Bangladesh J. Environ. Sci., Vol. 37, 94-97, 2019 **@ BAED ISSN 1561-9206**

EVALUATION OF SOIL HEALTH IN CONSTRUCTION SITES OF DEVELOPING COASTAL AREAS OF BANGLADESH

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ABSTRACT

The study was carried out taking soil samples from civil construction sites at polder 35/1 in Sharankhola upazila of the Bagerhat district during the period of February to June 2018. The Polder 35/1 is closest to the Sundarban and located in Sharankhola and Morelganj upazilas under Bagerhat District. A total of 15 soil samples were collected from five selected areas of polder 35/1, where dike upgrading works are being carried out. Three samples from every place and mixed together. Five composite samples were finally prepared. The collected soil samples (collected in 0-15 cm depth) processed for laboratory for determining their chemical properties according to standard method from Consultancy Research & Testing Services (CRTS), Khulna University of Engineering & Technology (KUET), Khulna-9203. The results obtained from this study showed that the N content of the soil was very low. The available P and K in the soil of the soil varied from 1.10-3.82 μg/g and 0.02 to 0.30 meq/100 g of soil, respectively. The available S varies greatly from location to location and ranged from 117 to 273 μg/g. i.e. very high level S was detected in all cases. This was mainly due to the frequent relocation of diesel-using vehicles that were engaged in dike upgrading activities. The available Zn content was 0.734 μg/g, seemed the low level of Zn in the studied soils. Environmental pollution is as old as civilization itself. It has become a major concern in recent decades. In this case top soil management must be ensured and minimum diesel pollution is highly recommended.

Key words: Soil nutrients, embankment, construction site.

Introduction

Bangladesh has recently made impressive gains in key indicators for human development. According to the 2008 statistical update of the UNDP Human Development Index, Bangladesh ranks 147 out of 179 countries with an HDI score of 0.524, making the country as development country. But although Bangladesh has taken these significant steps towards poverty reduction, there are still many challenges. More than 63 million people live below the poverty line. Bangladesh faces major challenges to support and build on the achievements of the past decade, and to stay on track to meet its sustainable development goals (SDGs). Environmental pressures, exacerbated by climate change, remain significant and can be easily implemented if corrective action is not a task at local and global level. While the population is expected to stabilize at around 200 million, the growing wealth and migration will put further pressure on ecosystems and the living environment. The problem has therefore arisen from the accumulated greenhouse gas emissions in the atmosphere, which are anthropogenically generated by long-term and intensive industrial growth and lifestyles with high consumption in developed countries. Although the international community must be constantly involved in dealing with this threat collectively and cooperatively, Bangladesh needs a strong national strategy to adapt firstly to climate change and secondly to further improve the environmental sustainability of its development path. This path is based on its unique resources, the highest priority of economic and social development and poverty reduction, and its compliance with its legacy of civilizations that place a high value on the environment and maintain ecological balance. WARPO (2006) predicted that the sea level rise (SLR) could be increased by 14, 32 and 88 cm in 2030, 2050 and 2100, respectively, which could overflow about 8, 10 and 16% of Bangladesh's total land mass respectively. DOE (2001) predicted in various studies that sea level in the Bay of Bengal could rise by 0.3 to 1.5 m by 2050. Any change in the current spatial and temporal variation of salinity will be the biophysical system of the coastal area. In the 1960s, modernization in the country's coastal zone began to turn this area into permanent agricultural lands to increase agricultural production. The polders in this area are surrounded on all sides by dikes or embankments, separate the land from the main river system and offer protection against floods, salinity intrusion, and sedimentation. Without dikes, the coastal communities would be exposed to daily tidal floods. These polders are equipped with inlet and outlet sluice doors to control the water in polder area. The polders have played a crucial role in protecting the coastal area; ensuring and increasing agricultural production; improving the livelihood of people; and limiting environmental damage. But these are vulnerable to storm tides; high tide; annual floods; land erosion and congestion of drainage. Changes in the land use pattern have created water management conflicts and newer dimension needs require the structures to make water flow in both directions. The maintenance of the polder system with slopes and structural elements has therefore become of continuing importance. The GoB, either with the help of international donors and credit institutions, or from its own resources, has spent money on a regular basis to keep the Polders in good condition and ultimately save the coastal community. The Coastal Embankment Improvement Program (CEIP) that is being implemented by the Bangladesh Water Development Board (BWDB) is one of the newest interventions to tackle systematic restoration and upgrading of the polder systems in the coastal region of Bangladesh.

However, it is recognized that construction workers are exposed to a wide range of environmental hazards. Hazard is seen as the situation that in certain circumstances can lead to damage. The severity of the hazard, the amount, duration and frequency of exposure to the hazard affects human health. Hazards may exist in the form of equipment-related hazards, water-related hazards, sanitary hazards, chemical-related hazards, use of soil for dike re-sectioning and other hazards. Despite the recognition that environmental issues are important to the survival of the construction industry, the industry continues to degrade the environment, exploiting resources and generating waste, and is slow to change its conventional practices to incorporate environmental matters as part of its decision making process (Ahmed and Rahman, 2015). So, the study was designed to evaluate the overall the soil health status in construction site that is expedient for sustainable crop production. It needs to be continued as the part of developing Bangladesh.

