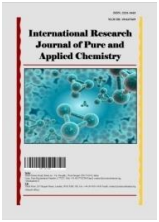

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Effect of Organics and Chemical Fertilizers on Soil Organic Carbon Distribution in a Typic Ustifluvents

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

To assess the effect of water hyacinth compost, vermicompost and inorganic fertilizers a field experiment was undertaken during *rabi* 2015-16 in light textured sandy loam soil of Mandan Bharti Agriculture College, Agwanpur, Saharsa, Bihar in split plot design with four levels of NPK in main plot and four levels of organic sources in sub-plot treatment in three replications. The experimental site was located in between 25°52'50" North latitude and 86°48'62" East longitude in agro-climatic zone-II of Bihar having hot moist sub-humid climate with average annual rainfall of 1050 mm and mean maximum and minimum annual temperature of 26°C and 18°C, respectively. Wheat (cv. DBW- 14) was grown as test crop during the reputed period of 2015-16. Vermicompost, compost made from aquatic weed water hyacinth (water hyacinth compost) alone or in combination with different levels of NPK of recommended dose of fertilizers were applied. The soil organic carbon decreased with increasing soil depth. Vermicompost, water hyacinth compost either alone or incombination with different levels of NPK fertilizer increased the status of soil organic carbon over control at each soil depth, Effect of water hyacinth compost, vermicompost or both either individually or in combination with chemical fertilizers had been very small.

Keywords: Organics; chemical fertilizer; organic carbon; ustifluvents.

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1. INTRODUCTION

Global food production needs to be increased at least by 70% over the current level by 2050 to meet the increase in food demands which rapidly increases as a result of over population. To achieve these challenges, agriculture must grow significantly inconsideration of the factors that contribute to increase the yield production, which are already reduced or tend to reduce, since they are pacing unprecedented pressure on the natural resources.

Intensive land use with continuous use of higher doses of inorganic fertilizers significantly influences soil health and crop growth. This has raised concerns about the potential long term adverse effect on soil health and environmental quality [1]. In the soil quality concept, soil physical attributes are given attention because they have close relationship with soil organic carbon and organic matter. Thus, nay soil management system that improves soil organic matter has direct bearing on soil physical properties and microbial biomass. Under such a situation, mixed application of both organic and inorganic nutrient might be right proportion for these soils, primarily for improvement of soil physical health. Integration of chemical and organic sources and their management have shown promising results not only in sustaining the productivity but have also proved to be effective in maintaining soil health and enhancing nutrient use efficiency [2].

In recent years, these have been increasing recognition of the importance of organics as a source of plant nutrients due to growing ecological concern and depleting inherent soil fertility. Organic manure offers the twin benefits of increase in organic matter content and improvement in physical, chemical and microbiological properties of soil while meeting a apart of nutrient need of the crop.

With the emerging concern on large quantity of the agricultural waste being produced, problematic aquatic weed such as water hyacinth compost, the compost of its management becomes a key focus of sustainable agricultural development. One of the alternative options of utilization of these large quantities of nutrient rich agricultural waste is by converting them into value added product like compost and recycle them back to field which have drawn the attention of scientist to reduced environmental pollution and increase efficiency of carbon and nutrient rich input for higher productivity.

2. MATERIALS AND METHODS

The present study was carried out during *rabi* season of 2015-16 in light textured sandy loam soil of Mandan Bharti Agriculture College, Agwanpur, Saharsa, Bihar. The climate of experimental site is hot moist sub-humid with average annual rainfall of 1050 mm and mean maximum and minimum annual temperature were 26^{o}C and 18^{o}C, respectively. The physico-chemical properties of experimental soil are depicted in Table 1. The experiment was laid out in split plot design with four levels of NPK viz., 0, 50, 100 and 150 per cent of recommended dose of NPK in main plot treatment and four levels of organic sources viz., no organics, vermicompost, water hyacinth compost and vermicompost + water hyacinth compost as sub plot treatment. The treatments were replicated three times. The recommended dose of NPK fertilizers in terms of N, P_2O_5 and K_2O were applied @120:60:40 kg ha^{-1}, respectively. N, P_2O_5 and K_2O were applied in the form of urea, single super phosphate and muriate of potash, respectively. Wheat cv. DBW-14 was grown as test crop during the reported period of *rabi* 2015-16.

Composite surface soil samples from six soil depth viz., 0-15, 15-30, 30-45, 45-60, 60-75 and 75-90 cm from each plot were collected harvest of wheat. These samples were air dried and pulverized to pass through 2 mm sieve. Organic carbon in soil was determined by a wet oxidation procedure [3].

