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M.A.W. SARKAR, M.H. KABIR*, S.A. LIRA, A. RAZZAQUE AND M.R.H. SARKER

Department of Environmental Science and Resource Management, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh.

*Corresponding author & address: Md. Humayun Kabir, E-mail: lhkabir0910007msu@gmail.com
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ABSTRACT

Sarkar MAW, Kabir MH, Lira SA, Razzaque A, Sarker MRH (2016) Comparison of soil nutrients status between an agricultural land close by brickfield and a productive agricultural land for agricultural activities in Sadar Upazilla, Sherpur, Bangladesh. *J. Soil Nature* 9(1), 8-12.

The study was conducted to compare the soil nutrients status between productive agricultural lands and an agricultural land close by brickfields at Bajitkhila union of Sherpur Sadar upazilla in Bangladesh during the period from November 2014 to May 2015. The soil samples were collected from the ten sampling points of each type of studied land areas where the depth of the soil layer was 0-15 cm. The study revealed that the pH, organic matter, total nitrogen, available phosphorus, available sulphur, available zinc, total iron and available boron of productive agricultural lands were ranged from 6.0-6.4, 2.0-2.7%, 0.10-0.18 µg g^{-1} soil, 6.30-9.40 µg g^{-1} soil, 28.10-37.44 µg g^{-1} soil, 1.22-1.86 µg g^{-1} soil, 323.2-376.4 µg g^{-1} soil and 0.37-0.64 µg g^{-1} soil, respectively. The study also showed that the pH, organic matter, total nitrogen, available phosphorus, available sulphur, available zinc, total iron and available boron of agricultural land close by brickfields were ranged from 5.5-5.9, 1.3-1.9%, 0.05-0.09 µg g^{-1} soil, 3.20-5.90 µg g^{-1} soil, 14.44-25.56 µg g^{-1} soil, 0.53-0.93 µg g^{-1} soil, 235.23-292.40 µg g^{-1} soil and 0.18-0.29 µg g^{-1} soil, respectively. The overall study stated that the soil nutrients of productive agricultural lands were within the suitable limit for agricultural production whereas the soil nutrients of agricultural land close by brickfields were not within the suitable limit for agricultural activities. Due to illegal brick field activities the soil nutrient contents of the surrounding areas of brick fields are much lower than the productive agricultural land. Careful measures such as to developed brickfield management system should be adapted to achieve the suitable quality of soil for agricultural activities.

Key words: *brickfield, soil nutrient, agricultural field soil*

INTRODUCTION

Soil is a natural resource for which there is no substitute. Soil is formed from the parent material by physical and chemical weathering of rocks (Yahaya *et al*. 2009). It is an essential component of the terrestrial ecosystem of the earth. Properties of soil that make it useful by providing water, nutrients and anchorage for plants and trees in natural forests and grasslands, annual and perennial crops and planted grassland, provides the habitat for decomposer organisms (Wild 1996). Brick kiln is one of the principal agents of top soil degradation and environmental pollution. Brick kilns are destroying large areas of lands every year especially in Bangladesh (Rahman and Khan, 2001). However, brickfields cause crop loss, corrosion of metallic content of soil and loss of soil fertility. The top soil nutrient elements and biota are destroyed through the brick burning. It also makes the land unusable for cultivation up to several years (Khan *et al*. 2007). It also largely influences the concentration of greenhouse gases in the atmosphere (IUSS 2002). Bangladesh is an agro-based country and most of the people of the country are poor and depend on agriculture (Banglapedia 2008). Demand of crop production is increased day by day for increased people but the agricultural land is decreasing due to various natural and anthropogenic activities (Yahaya *et al*. 2009). Urbanization is one of the most important reasons for decreasing agricultural lands which requires brick and there are about 6000 brick manufactures in Bangladesh (Banglapedia 2008). Unplanned and rapid increasing of brickfields change the physical, chemical and biological properties of soil and country suffer from various problems like nutrient deficiency or toxicity of soil, improper soil and crop management, alteration of agricultural land and many others (Hassan *et al*. 2012). Soil pollution adversely affect the agricultural land such as loss of productivity of soil, damage of crop production and most important the effects on soil nutrients (Ahmed 2002). Agricultural crops can also be injured when exposed to high concentrations of various air pollutants. Injury ranges from visible markings on the foliage to premature death of the plants (Gheorghe and Ion, 2012).

