Original Research Article

A comparative assessment of series wise soil fertility in Bheramara upazilla of Kushtia district between the years 1995 to 2016

ABSTRACT

Aims: To quantify the changes in soil fertility in terms of available nutrient content, to determine the changes in organic matter content and to assess the changes of soil P^H over time period.
Study Design: The design of the study is a randomized complete block design.
Place and Duration of Study: Bheramara upazilla of Kuahtia district in Bangladesh; between the years 1995 (considered as base line database) to 2016.
Methodology: Soil Resource Development Institute (SRDI) has conducted semi-detailed soil survey at Bheramara upazilla of Kushtia district in 1995 and collected 18 soil samples and analyzed in the laboratory for chemical parameter. These data base considered as base line database for the present study (2016) and 18 soil samples were collected from the same or adjacent sampling point of 1995. Land use, use of organic matter, crop yield and fertilizer use related information was also collected during the survey. Then chemical analysis was performed in the regional laboratory, SRDI, Kushtia by following standard methods.
Results: Results revealed that soil pH was decreased in most of the series, Organic Matter in all the series was little bit increased, the increment of exchangeable potassium was observed in most of the series except Ganges Silt and Ghior series, the increment of phosphorus was found in Sara, Gopalpur, Iswardi and ghior series while decreased trend was found in Ganges Sand and Ganges Silt series, the increment of Sulfur was found in Sara, Gopalpur and Iswardi series while decreased trend was found in Ghior, Ganges sand & Ganges Silt series, the increment of available Zinc was observed in all the series except Ganges Silt series, available Boron (B) was depleted from all the series.
Conclusion: Soil nutrient data of the study revealed that most of the parameter were showing positive direction towards fertility development due to agricultural knowledge development and advance soil and fertilizer management.

Key Words: Soil Fertility; Soil Series; Nutrient Status; Soil pH; Organic Matter.

1. INTRODUCTION

Soil fertility—the capacity of soil to supply essential nutrients to crops—has long been a major concern of agriculturalists. Soil fertility decline occurs when the quantities of nutrients

removed from the soil in harvested products exceed the quantities of nutrients being applied. In this situation, the nutrient requirements of the crop are met from soil reserves until these reserves cannot meet crop demands. This results in a reduction of plant growth and yield. However, the problem of declining soil fertility is becoming one of the major challenges for sustainable agriculture production. Agricultural productivity per unit area of land is declining through time and food production could not keep pace with population growth [1]. In order to feed the growing population, agricultural production has to grow at least by 3-4% per annum [2]. This can be achieved either by bringing more land under cultivation (i.e. area expansion) or by increasing productivity per unit area of land (i.e. intensification). The first option has been less feasible due to land shortage. The remaining feasible option to increase productivity per unit area through improved soil fertility management accompanied with the use of improved crop varieties and better agronomic practices [3]. However, in many place, farmers continue mining soil nutrients without adequate replenishment and soil and water conservation. There is widespread perception that per hectare yield of most of the crops in Bangladesh are either declining or stagnating. It might be the casual effect of crop intensification without fallow period, cultivation of modern varieties, without recommended soil and fertilizer management practices, removal of crop residues etc. Food and Agriculture Organization first reported that yield of major crop in Bangladesh either declining or stagnant [4]. However a few research works has been performed on the changing of soils fertility status in Bangladesh, but there is no study found on changes of soil fertility status over a long period of time in present study area. Keeping all this in view, the present study aimed at -i) To quantify the changes in soil fertility over time period in terms of available nutrient content, ii) To determine the changes in organic matter content over time period and iii) To assess the changes of soil P^H over time. The findings from the comparison of initial and current soil fertility status will be helpful for determination the nature and extent of changes of soil fertility over time.

