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Nutrients Analysis of Salt Marsh Plant (*Spartina alterniflora*) at Moheshkhali Coastal Area, Cox's Bazar, Bangladesh

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Abstract:

The study on nutrients analysis of salt marsh grass *Spartina alterniflora* was conducted in the vicinity of Moheshkhali Coast, Cox's Bazar, Bangladesh. The experiment was laid out firstly quadrate methods then in Randomized Complete Block Design with a split plot arrangement of three was allotted to sub plots. Three (3) transects approximately 50m long was set in each site parallel to the shore and perpendicular to the creek. Every transect was 100m apart from previous one. Each transect will be drawn from the bank of the tidal creek and will be extended towards the upland. Transect 1 will be set in the upland (mid tide. mark) and Transect 3 will be set in the seaward position. Transect 2 will be set in the middle of each experimental plot. Three stations namely station -1,2,3. In each site quadrates (1 X 1 m^2) of same size will be set in the centre of each station for the collection of sample from each quadrates (30cm X 30cm) were hand collected using spade, hand corer, cutter, poly bag in different vegetative stages of salt marsh. The highest values of protein of *Spartina alterniflora* plant were recorded 12.35± 0.53%, 12.09±0.32% and 11.69±0.16% from station-1, station-2 and station-3 respectively. One factor analysis of variance (ANOVA) showed that the protein in salt marsh plant was significantly different between three stations are $p=0.5627(p>0.05)$. The highest values of fat of *Spartina alterniflora* plant were recorded 0.51± 0.05%, 0.45±0.04% and 0.40±0.04% from station-1, station-2 and station-3 respectively. One factor analysis of variance (ANOVA) showed that the fat of *Spartina alterniflora* plant was significantly different between three stations are $p=0.0187(P<0.05)$. The highest values of ash of *Spartina alterniflora* plant were recorded 21.30± 0.89%, 21.28±0.61% and 20.63±0.44% from station-1, station-2 and station-3 respectively. One factor analysis of variance (ANOVA) showed that the ash was significantly different between three stations are $p=0.607(P>0.05)$. The highest values of moisture of *Spartina alterniflora* plant were recorded 19.84± 0.78%, 20.50±0.54% and 21.1±0.07% from station-1, station-2 and station-3 respectively. One factor analysis of variance (ANOVA) showed that the moisture was significantly different between three stations are $p=0.00186(P<0.05)$. The present study guessed that the variations of nutrients were strongly correlated with the hydrological parameters as well as minerals of the salt marsh *(Spartina alterniflora)* plant and their growing bed of the Moheshkhali Coast near jetty, Cox's Bazar, Bangladesh and it requires more researches and analysis.

Keywords: Nutrients, Salt marsh plant, Protein, Fat, Ash, etc.

INTRODUCTION

Demand of ecological role depends on mainly its biochemical composition of plants. Protein is the prime constituents of any bios. Considering all these factors present investigations were carried out to determine the proximate biochemical composition (protein, fat, ash) of the salt marsh plants. Biochemistry concerns with the chemical reaction of living organisms. Four major types of compounds are found in the living organisms, namely protein, fat, carbohydrate and nucleic acid. Biochemical processes such as organic matter and nutrients accumulation, de-nitrification, and tidal export of nutrients may require ever longer developing to levels comparable to natural wetlands (Craft et al. 1993, 1991a). Craft et al. (1993) reported that, after 15 reconstructed *Spartina alterniflora* marshes contained significantly lower soil nutrient (N,P, organic C) reservoirs than in nearby natural marshes.

The salt marsh bed ranks among the most productive ecosystem on the earth. Live *Spartina alterniflora* is not a source of food but death plant are a source of nourishment for many species. Decaying *Spartina alterniflora* breaks into small pieces called detritus that fuel the marsh and the animals. In monsoon and spring, marshes are lush green, highly productive grow in height. In dry season the *spartina alterniflora* begin to turn brown as leaves die and decomposition begins. Water, wave, wind and storms dislodge and break up decaying leaves and transport them to mud flats and other location around the marsh and adjacent water ecosystem. This death plant matter and or detritus form an attachment site for microscopic organisms such as fungi, bacteria and small algae. These organisms colonize the broken bits of plant material and break down portions of the detritus that are not digestible by animals.