The Bajitkhila union of Sherpur Sadar upazilla of Sherpur district in Bangladesh is experiencing the rapid and illegal development of bricks industry by influential local persons (The Daily Star 2010). Most of these illegal brick fields are developed at or adjacent to the productive agricultural lands which is supposed to fostering the degradation of agricultural productivity and the environmental quality. Keeping this view in mind, the study was conducted to assess the soil properties and nutrient status in productive agricultural lands and agricultural lands adjacent to brickfields area and compare the soil nutrients between of these lands of Bajitkhila union of Sherpur district.

MATERIALS AND METHODS

Study area

This study was conducted agricultural land close by brickfield (ALB) and another productive agricultural land (PAL) at Bajitkhila union in Sherpur Sadar Upazila of Bangladesh. It is located in between 24°55' and 25°06' north latitudes and in between 89°53' and 90°07' east longitudes. The climate of the study area is characterized by high temperature, high humidity and heavy rainfall with occasional gusty winds during *kharif* season (February-September) and low rainfall and moderately low temperature in the *rabi* season (October-January). The area is a part of the old Brahmaputra Floodplain tract, characterized by high, undulated land surface with sandy soil, criss crossed by flood plains and streams (Banglapedia 2015).

Sample collection

The total twenty (20) soil samples were collected from the study area, among them ten (10) samples were collected from ALB and the rest of ten (10) samples were collected from PAL. The soil samples were denoted as S1, S2, S3, S4, S5, S6, S7, S8, S9 and S10 which were collected at a minimum distance (approximately 40 meter) of the ALB and PAL site. The soil samples were collected from the depth layer of 0-15 cm. The samples were scraped from the top to bottom with the help of an auger. Each of the samples were mixed thoroughly and kept separately on a brown paper. About 500 g soil was collected from each paper to give a representative sample which placed in a sealed polythene bags and labeled including collection date, location and code number. The collected soil samples were carried to the laboratory of the Soil Resource Development Institute (SRDI), Jamalpur, Bangladesh.

Preparation of soil sample

The soil samples were then placed in a thin layer on a clean piece of paper on a shelf in the room for air drying. The visible roots, plant fragments and other types of solid wastes were removed from the soil samples. For the preparation of soil samples, soil was passed through the grinder and subsequently, a 2 mm stainless sieve. After that, the soil samples were kept in a clean polythene bag for chemical analysis.

Sample analysis

In the study, the soil pH was measured by Soil pH meter (Soil pH and Moisture Meter ZD% PM 0909). The organic matter (OM) content was analyzed by wet oxidation method (Walkley and Black, 1934). The iron (Fe) was determined by rapid colorimetric technique (Imam and Didar, 2005). Total nitrogen (N) content of soil was determined by semi-microkjeldahl method. Available soil phosphorus (P) was determined by Olsen's method. The samples were read with the help of a spectrophometer at 660 nm wave length. The sulphur (S) was analyzed by calcium chloride extraction method (Sattar and Rahman, 1987). Available zinc (Zn) was determined by atomic absorption spectrophotometer (AAS, UNICAM 969) at the wavelengths of 213.9 (Huq and Alam, 2005). The boron (B) was analyzed according to hot-water extraction method by dilute calcium chloride solution (Wolf 1971). The collected data were analyzed by using the software MS Excel.

RESULT AND DISCUSSION

pH: The pH value of PAL were ranged from 6.0-6.4 with an average value of 6.18 (standard deviation, SD±0.15) where the pH value of ALB were ranged from 5.5-5.9 with an average value 5.68 (SD±0.12) (Table 1). According to SRDI (2009) the range of pH value for agricultural production in Bajitkhila land is 5.7-7.4 (Table 2). The result of the study stated that the pH value of ALB was slightly acidic for agricultural activities whereas the pH value of PAL was suitable for agricultural production. The study conducted by Khan *et al.* (2007) on degradation of agricultural soils arising from brick field burning in western part of Bangladesh showed that burning of soils significantly decreased the mean pH values of soils by 0.4.

