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Short Communication

Need of Organic Amendments in Intensive Agriculture in Bangladesh

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Abstract

Bangladesh is an agricultural country. Lands are intensively used for crop production with little or no fallow period. The most serious threat to sustainable agriculture is the depletion of soil organic matter which results in low productivity. Intensive agriculture affects soil fertility negatively mainly because of loss in soil organic matter. Sustainable practices like use of organic amendments is a useful tool to maintain or increase organic matter content in agricultural soils which contributes in preserving and improving soil fertility. Maintaining organic matter in the soil is the best choice for sustainable crop production to ensure food security of the burgeoning populations.

Keywords: Organic Amendments; Organic Matter; Bangladesh

Introduction

Bangladesh is an agricultural country. Lands are intensively used for crop production with little or no fallow period. Agricultural land use at a local level is expressed by the spatial and temporal distribution of crops often expressed as cropping pattern (CP). Three hundred and sixteen CPs were identified throughout Bangladesh excluding the very minor ones [1]. The most serious threat to sustainable agriculture in Bangladesh is the depletion of soil organic matter which results in low productivity. In Bangladesh, most soils have less than 17g/kg and some soils have less than 10g/kg organic matter (Figure 1).

Soil and crop management practices determining soil organic matter (SOM) include tillage and planting techniques, methods of handling crop residue, application of organic amendments, crop rotations, and use of cover crops. SOM in its totality includes soil organisms, simple organic compounds, large and complex humic substances, as well as relatively fresh residue in various stages of decomposition. All these SOM fractions are usually affected by soil and crop management practices.

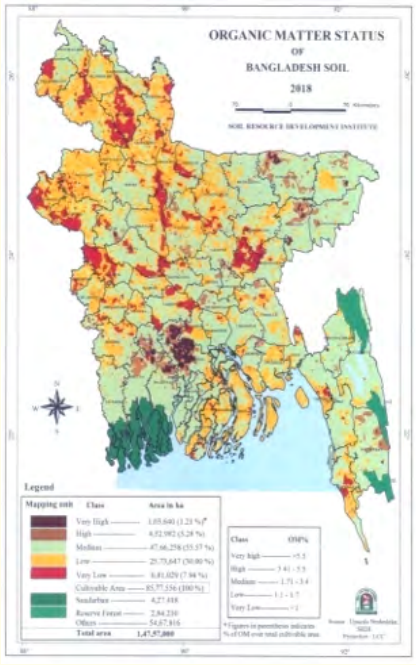

Figure 1

Under intensive agriculture soil management needs appropriate practices and all efforts must be made to reduce soil degradation due to stress conditions resulting from this management. Normally organic amendments having different levels of decomposition is used in the soil. When composts are used they increase soil organic C stock, supplies essential nutrients like N and P and improve microbial populations and activities. Magdoff and van Es [2] stated that organic matter have profound effects on almost all soil properties – physical, chemical, and biological and are placed at the center of soil health and soil quality.

In this article, benefits of use of organic amendments which enhances soil quality in intensive agriculture systems like Bangladesh are discussed below.

Physical fertility

Soil physical properties are affected by the amount of water, air and nutrients available for plant growth in the soil. Determination of soil physical properties will ultimately help us to fix ways to manage them effectively. Soil is a dynamic natural system that provides critical ecosystem service for the sustenance of humanity [3]. Soil structure as well as physical and chemical qualities are by application of organic amendments such as compost [4]. Khaliq and Abbasi [5] observed that the use of organic amendments increases soil organic matter and as a consequence soil aggregate stability, water holding capacity and Celik., *et al*. [6] opined that it improves soil porosity and thus improves soil quality. Karami., *et al.* [7] observed that soil aggregate stability was increased and soil bulk density was decreased by the application of organic amendments such as sheep manure, cow manure, rice husk, reeds, and wheat straw. Chaudhari., *et al.* [8] observed similar effects of organic matter on bulk density. Knowledge on soil bulk density helps in soil management as well as planning modern farming practices. Soil bulk density was observed to be strongly correlated to soil organic C, as the addition of organic amendments increases soil organic C and decreases soil bulk density [9]. Zhao., *et al.* (2009) conducted a long-term study in China, and found that farmyard manure and straw application resulted in decrease of soil bulk density (1.21 and 1.18 Mg m^{-3}, respectively) when compared with untreated soils (1.43 Mg m^{-3}) due to increase in soil organic C and porosity. Liu., *et al.* [10] observed that incorporation of biochar in the soil improves soil structure. Organic amendments with biochar, improves particle size distribution and contributes to aggregate stability.

Chemical fertility

The chemical soil fertility is largely governed by the presence of macro and micro or trace elements, soil acidity (pH), the salt content (EC) and the cation-exchange capacity (CEC). This is also influenced by the organic-matter content and its humus percentage on any agricultural farm. Bonanomi., *et al.* [11] stated that in intensive agriculture without replenishment of SOM have negative impacts on soil chemical properties which results in reduction of soil C content that in turn produces detrimental effects on soil microbial biomass, soil enzymatic activities, functional and species diversity. In different studies with application of organic amendments like compost it was found to recover soil organic C stock [12,13]. Organic C mineralization rate and dynamics of nutrient release can be predicted by C/N ratio [14].

Organic amendments induce a slow release of mineral N on the other hand chemical fertilizers induce rapid release of mineral N. Application of compost promotes nitrification process, as compared to mineral fertilization it reduces N leaching and decreases the possibility of groundwater contamination by nitrate.

Application of organic amendments not only increase organic C stock but also increases soil cation exchange capacity (CEC). High values of CEC allow retention of essential nutrient cations in soil and make them available for crops uptake which leads to increased crop production.

Biological fertility

A variety of organisms inhabit the soil which decompose organic matter, fix atmospheric nitrogen, cause de-nitrification and plant disease known as microorganisms. These are generally confined to the surface 20 to 30 cm layer and work best when there is good aeration, a neutral reaction, soil moisture content at about half of the water holding capacity and temperature between 25ºC and 38ºC. Microorganisms decomposes organic matter. Diversity of soil microbial communities play a key role in maintaining soil fertility and agricultural sustainability by increasing the mineralization rate of soil organic C. Strong correlation between soil biological fertility and soil organic C content was observed when organic amendments are applied to the soil which favors the growth and diversity of microbial communities [15]. Soil biological properties and enzymatic activities are influenced by the use of soil organic

amendments as compost. It is well established that organic fertilization treatments alter the composition of both the soil bacterial and fungal communities.

Practices for improved Soil Organic Matter (SOM) management

Soil management practices that usually improve soil health through application of SOM include (1) more complex crop rotations, especially those with high-residue crops, (2) reduced tillage, (3) intensive use of cover crops, and (4) use of a variety of organic amendments [16]. Improved soil properties that results from these practices are- more available water, less compaction, better timing of nutrient availability to crop needs, and production of growth-promoting substances, promote the growth of plants that can better defend themselves from pests [17-20].

Conclusion

In Bangladesh we have no choice but to maintain organic matter in the soil for sustainable crop production. For this SOM management is a must. Improving crop rotations, using cover crops, reducing tillage, conserving crop residues, using organic amendments such as animal manure, quick composts, vermicompost, and practicing specific erosion control measures are positive steps to towards better SOM management.

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Volume 3 Issue 5 May 2019