Aerial tissues of this plant are important as habitat and ultimate food source for marshes animal (Teal, 1962; Odum and De la cruz, 1971, 1988, Boes ch and Turner, 1984). Their Principal Value to soil stabilization, however, is as a carbohydrate source that fuels proliferation of surface tissues. It necessarily follows that soil condition conducive to growth of salt marsh stems and leave likely would be those that promote rapid soil stabilization. The salt marsh can also become a source of nutrients and contaminants. Temporary or local oxidation of the sediments can results in increased mineralization of the organic matter and in remobilization of contaminants. This oxidation can occur in dry periods, but might also be induced by soil oxidation due to rooting of plants (Giblinet et al, 1980, 1986) in contrast at it was recently suggested that an increased in iron or hydroxides in the soil, caused by oxidation of the Rizosphere of salt marsh plants, may lead to an increase in metal retainment by absorption of metals to this hydroxides (Ottes et al.,1993). If however remobilization takes place nutrients and contaminants can be released in drainage or flood water or can become available for uptake and accumulation by salt marsh plants (Otte et al, 1993) and animals (Banus et al. 1975). This can lead to a further transfer into the food wave via marine animals and birds. The salt marsh grasses play a vital role in processes and operating in coastal systems. It acts as an ecological buffer and provides a protected habitat for both marine and terrestrial organisms, some of which are endangered and protected. Physically it protects coastline from the erosive effects of storms and extreme tides. Traps and binds sediment aiding in the land making process. Hydro logically it support the water quality and maintenance of ground water. Economically salt marsh areas are grazed by cattle in the coastal regions of the south Asian countries. Salt marsh acts as filter, tidal creeks meander through the marsh transporting valuable nutrients as well as pollutants from up land development. Salt marsh can absorb or trap, a some of these pollutants, reducing the plant load entering estuary salt marsh also prevent sediments for washing off shore, after creating more land on which salt marsh can grow

In recent years, however, there has been increasing interest in this plant in connection with marsh creating projects (Broome et al, 1986, 1988; Padgett et al, 1998).

MATERIALS AND METHOD

Geographical location of the Study area

Moheshkhali Island in the Bay of Bengal, near Cox's Bazar is situated between 21°20′North and 21°45′ North and 91°50′ East and 92°01′ East. It has an area of 123 sq miles being 15-16 mile long and 7-8 mile broad. Through the center of the island and along the eastern coastline rise a range of low hills, about 300 ft high; but the coast, to the south east where the Moheshkhali jetty located, is a plain low lying tract of muddy loam and fringed by mangrove vegetation .In the hills on the eastern coast by the Moheshkhali channel which separates the Island from the mainland is built by the shrine of Adinath (Ahmed, 2010; Islam 2003).

The channel is located eastern side of the island and 172 km southeast away from Chittagong and 13 km northwest from Cox's Bazar and lies between 210 24' and $21^0$46' N, $91^0$5' and $91^0$59'E (Figure 1, Map showing the sampling stations).

The Moheshkhali jetty (pakka) is located at Gorokghata, about half kilometer southeast away from the Upazilla head quarter. The geographical location of the jetty is $21^0$31' N and $91^0$85' E.

The Moheshkhali jetty built in August 10, 1989, is about 853.44 meter in length and 6 meter in width and stands on a total 182 no. of R.C.C. steel made pillars in two rows. Landing platform of the jetty is 36.8-meter long and 3.45 meter wide (Water Review, 1989).Its surrounding is covered by mangrove vegetation and salt marsh vegetation. But the local people are destructing this mangrove vegetation and salt marsh vegetation to meet theirresult the island is in a great threat of natural disaster.

● Study Area

Figure 1 Map of Moheshkhai Upazilla, Cox's Bazar

(Source: www.googlemap.com)

Collection of Samples

Sample was collected from Moheshkhali Coast, Cox's Bazar, from September 2012 to July 2013. Spade, cutter, poly bag, hand corer, DO bottle, and marker were used for sample collection. The collected samples were placed in the pre-labeled plastic bags, bottle and brought back to the Institute of Marine Sciences and Fisheries (IMSF) laboratory. In laboratory, the samples were dried carefully by sun for 1 week for better result. Experiments were conducted in laboratory of IMSF, Chittagong University.