Table 1. Soil properties of agricultural land close by brickfield (ALB) and a productive agricultural land (PAL) at Bajitkhila union of Sadar Upazilla, Sherpur, Bangladesh

SP.	Parameters											
	pH		OM (%)		Total N (%)		P (μg g^{-1} soil)		S (μg g^{-1} soil)		Zn (μg g^{-1} soil)	
	ALB	PAL	ALB	PAL	ALB	PAL	ALB	PAL	ALB	PAL	ALB	PAL
S1	5.7	6.1	1.4	2.2	0.07	0.10	4.40	8.20	24.75	37.44	0.82	1.48
S2	5.6	6.0	1.8	2.5	0.07	0.11	4.10	8.00	17.76	34.58	0.62	1.72
S3	5.5	6.2	1.5	2.0	0.05	0.10	3.90	6.60	14.64	37.09	0.53	1.22
S4	5.6	6.2	1.7	2.1	0.06	0.12	3.50	7.30	19.77	32.15	0.84	1.45
S5	5.9	6.4	1.9	2.7	0.08	0.14	3.20	9.40	22.89	32.96	0.93	1.86
S6	5.7	6.1	1.8	2.6	0.07	0.13	3.70	8.70	25.56	33.27	0.82	1.28
S7	5.6	6.3	1.6	2.4	0.09	0.18	3.70	7.80	20.86	29.95	0.60	1.24
S8	5.8	6.1	1.3	2.2	0.07	0.17	5.60	6.30	22.78	28.10	0.84	1.45
S9	5.8	6.4	1.7	2.4	0.06	0.14	3.40	8.10	18.10	30.24	0.72	1.58
S10	5.6	6.0	1.9	2.6	0.07	0.12	5.90	7.40	16.99	28.96	0.66	1.65
Max.	5.9	6.4	1.9	2.7	0.09	0.18	5.90	9.40	25.56	37.44	0.93	1.86
Min.	5.5	6.0	1.3	2.0	0.05	0.10	3.20	6.30	14.64	28.10	0.53	1.22
Mean	5.68	6.18	1.66	2.37	0.07	0.14	4.22	7.80	20.36	32.52	0.74	1.49
SD(±)	0.12	0.15	0.20	0.23	0.01	0.03	1.02	1.06	3.99	3.54	0.13	0.21

Note: Sampling point (SP) = S1-S10; SD = Standard Deviation

Organic Matter (OM): The average OM value of PAL was 2.37% (SD±0.23) where the average OM value of ALB was 1.66% (SD±0.20). The OM values of PAL were ranged between 2.0-2.7% while the OM values of ALB were ranged between 1.3-1.9% (Table 1). SRDI (2009) reported that the suitable OM values of Bajitkhila agricultural soils ranged from 2.00-4.00% (Table 2). The study revealed that OM value of PAL was within the standard limit for good yield production were the OM value of ALB was lower than the suitable limit for agricultural production. Sharmin *et al*. (2015) reported that OM values are decreased gradually in the brick field soil sites.

Total Nitrogen (N): The total N content of the PAL and ALB were ranged from 0.10-0.18% and 0.05-0.09%, respectively whereas the average N content of PAL and ALB was 0.14% (SD±0.03) and 0.07% (SD±0.01), respectively (Table 1). The standard values of total N content in Bajitkhila agricultural soils were ranged from 0.13-0.19% (Table 2). The result of the study depicted that the N content of PAL was within the suitable limit but N content values of ALB were much lower than the suitable limit for agricultural production. Khan *et al.* (2007) asserted that loss of this valuable soil component is due to the burning of agricultural top soils amounted 53-63% for soil organic matter.