2. MATERIALS AND METHODS

Soil Resource Development Institute (SRDI) has conducted semi-detailed soil survey at Bheramara upazilla of Kushtia district in 1995 which is located between 23^0 59` to $24^0$ 08` N latitude and 88^0 54` to $89^0$ 4` E longitude [5]. During that survey SRDI collected 18 soil samples and analyzed in the laboratory for chemical parameter. These data base considered as base line database for the present study. For conducting the present study to quantify the change in soil quality over time period in terms of available nutrient content, changes in organic matter content and changes of soil P^H over time, new semi detailed soil survey was conducted using previous map in the year 2016. During this survey 18 soil samples were collected from the same or adjacent sampling point of 1995. Land use, use of organic matter, crop yield and fertilizer use related information was also collected during the survey. Agricultural constraints and development possibilities were discussed in Farmers Group Discussion. Then chemical analysis was performed in the regional laboratory, SRDI, Kushtia by following standard methods. Soil P^H was determined by Glass Electrode P^H meter method with soil water ratio 1:2.5 [6], Organic matter was determined by Walkley-Black method [7], Potassium was determined by ammonium acetate extraction method [8], available sulfur was determined by Turbidimetric method [9], available zinc was determined by DTPA Extraction method [10] and boron was determined by Calcium chloride extraction method [11]. Statistical analysis was performed by using MS Excel software.

3. RESULTS AND DISCUSSION

The soil series identified in this upazilla were Sara, Gopalpur, Iswardi, Ghior along with Ganges sand & Ganges silt in both the survey.
The highest soil pH was observed in both the Ganges Sand and Ganges Silt soils in the year 2016 and in case of 1995 the highest pH observed in Ganges sand (Fig. 1). Among the six soil series, soil pH was decreased in most of the series due to decalcification or removal of lime and other bases from soils and addition of nitrogen and sulfur fertilizers in soils.

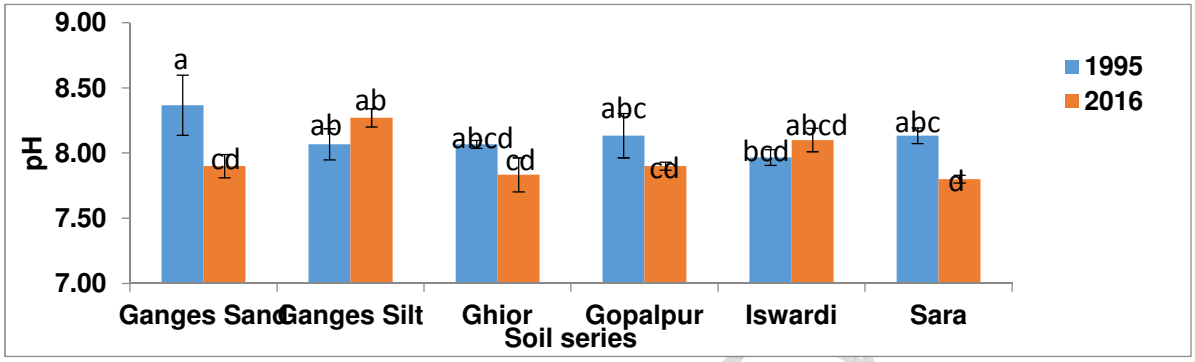

Fig. 1. Changes of Soil P^H between the years 1995 to 2016 period in studied soil series

Among all the six soil series, soil Organic Matter (OM) was little bit increased in 2016 compared to 1995 (Fig. 2) due to higher cropping intensity-root biomass & remaining portion of crop residues, wet land cultivation viz. rice-rice cropping pattern might have positive influence on soil OM and the highest OM was found in Ghior soil series while the lowest OM was found in Ganges Sand soil series in both the year.