Determination of Protein from the plant sample

Principle

The protein content of the feed stuff is obtained by estimating the nitrogen content of the materials and multiplying the nitrogen value by 6.25 this is referred to as crude protein content. According to Kjeldahl methods-proteins are hydrolyzed to amino and with H_2SO_4. Further heating decomposes the amino acid releasing- Ammonia which immediately trapped on $(NH_4)_2SO_4$ and water. Micro kjeldhal

Method (kjeldhal, 1983) was to determine the crude protein.

Calculation

- % of Nitrogen = {(Volume of HCl×N. of HCl×14) ÷ Weight of sample)} × 100
- % of Crude Protein = % of Nitrogen × Conversion factor
- (Conversion factor for animal and plant origin are 6.25 & 5.90 respectively).

Determination of Crude fat from the plant sample

Fat is examined with low boiling organic solvent (petroleum ether/ diethyl ether, xylen) by soxhlet extraction and the extract thus obtained weighed after recovery of the solvent. Crude Fat was determined through Sox let Extraction Technique (Maynard, 1970) using hexane (65-70ºc B.P.) as the solvent.

Calculation

% of crude fat = {Corrected weight of fat ÷ Weight of sample) × 100

Determination of Ash from the plant sample

Ash is the residues of the inorganic matter (mineral) of the sample after burning. If the sample in a muffle furnace at 600ºc, the organic matter is evaporate and residues are called ash. Ash content of each feed was estimated by following incineration Method (Maynard, 1970).

Calculation

% of ash = (Weight of ash ÷ Weight of sample) × 100

Determination of Moisture of the plant sample

Moisture is an important, debutante of the nutrient of the feed or feed ingredients. It is necessary to know the moisture contents of the feed, because it has an important function determines the form of the diet. Moisture contents in the feed were determined by the following oven method (Lovell, 1989).

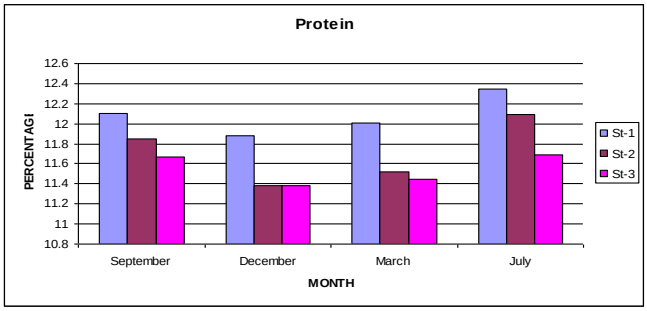
Calculation

The percentage of the moisture content in the sample was calculated by the following formulae:
% of moisture = {(Weight of original sample – Weight of dried sample) /Weight of original sample} × 100.

RESULTS AND DISCUSSION

Protein in salt marsh plant, Spartina alterniflora

The protein was determined from salt marsh (*Spartina alterniflora*) plant sample in dry basis. The percentage of protein recorded which range was 8.38 to 9.35 %.the highest value was recorded 9.35 % in July at the station -1 and the lowest value found in December 8.38 % at the station



Graph 1 the amount of protein (%) in dry basis of salt marsh plant (*Spartina alteniflora*) different month in different stations

At the station – 1 the highest value was recorded 9.35 % in July and the lowest value was recorded 8.88 % in December, At the station – 2 the highest value was recorded 8.85 % in September and the lowest value was recorded 8.09 % in July, At the station – 3 the highest value was recorded 8.69 % in July and the lowest value was recorded 8.38 % in December.

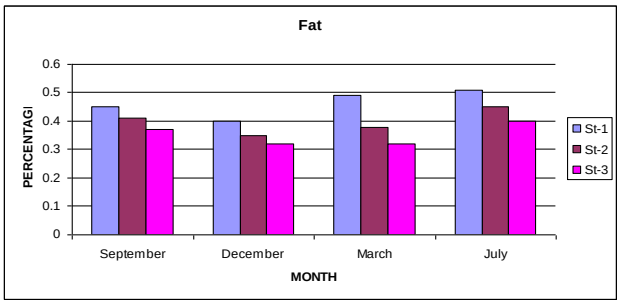
Correlation between Protein and Fat is 0.9839; Protein and ash is 0.7244 in the value from salt marsh plant *Spartina alterniflora* of Moheshkhali coast, Cox's bazar.

