86
06	Kadamtala	Dumki	Patuakhali	7.2	1.19
	Range			5.2-7.9	0.86-5.7

The concentrations of Ca and Mg in sweet gourd: The concentration of Ca and Mg in sweet gourd was higher at highest EC level and uptake of Ca and Mg ware increased with the increase of Ca and Mg concentration in soil (Table 1 and Fig. 1). The Ca concentration was lowest at lowest EC level. The concentration of S and P was higher at lower EC levels of soil.

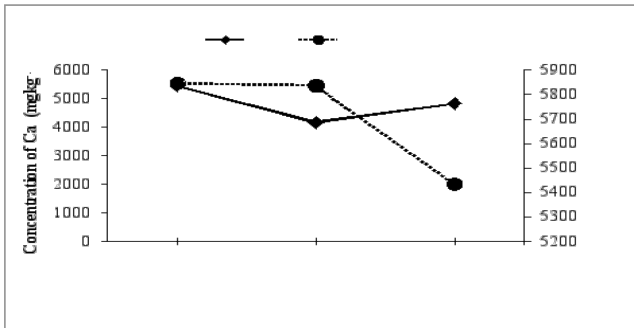

Fig. 1. Concentration of Ca and Mg in sweet gourd at different EC levels at different locations of Barguna and Patuakhali districts.

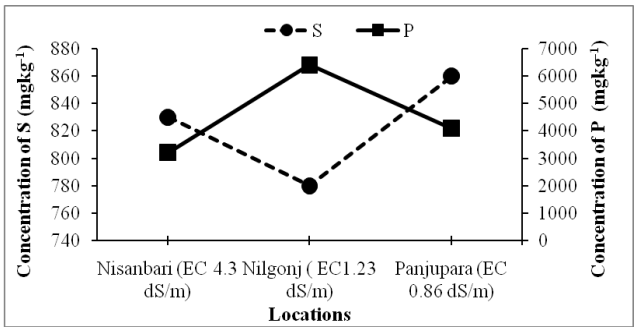

Fig. 2. Concentration of S and P in sweet gourd at different EC levels at different locations of Barguna and Patuakhali districts.

The concentrations of P, K, and S in sweet gourd: The limits of P and K ranged from 3205.13-6410.26 & 47.0-102 $mgKg^{-1}$. The maximum P and K were estimated in Sweet gourd at Nilganj, khepupara, Patuakhali(EC 1.23dSm^{-1}) and Panjupara, kuakata, Patuakhali(EC 0.86dSm^{-1}) respectively. The lowest P and K were present in Sweet gourd (fruit) at Nisanbari, Taltoly, Barguna(EC 4.30dSm^{-1}) and Nilganj, khepupara, Patuakhali(EC 1.23dSm^{-1}) respectively (Table-1 and Fig. 2 and 3). The limits of S ranged from 780-860 $mgKg^{-1}$ (Fig. 2). The lowest S was present in Sweet gourd at Nilgonj, Khepupara, Patuakhali (EC 1.23dSm^{-1}).

The uptake of K, S and P in sweet gourd was increased with the increase of K, S and P concentration in soil (Fig. 2 and 3). This might be due to the reactions of soil with plant nutrients, fertilizer application and environmental conditions.

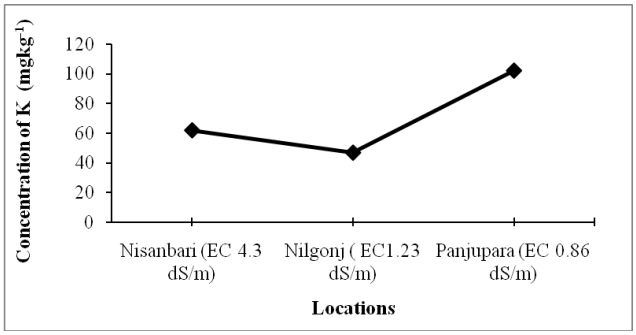

Fig. 3. Concentration of K in sweet gourd at different EC levels at different locations of Barguna and Patuakhali districts.