Available Phosphorous (P): The available P content of the PAL was fluctuated between 6.30-9.40 µg g^{-1} soil with an average value of 7.80 µg g^{-1} soil (SD±1.06). Similarly, the available phosphorous content of the ALB were varied between 3.20-5.90 µg g^{-1} soil with a mean value of 4.22 µg g^{-1} soil (SD±1.02) (Table 1). The available phosphorous content of PAL was higher than the ALB (Table 1). According to the SRDI (2009) the range of available phosphorous content in Bajitkhila agricultural soils were ranged from 10.51-15.75 µg g^{-1} soil (Table 2). On the basis of the study, the available phosphorous content of both PAL and ALB were not within the suitable range for agricultural activities. Ahamed *et al.* (2014) reported that due to illegal brick field activities the available phosphorous content of the surrounding areas of brick fields are decreased gradually.

Available Sulphur (S): The value of available S content were ranged from 28.10-37.44 µg g^{-1} soil and 14.64-25.56 µg g^{-1} soil of PAL and ALB soils, respectively. The mean available sulphur (S) content was 32.52 µg g^{-1} soil (SD±3.54) and 20.36 µg g^{-1} soil (SD±3.99) in PAL and ALB, respectively (Table 1). The standard value of available S content for crop cultivation is 31.5 µg g^{-1} soil and the critical value is 10 µg g^{-1} soil (BARC 2012). According to SRDI (2009) the range of available S content in agricultural land of Bajitkhila was recorded 22.51-37.50 µg g^{-1} soil (Table 2). The study also showed that the available S content of the land close by brick field area was not within the suitable range for agricultural activities.

Available Zinc (Zn): The study revealed that the available Zn content of the PAL were ranged from 1.22-1.86 µg g^{-1} soil with an average available Zn content was 1.49 µg g^{-1} soil (SD±0.21) whereas the available Zn content of ALB ranged from 0.53-0.93 µg g^{-1} soil with an average available Zn content was 0.74 µg g^{-1} soil (SD±0.13) (Table 1). SRDI (2009) reported that the suitable range of available Zn content in agricultural land of Bajitkhila was 1.35-2.25 µg g^{-1} soil (Table 2). The study depicted that the available Zn content of the PAL was within the suitable limit as well as suitable for agricultural production while the ALB showed the lack of available Zn content for agricultural activities. Hodges (2001) reported that as soil pH increases, Zn availability decreases. That the study showed that in agricultural land close by brick field soil pH was increased and Zn concentration was decreased.

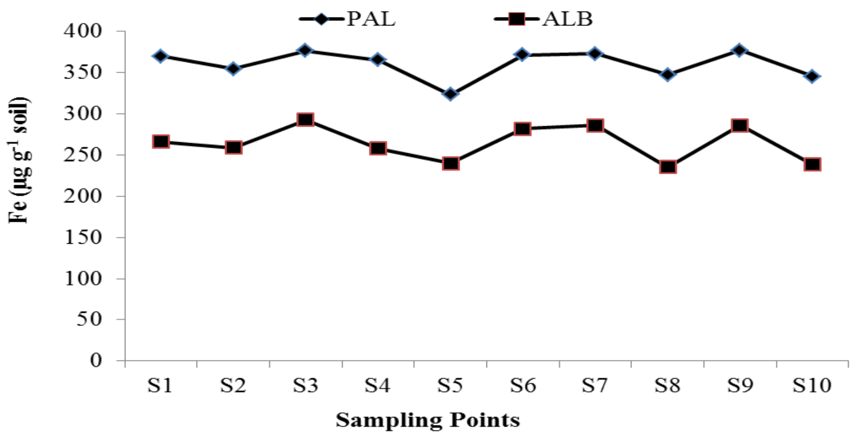

Fig. 1. The total Fe content of the different sampling points of PAL and ALB

Total Iron (Fe): The total Fe content of the PAL was fluctuated between 323.2-376.4 µg g^{-1} soil with an average value of 359.95 µg g^{-1} soil (SD±17.36). Similarly, the total Fe content of the ALB were fluctuated between 235.23-292.4 µg g^{-1} soil with an average value of 264.05 µg g^{-1} soil (SD±21.59). The total Fe content of the PAL was higher than the ALB (Fig. 1). According to SRDI (2009) the range of total Fe content of Bajitkhila soils recorded as 22-81 µg g^{-1} soil which were lower than PAL and ALB (Table 2). Ahamed *et al.* (2014)

reported that due to brick field activities the total Fe content of the surrounding areas of brick fields are much lower than the productive agricultural land.