ANOVA Table 1 Protein in salt marsh plant, *Spartina alterniflora* in dry basis

ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.16625	2	0.083125	0.61323	0.562765	4.256495
Within Groups	1.219975	9	0.135553			
Total	1.386225	11				

Fat in salt marsh plant, Spartina alterniflora

The amount of fat was determined from salt marsh (*Spartina alterniflora*) plant sample in dry basis. The percentage of fat range was recorded 0.32 % to 0.51%.



Graph 2 the amount of fat (%) in dry basis of salt marsh plant (*Spartina alterniflora*) different month in different stations

The highest value was recorded in July 0.51 % at the station-1.the lowest value was recorded 0.32 % in December at the station -3. At the station – 1 the highest value was recorded 0.51 % in July and the lowest value was recorded 0.40 % in December, At the station – 2 the highest value was recorded 0.45 % in July and the lowest value was recorded 0.32 % in December, At the station – 3 the highest value was recorded 0.40 % in July and the lowest value was recorded 0.32 % in December and march.

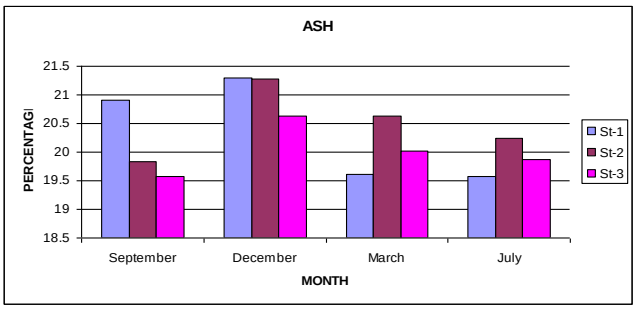
Correlation between Fat and protein is 0.9839; fat and ash is 0.5895 in the value from salt marsh plant *Spartina alterniflora* of Moheshkhali coast, Cox's bazar.

ANOVA Table 2 Fat in salt marsh plant, *Spartina alterniflora* in dry basis

ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.024467	2	0.012233	6.391872	0.018728	4.256495
Within Groups	0.017225	9	0.001914			
Total	0.041692	11				

Ash in salt marsh plant, Spartina alterniflora

The percentage of ash of dried salt marsh (*Spartina alterniflora*) plant sample was determined. The range of ash found 19.58 % to 21.30 %.



Graph 3 the amount of ash (%) of dried sample of salt marsh plant (*Spartina alterniflora*) different month in different stations

The highest value was recorded as 21.30% in December at the station-1 and the lowest value was recorded in July as 19.58 % at the station-1.

Correlation between ash and protein is 0.7244; ash and fat is 0.5895; ash and moisture is -0.6648 in the value from salt marsh plant *Spartina alterniflora* of Moheshkhali coast, Cox's bazar.

ANOVA Table 3 Ash in salt marsh plant, S*partina alterniflora* in dry basis

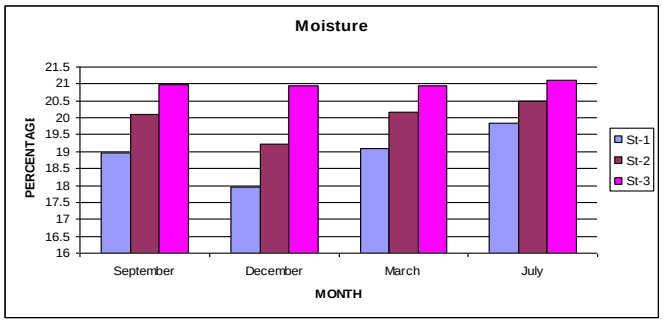
ANOVA						
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.477017	2	0.238508	0.527638	0.607181	4.256495
Within Groups	4.068275	9	0.452031			
Total	4.545292	11				

Table 4 Correlation within biochemical composition of the salt marsh *Spartina alterniflora* plant

	Protein (%)	Fat (%)	Ash (%)
Protein (%)	1		
Fat (%)	0.9839	1	
Ash (%)	0.7244	0.5895	1

Moisture in salt marsh plant, Spartina alterniflora

The percentage of moisture of dried salt marsh (*Spartina alterniflora*) plant sample was recorded the moisture range was 17.96 % to 21.10 %.