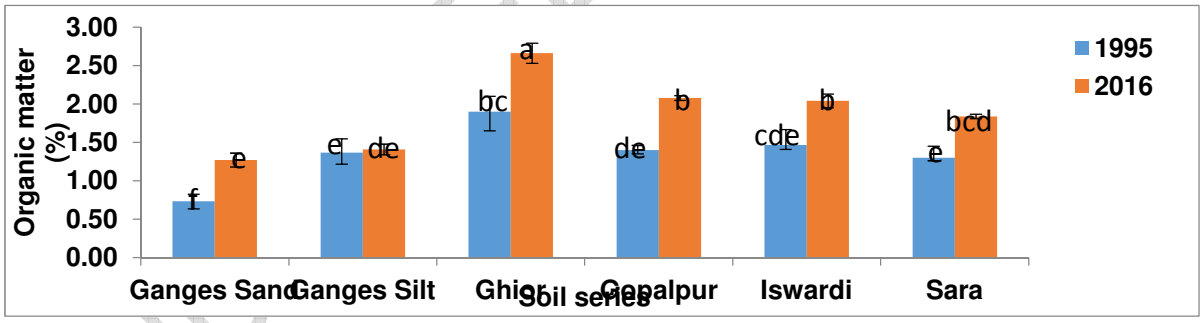

Fig. 2. Changes of Soil Organic Matter (OM) between the years 1995 to 2016 period in studied soil series

Potassium (K) is very mobile element both in soils and plants, this element also quickly changes its existence from active site to soil solution. However, the increment of exchangeable potassium was observed in most of the series except Ganges Silt and Ghior series, the maximum increment was found in Sara series (0.19 meq/100g). In both the year, the highest exchangeable potassium was observed in Ghior series and the lowest exchangeable potassium was in Ganges Sand soil series (Fig. 3).

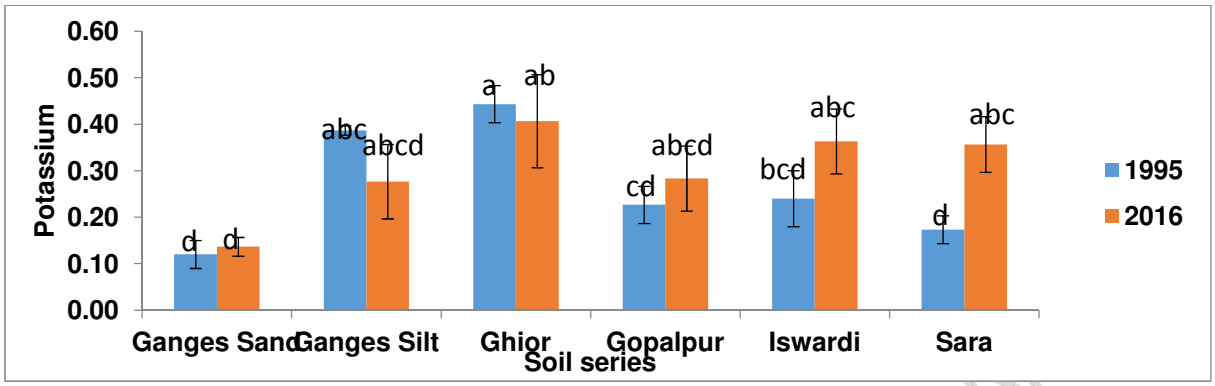

Fig. 3. Changes of Soil Potassium (K) between the years 1995 to 2016 period in studied soil series

The increment of soil phosphorus (P) was found in Sara, Gopalpur, Iswardi and ghior soil series while decreased trend was found in Ganges Sand and Ganges Silt soil series (Fig 4). The application of P fertilizers is increased several times from 1995 to 2016 and their residual effect might have the cause of the increment of P content in soils. In the year 2016, the highest P content was found in Ghior series (12.94 ppm) and the lowest was found in Gopalpur series (8.15 ppm).