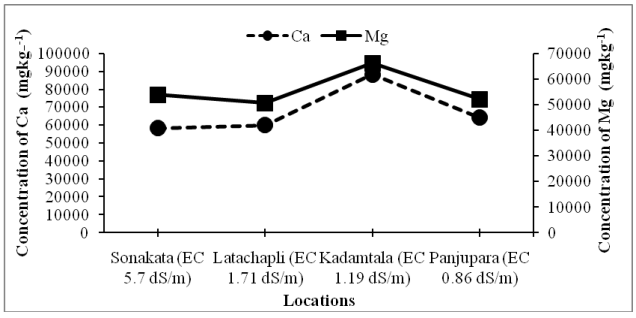

Fig. 4. Concentration of Ca and Mg in sweet gourd leaf at different EC levels at different locations of Barguna and Patuakhali districts.

The concentrations of Ca, Mg, P, S and K in sweet gourd leaf: The limits of P and K in leaf ranged from 3205.13-3846.15 & 57.0-108.0 $mgKg^{-1}$. The maximum P and K were estimated in Sweet gourd leaf at Kadamtala, Dumki, Patuakhali (EC 1.19dSm^{-1}) and Latachapli (EC

1.71dSm^{-1}) respectively. The lowest P and K were present in Sweet gourd (leaf) at Sonakata, Taltoly, Barguna (EC 5.70dSm^{-1}) (Table 1, Figs. 5- 6).

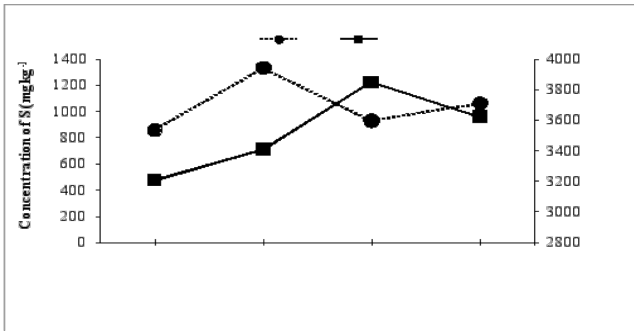

Fig. 5. Concentration of S and P in sweet gourd leaf at different EC levels at different locations of Barguna and Patuakhali districts.

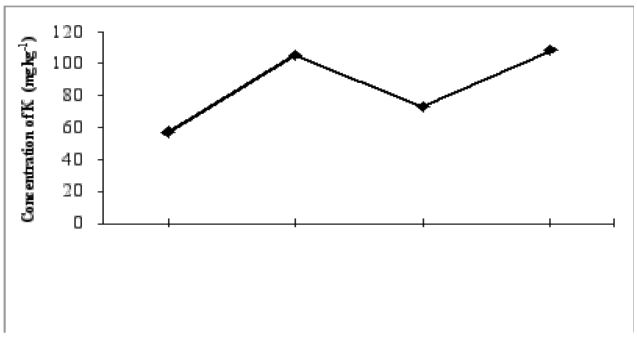

Fig. 6. Concentration of K in sweet gourd leaf at different EC levels at different locations of Barguna and Patuakhali districts.

The limits of Ca, Mg and S ranged from 58356.5-88176.0, 50557.2-66123.2 and 860.0-1330.0 mgKg^{-1}.The maximum Ca and Mg were estimated in Sweet gourd leaf at Kadamtala, Dumki, Patuakhali (EC 1.19dSm^{-1}) and S was present at Latachapli (EC 1.71dSm^{-1}). The lowest Ca and S were present in Sweet gourd leaf at Sonakata (EC 5.70dSm^{-1}) and Mg was lowest at Latachapli (EC 1.71dSm^{-1}) (Table-1 and Fig. 3). The concentrations of Ca, Mg, S and P in sweet gourd leaf were found higher at lower EC level of soil. Therefore salinity reduced the uptake of Ca, Mg, S and P in sweet gourd leaf and their concentration were increased simultaneously with the concentration present in soil (Table 1, Fig. 4 and 5). The K concentration was increased with the decrease of soil salinity. The uptake of K in sweet gourd leaf increased with the increase of K concentration in soil (Table 1 and Fig. 6).

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