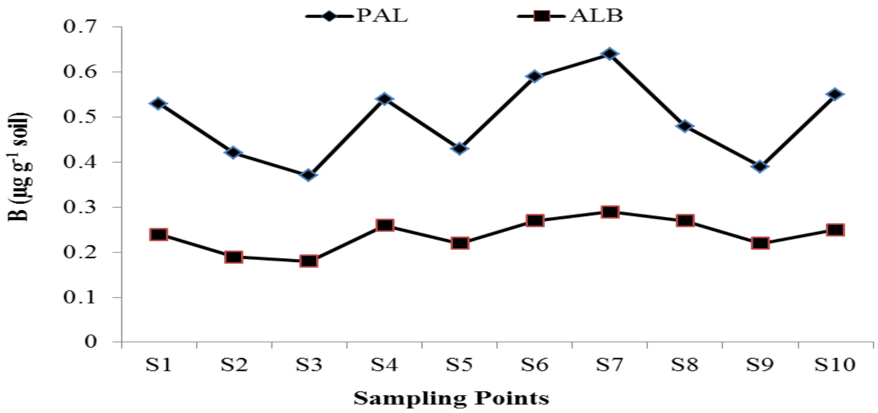

Fig. 2. The total B content of the different sampling points of PAL and ALB

Available Boron (B): The mean concentration of available B of PAL and ALB was found 0.49 and 0.23 µg g^{-1} soil, respectively. The study revealed that the highest available B content (0.64 µg g^{-1} soil) in the PAL was found at the sampling point S7 and in the ALB the highest available B content (0.29 µg g^{-1} soil) was found at the point S7 while the lowest available B content (0.37 µg g^{-1} soil) in PAL soils was recorded at the point S3 and in the ALB soil the lowest available B content (0.18 µg g^{-1} soil) was found at the point S3 (Fig. 2). SRDI (2009) reported that for agricultural activities the available B content of Bajitkhila soil should be 0.45-0.60 µg g^{-1} soil (Table 2). The study showed that in productive agricultural soil the available B content was within the suitable limit whereas agricultural field close by brick field soil showed lower level of available B content. Sharmin *et al*. (2015) reported that available B content of agricultural field soil is higher than the brick field soil.

Table 2. Comparison of present soil nutrient properties with the standard limit of Bajitkhila

Parameters	Unit	Standard limit of agricultural land in Bajitkhila (SRDI 2009)	Present study of Bajitkhila	
			PAL	ALB
pH	-	5.7-7.4	6.0-6.4	5.5-5.9
OM	%	2.00-4.00	2.0-2.7	1.3-1.9
Total N	µg g^{-1} soil	0.13-0.19	0.10-0.18	0.05-0.09
Available P	µg g^{-1} soil	10.51-15.75	6.30-9.40	3.20-5.90
Available S	µg g^{-1} soil	22.51-37.50	28.10-37.44	14.44-25.56
Available Zn	µg g^{-1} soil	1.35-2.25	1.22-1.86	0.53-0.93
Total Fe	µg g^{-1} soil	22-81	323.2-376.4	235.23-292.40
Available B	µg g^{-1} soil	0.45-0.60	0.37-0.64	0.18-0.29

CONCLUSION

The study revealed that brick kilns are not only destroying large areas of lands, but also causing the loss of organic matter and nutrients in the soil. In this regard, the study showed that the value of pH, organic matter, total nitrogen, available phosphorus, available sulphur, available zinc, total iron and available boron of agricultural land close by brick field were much lower than the productive agricultural land. The study also depicted that areas adjacent to the brick fields are not suitable for agricultural activities. Therefore, to minimize soil nutrients loss and soil degradation, this study suggested that some appropriate steps should be taken as: brick field should be made near the at the river; farmers should not sold soil from agricultural land for brick manufacturing, and restoring organic matter could be an important remedial measure. However, as a cheaper and readily available source of organic matter, farmyard manure has to be applied in higher quantities so as to offset the negative impact of brick manufacturing adjacent to the agricultural fields.

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