Materials and Methods

The study was carried out taking soil samples from civil construction sites at polder 35/1 in Sharankhola upazila of the Bagerhat district during the period of February to June 2018. The Polder 35/1 is closest to the Sundarban and located in Sharankhola and Morelganj upazilas under Bagerhat District. The total length of the dike/ embankment in the polder is 62.50 km and the design top level is 4.88 m PWD. It has 14 drainage sluices and 23 flush inlets that run through a drain of 56.00 km in the polder. The gross protected area is 13,058 ha and the net beneficiary area is 10,700 ha. The dike and water control structures as well as the drainage channels have performance limitations due to the low crest height of embankment, damage to the structures and sludge deposits in the drainage channels. The design of the top level has always been proposed up to 5.50 m to 6.00 m PWD under CEIP. A total of 50.00 ha of land have been proposed for acquisition to improve the polder. The project proposed afforestation on an estimated 22.00 ha of land along the improved dike as a protective green strip. A total of 15 soil samples were collected from five selected places in polder 35/1, where the dike works are being carried out (starting from Km. 28.00 and ended to km. 51.00). Three samples from every place and mixed together. Five composite samples were finally prepared. The collected soil samples (0-15 cm depth) were sealed tightly as quickly as possible in a labeled polythene bag to prevent exposure to air. After collecting the soil samples, the stones, gravel, pebbles, plant roots, leaves, etc. were removed and then half of the soil was air dried and the rest of the soil was oven dried, well mixed and ground to a 10 mesh screen. Thereafter, the processed soil samples were analyzed for their chemical properties following the standard method in Consultancy Research & Testing Services (CRTS), Khulna University of Engineering & Technology (KUET), Khulna-9203. Semi-microkjeldahl method was used for the analysis of total nitrogen (Page *et al*., 1989). Available P was determination by Bray and Kurtz method (Bray and Kurtz, 1945). Available K and S were analyzed by the method described by Page *et al.* (1989). Zn was determined by DTPA extracting solution as outlined by Peterson (2002). The collected data were analyzed statistically by F-test to ascertain the soil quality and ranked by Duncan’s Multiple Range Test (DMRT).

Results and Discussion

The collected soil samples were analyzed to know the prevailing nutritional status of crop field soils, where a lot of soils are being used for Polder up gradation works. The analytical results expressed that amount of nitrogen varied from 0.08-0.17%, which ensured the very low-low nitrogen status in the soil around the dike area of polder 35/1 (Tables 1-2). These results came very close to the findings of Portach and Islam (1984) and BARC (1997), where it was reported that hundred percent soil of Bangladesh contained N below the critical level. The available phosphorus in different soils is shown in Table 1. In surface soils, the available phosphorus content varied from (1.10 to 3.82 µg/g) with the average values of 2.426 µg/g. The results showed that the phosphorus status was quite low and only low at Sonatola (Table 2). Portch and Islam (1984) reported that 41% of Bangladeshi soil contains phosphorus below the critical level and 35% below the optimum level. In surface soils, the exchangeable K content varied from (0.02 to 0.30 meq/100g of soil) with the average values of 0.114 meq/100g of soil. The k level was found to be very low to optimum level. These findings have been agreed by Biswas (2008). Results presented in Table 1 showed that the available S varies greatly from location to location. It ranged from 117 to 273 µg/g. i.e. very high level S was found in all cases. This was mainly due to the frequent relocation of diesel-using vehicles that were busy for upgrading the dike. The available Zn content varied from one location to another. It varied from 0.51 to 0.87 µg/g with the average Zn content as 0.734 µg/g. These results ensured the low level of Zn in the studied crop soils around the newly constructed/improved dike. However, environmental pollution is as old as civilization itself. It has become a major concern in recent decades. In this case top soil management can be guaranteed and minimum diesel pollution is highly recommended.

Table 1. Soil nutrient status in different specific locations at polder 35/1 in Sharankhola upazila of Bagerhat district

Sampling site/ Location	Embankment Chainage*	Soil nutrient status				
		Nitrogen (%)	Phosphorus (µg/g)	Potassium (meq/100g)	Sulfur (µg/g)	Zinc (µg/g)
Sharankhola	km. 28.00	0.13	3.60	0.02	119	0.72
Sonatola	Km. 33.00	0.17	3.82	0.16	276	0.81
Rasulpur	Km. 38.00	0.13	2.49	0.04	173	0.87
Bolarpar	Km. 44.00	0.08	1.10	0.30	127	0.76
Rajapur	Km. 51.00	0.16	1.12	0.05	117	0.51
Mean		0.134	2.426	0.114	162.40	0.734

* Km. 0.00 started nearest from Shannashi khal (DS-1) of Polder 35/1.

Table 2. Soil nutrient value for loamy to clayey soils of wetland rice crops in Bangladesh (FRG, 2005)

Nutrient	Measurement unit	Bangladesh Standard					
		Very low	Low	Medium	Optimum	High	Very high
Nitrogen (N)	%	<=0.09	0.091-0.180	0.181-0.270	0.271-0.360	0.361-0.450	>0.450
Phosphorus (P)	µg/g	<=3.75	3.751-7.50	7.51-11.25	11.251-15.00	15.10-18.75	>18.75
Potassium (K)	meq/100g	<=0.075	0.076-0.15	0.151-0.225	0.226-0.30	0.31-0.375	>0.375
Sulfur (S)	µg/g	<=9.0	9.1-18.0	18.1-27.0	27.1-36.0	36.1-45.0	>45.0
Zinc (Zn)	µg/g	<=0.45	0.451-0.90	0.91-1.35	1.351-1.80	1.81-2.25	>2.25

Acknowledgement

The authors are very grateful to the BWDB & CEIP-1 official for providing support and the necessary information to prepare this manuscript. Without their information this would be impossible.

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