Graph 4 the amount of moisture (%) of dried sample of salt marsh plant (*Spartina alterniflora*) different month in different stations

The moisture range was 17.96 % to 21.10 %.the highest value was recorded 21.10 % in July at the station-3 and lowest value was recorded as 17.96 % in December at the station -1.

Correlation between moisture and protein is -0.9966; moisture and fat are -0.9953; moisture and ash is -0.6648 in the value from salt marsh plant *Spartina alterniflora* of Moheshkhali coast, Cox's Bazar.

ANOVA Table 5 Moisture in salt marsh plant, *Spartina alterniflora* in dry basis

ANOVA

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	8.222017	2	4.111008	13.69284	0.001862	4.256495
Within Groups	2.702075	9	0.300231			
Total	10.92409	11				

Protein content in salt marsh plant, Spartina alterniflora (Dry basis)

The protein was determined from salt marsh (*Spartina alterniflora*) plant sample in dry basis. The percentage of protein recorded which range was 11.38 to 12.35 %. Protein content of the vegetables (leaves) is varying from 5.5% to 16%.

Table 6 Variation of protein of some algae and vegetables plants

Plants/algae	Protein (%)	Author
Catenella nipae (algae), Fauzdarhat.	15.63-16.25	Zakir (2005)
Spartina alterniflora. Moheshkhali.	11.38-12.35	This study

Fat content of the salt marsh plant, Spartina alterniflora (Dry basis)

The percentage of fat range was recorded 0.32 % to 0.51%. The highest value was recorded in July 0.51 % at the station-1.the lowest value was recorded 0.32 % in December at the station -3. At the station – 1 the highest value was recorded 0.51 % in July and the lowest value was recorded 0.40 % in December, At the station – 2 the highest value was recorded 0.45 % in July and the lowest value was recorded 0.32 % in December, At the station – 3 the highest value was recorded 0.40 % in July and the lowest value was recorded 0.32 % in December and march.

Table 7 variation of fat content among some vegetables and algae

Plants/algae	Fat(%)	Author
Catenella nipae (algae),Fauzdarhat.	1.40-2.07	Zakir (2005)
Spartina alterniflora,Moheshkhali.	0.32-0.51	This study

Ash in salt marsh plant, Spartina alterniflora (Dry basis)

The percentage of ash of dried salt marsh (*Spartina alterniflora*) plant sample was determined. The range of ash found 19.58 % to 21.30 %.the highest value was recorded as 21.31% in July at the station-1 and the lowest value was recorded in July as 19.58% at the station-3.

Table 8 variation of ash of some vegetables and algae plants

Plants/algae	Ash (%)	Author
Catenella nipae (algae),Fauzdarhat	17.02-19.21	Zakir(2005)
Spartina alterniflora,Moheshkhali	19.58-21.30	This study.

Moisture in salt marsh plant, Spartina alterniflora (Dry basis)

The percentage of moisture of dried salt marsh (*Spartina alterniflora*) plant sample was recorded .the moisture range was 17.96 % to 21.10 %.the highest value was recorded 21.10 % in July at the station-3 and lowest value was recorded as 17.96 % in December at the station -1.

Table 9 variation of moisture of some vegetables and algae plants

Plants/algae	Moisture (%)	Author
Catenella nipae (algae), Fauzdarhat.	17.16-17.87	Zakir (2005)
Spartina alterniflora, Moheshkhali.	17.96-21.10	This study.

CONCLUSIONS

The biochemical composition is related to the seasonal changes. During rainy season the pore water temperature relatively moderate, the water salinity is lower, the pore pH is alkaline and dissolve oxygen is higher. For this condition protein, fat, ash and moisture found higher than other seasons.

After rainfall, October-November, the protein, fat, ash and moisture are found relatively lower than other seasons. Because the pore water DO, temperature, pH is lower and salinity is higher.

In winter season December to January the pore water turn in to acidic (pH=6.4) and the salinity will be highest, DO is the lowest. The nutrients (NO_2-N, PO_3-P, and Ca) are higher than other season. So the approximate composition is relatively lower than other seasons found in the salt marsh plant analysis in dry basis.

The present investigation is a baseline study for *Spartina alterniflora* in the southeastern coastal area of Bangladesh. This information is useful for *Spartina alterniflora* importance of Bangladesh and also other tropical countries of the world.

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