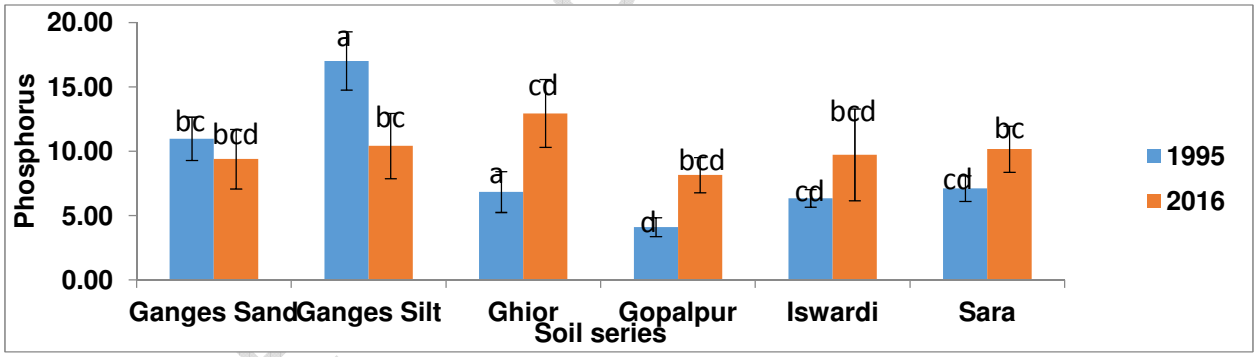

Fig. 4. Changes of Soil Phosphorus (P) between the years 1995 to 2016 period in studied soil series

The increment of soil Sulfur was found in Sara, Gopalpur and Iswardi soil series while decreased trend was found in other three soil series (Fig. 5). In the year 2016, the highest S content was found in Iswardi Series (25.70) ppm) and the lowest was found in Ganges Sand series (13.53 ppm).

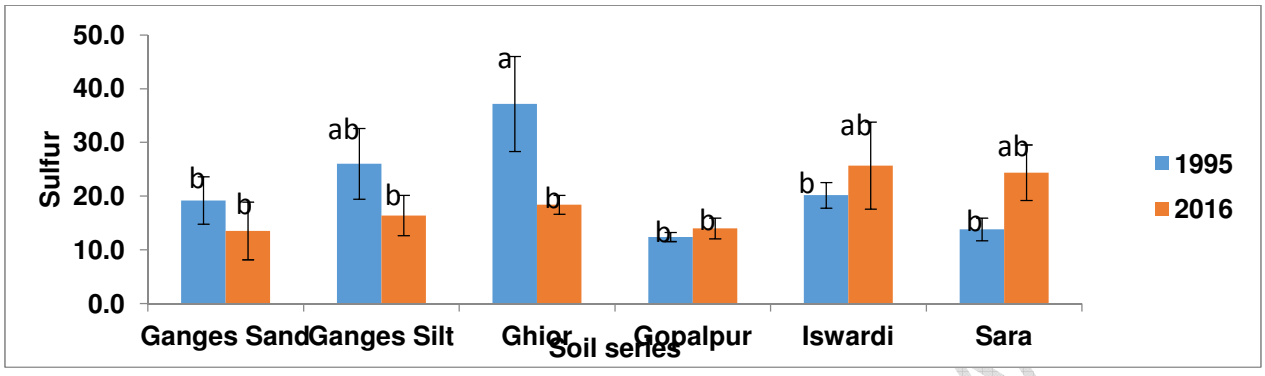

Fig. 5. Changes of Soil Sulfur (S) between the years 1995 to 2016 period in studied soil series

The increment of available Zinc (Zn) was observed in all the series except Ganges Silt soil series (Fig. 6). Application of Zn fertilizers and little bit lowering of soil pH might have the influence on increment on available Zn content in the study area. In the year 2016, the highest available Zn was observed in Ghior series (1.0 ppm) while the lowest was observed in Gopalpur series (0.66 ppm).