3. RESULTS AND DISCUSSION

The organic soil content in surface soil (0-15 cm) varied from 4.3 to 7.9 g kg^{-1} while that in 15-30, 30-45, 45-60, 60-75 and 75-90 cm soil depth varied from 3.7 to 7.6, 3.6 to 6.8 2.6 to 5.8, 2.0 to 3.3 and 1.5 to 2.9 g kg^{-1}, respectively (Table 2). The data revealed that organic carbon content was higher in surface layer and is decreased downwards upto 90 cm. [4,5,6] also observed that organic carbon content decreased along with depth. Higher value of organic carbon in surface layer might be due to high organic matter content and also due to better root growth and more plant residue addition after harvest of wheat crop. The organic carbon content

Table 1. Initial properties of experiential soil

Parameters	Value	Method used	Reference
pH	7.12	Backman glass electrode pH meter	[7]
Electrical conductivity	0.33	EC meter	[8]
Organic Carbon (%)	0.51	Wet Oxidation Method	[3]
Available Nitrogen (Kg ha^{-1})	235.00	Alkaline potassium permanganate method	[9]
Available P_2O_5 (Kg ha^{-1})	18.63	Colorimetric method	[10]
Available K_2O (Kg ha^{-1})	98.0	Ammonium Acetate Method	[7]

Table 2. Effect of vermicompost, water hyacinth compost and chemical fertilizers on Depthwise distribution of organic carbon (g kg^{-1}) after harvest of wheat

Fertilizer level	Organic sources				
	Control	Vermicompost	Water hyacinth compost	Vermicompost + water hyacinth compost	Mean
0-15 cm					
No NPK	4.3	5.1	5.2	5.9	5.1
50% NPK	4.8	5.8	5.7	6.5	5.7
100% NPK	5.5	6.2	6.1	7.6	6.3
150% NPK	5.7	6.3	6.2	7.9	6.5
Mean	5.0	5.8	5.8	6.9	
15-30 cm					
No NPK	3.7	5.1	5.2	5.7	4.9
50% NPK	4.4	5.5	5.3	6.8	5.5
100% NPK	4.8	5.6	5.4	7.0	5.7
150% NPK	5.5	6.2	6.0	7.6	6.3
Mean	4.6	5.6	5.4	6.7	
30-45 cm					
No NPK	3.6	4.5	4.4	5.1	4.4
50% NPK	3.9	4.9	5.0	5.8	4.9
100% NPK	4.5	5.0	4.9	6.5	5.2
150% NPK	5.2	5.5	5.4	6.8	5.7
Mean	4.3	4.9	4.9	6.0	
45-60 cm					
No NPK	2.6	3.1	3.0	3.6	3.0
50% NPK	2.9	3.5	3.4	4.3	3.5
100% NPK	3.4	3.7	3.9	5.2	4.0
150% NPK	3.7	4.6	6.4	5.8	5.1
Mean	3.1	3.7	4.1	4.7	
60-75 cm					
No NPK	2.0	2.3	2.5	2.9	2.4
50% NPK	2.3	2.7	2.8	3.1	2.7
100% NPK	2.5	2.9	2.7	3.2	2.8
150% NPK	2.9	3.0	3.1	3.3	3.0
Mean	2.4	2.7	2.7	3.1	
75-90 cm					
No NPK	1.5	1.9	1.8	2.0	1.8
50% NPK	1.6	2.2	2.1	2.3	2.0
100% NPK	1.7	2.4	2.3	2.6	2.2
150% NPK	2.3	2.6	2.7	2.9	2.6
Mean	1.7	2.2	2.2	2.4	

was highest at all the soil depth in plots receiving highest dose of fertilizers with vermicompost and water hyacinth compost. Bellakki et al. [11] also confirmed this finding. Lower value of organic carbon in soil was found in control and maximum recorded in the treatment receiving both vermicompost and water hyacinth compost. The order of effectiveness was vermicompost + water hyacinth compost > vermicompost > water hyacinth compost > no organics [12]. Reported that the highest organic carbon content was observed that significantly superior content of organic carbon was noted where plant residue, FYM, phosphocompost and cotton stalk was applied. Proportionally higher carbon content in the soil was recorded in FYM added plots which might be due to slows breakdown or constant mineralization of added organic residue [13]. Sharma and Subehia [14] also reported greater level of soil organic carbon under integrated treatment of organic and inorganic combinations in alfisols. Saha et al. [15] also reported that addition of NPK fertilizers along with organic manure, lime and biofertilizers increased soil organic content.

4. CONCLUSION

The organic carbon content decreased with increase in depth, vermicompost, water hyacinth compost either alone or in combination with different level of NPK fertilizers increased the amount of organic carbon of soil over control at each soil depth.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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