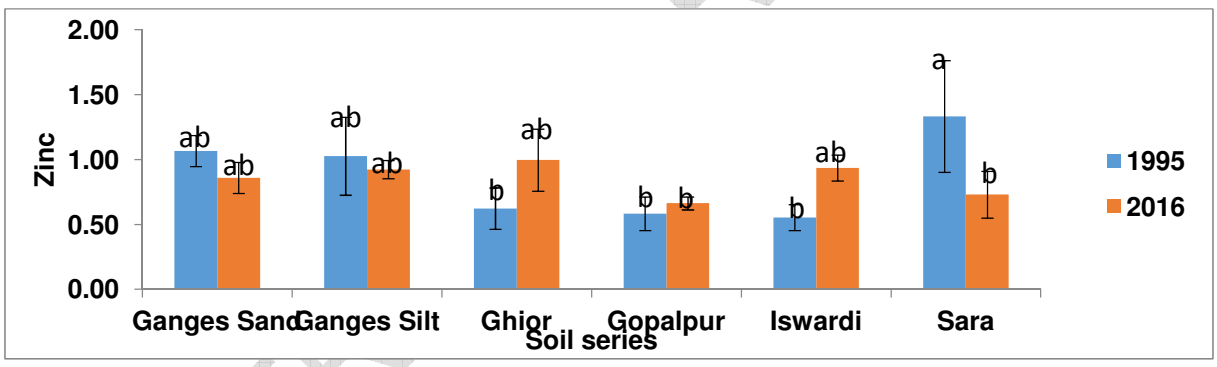

Fig. 6. Changes of Soil Zinc (Zn) between the years 1995 to 2016 period in studied soil series

Available Boron (B) was depleted from all the soil series from the year 1995 to 2016 (Fig. 7). Application of B fertilizers is very new to the farmers of the study area and they use it only few crops, more over the unavailability of quality B fertilizers in local market might be the cause of B deficiency in soils. In the year 2016, the highest available boron was in Gopalpur series (0.96 ppm) while the lowest in Ganges Sand series (0.44 ppm).

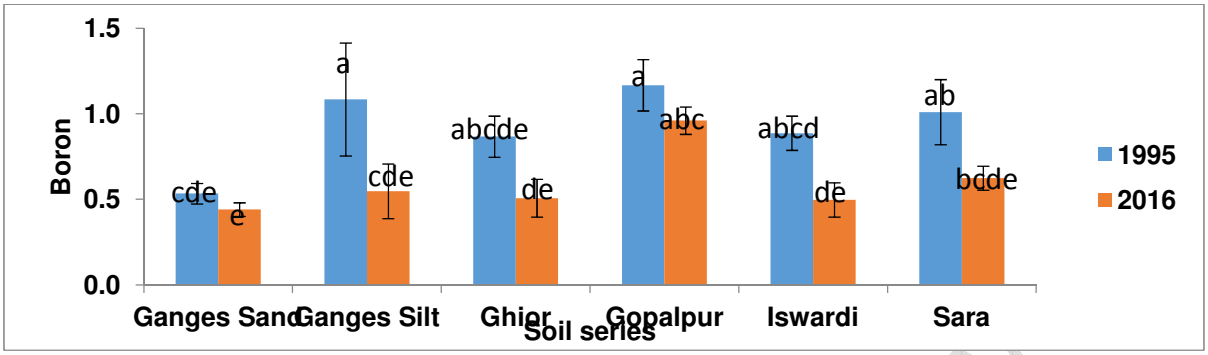

Fig. 7. Changes of Soil Boron (B) between the years 1995 to 2016 period in studied soil series

4. CONCLUSION

Soil nutrient data of the study revealed that most of the parameter were showing positive direction towards fertility development due to agricultural knowledge development and advance soil and fertilizer management among the farmers by different government and non- government agricultural program which helps to enhance fertility status in the field. Soil pH decreased in most of the series due to decalcification, soil OM was little bit increased in all the series, other elements showed an increasing trend in most of the series from 1995 to 2016, But Boron was depleted from all the soil series due to inadequate use and unavailability of quality B fertilizers in local market. However, there is a need to establish the soil testing laboratories preferably at all the district with modern facilities and adequate staff for generating accurate and reliable results. The concept of soil health and importance of maintaining soil fertility should be incorporated in all the training programs. Farmers should also be educated the ways of enriching soil fertility through appropriate cultivation practices such as crop rotation, mulching and minimum tillage.

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