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Organic Matter and Nutrients Depletion in Soil of Itakpe Iron Ore Deposit Area of Kogi State, Nigeria

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Abstract: Mining has been reported to deplete the organic matter content and nutrients of soil through erosion and decomposition. The effect of mining on organic matter content and nutrients of soil in the iron ore deposit area of Itakpe, Kogi state of Nigeria was investigated. The study involves the determination of organic matter content and nutrients content viz nitrogen, potasium and phosphorous of some soil in order to have a baseline for assessing the impact of iron ore mining in future. Soil samples were collected, predigested and analysed using appropriate standard methods. The results revealed that soil of the mined sites have lower organic matter content and nutrients than unmined site. Likely, consequences of this discovery on the livelihood of residents of the area are discussed. Useful suggestions are made on building up of the soil organic matter content and nutrients for agricultural activities.

Key words: Deplete, soil, mined, unmined, organic matter, nutrients

INTRODUCTION

Organic matter is the vast array of carbon compounds in soil. It is originally, created by plants, microbes and other organisms, these compounds play aa variety of role in nutrient, water and biological cycles (Extension, 2002). It covers a wide range of things like lawn clippings, leaves, stems, branches, moss, algae, lichens any parts of animals, manure droppings, sewage sludge, sawdust, insects, earthworms and microbes (Soil Health, 2008).

Organic matter increases the nutrient holding capacity of soil. It serves as a pool of nutrients for plants, it chelates nutrients, preventing them from becoming permanently unavailable to plants. It is food for soil organisms, these hold on to nutrients and release them in form available to plants.

It improves the water dynamics of soil by improving water infiltration, decreases evaporation and increases water holding capacity especially in sandy soils. It affects soil structure by reducing crusting, encourages root development improves aggregation and preventing erosion and compaction (Extension, 2002).

Intensive tillage increases the loss of organic matter by speeding decomposition (Extension, 2002). Mining definitely exposes the earth even more than tillage hence, it will contribute to depletion of organic matter content of mined out soil.

Itakpe is situated in Kogi state of Nigeria. It lies on longitude 6°16'E and between latitude 7°36'N and 7°39'. This study examines the depletion of organic matter content and nutrients in the soil of Itakpe iron ore deposit area of Nigeria.

MATERIALS AND METHODS

Three replicates of composite samples of top soil were collected randomly from each site. Steel butch auger was used to collect the soil samples (FAO, 1977). The sites are West Mine, WM, East Mine, EM and Pilot Mine, PM; Garden 1 close to East mine, Garden 2 close to West Mine. The control site used is an unmined site several km away from the mines.

Organic matter content of soil was measured using ASTM (1987) D2974-87 procedures. The total moisture of soil sample was air dried and subsequently oven dried at 105°C. The ash content of the soil was determined by igniting the oven dried sample from in a furnace at 440°C. The substance remaining after ignition is ash the organic matter was determined by subtracting percentage ash content from 100.

Total Nitrogen content of soil was determined using Kjeldhal digestion method using $CuSO_4$ and Na_2SO_4 catalyst mixture (Bremen and Mulvancy, 1982).

Phosphrous content was determined by Bray 2 extractant method (Olsen and Sommer, 1982) and extractable sodium was determined using flame photometer method (AOAC, 2000).

RESULTS AND DISCUSSION

Table 1 shows the organic matter content of sampled soils. The average organic matter content of soil in east mine, EM is 0.03, in west mine, WM is 0.03%, in pilot mine, PM, 0.04% in garden 1, G1, 2.08%, in garden 2, 2.17% and control site, which is several kilometers away from the mined sites, 3.18%. The result shows that the average/ mean organic matter content in soil is higher in control (unmined) site than (other) mined sites. This is in accordance with the report that intensive tillage increases the loss of organic matter by speeding decomposition (Extension, 2002).

Table 2 shows the nitrogen content of sampled soils. The average nitrogen content of soil in east mine, EM is 0.002, in west mine, WM is 0.002%, in pilot mine, PM, 0.005% in garden 1, G1, 0.12%, in garden 2, 0.14% and control site, which is several km away from the mined sites, 0.20%. The result shows that the average/mean nitrogen content in soil is higher in control (unmined) site than (other) mined sites. This is in accordance with the report that intensive tillage increases the loss of organic matter by speeding decomposition, hence, loss of soil nutrients (Extension, 2002).

Table 3 shows the phosphorous content of sampled soils. The average phosphorous content of soil in east mine, EM is 1.84, in west mine, WM is 2, 10%, in pilot mine, PM, 2.11% in garden 1, G1, 2.21%, in garden 2, 2.39% and control site which is several kilometers away from the mined sites, 3.38%. The result shows that the average/mean phosphorous content in soil is higher in control (unmined) site than (other) mined sites. This is in accordance with the report that intensive tillage increases the loss of organic matter by speeding decomposition, hence, loss of soil nutrients (Extension, 2002).

Table 4 shows the sodium content of sampled soils. The average sodium content of soil in east mine, EM is 0.54, in west mine, WM is 0.17%, in pilot mine, PM, 0.19% in garden 1, G1, 0.25%, in garden 2, 0.26% and control site, which is several km away from the mined sites, 0.34%. The result shows that the average/mean sodium content in soil is higher in control (unmined) site than (other) mined sites. This is in accordance with the report that intensive tillage increases the loss of organic matter by speeding decomposition, hence loss of soil nutrients (Extension, 2002).

Table 1: Organic matter content of soil in the sites studied

Samples	1st	2nd	3rd	Mean	SD	Min.	Max.
EM	0.03	0.03	0.04	0.03	0.010	0.03	0.04
WM	0.05	0.04	0.03	0.03	0.010	0.03	0.04
PM	0.04	0.05	0.04	0.04	0.010	0.04	0.05
G1	2.05	2.10	2.09	2.08	0.025	2.05	2.10
G2	2.16	2.19	2.16	2.17	0.016	2.16	2.19
CS	3.16	3.19	3.19	3.18	0.016	3.16	3.19

Table 2: The nitrogen content of soil in the sites studied

Samples	1st	2nd	3rd	Mean	SD	Min.	Max.
EM	0.002	0.004	0.001	0.002	0.002	0.001	0.004
WM	0.003	0.003	0.001	0.002	0.018	0.001	0.003
PM	0.006	0.004	0.005	0.005	0.001	0.004	0.006
G1	0.110	0.110	0.140	0.120	0.020	0.110	0.140
G2	0.130	0.150	0.150	0.140	0.010	0.130	0.150
CS	0.190	0.210	0.190	0.200	0.010	0.190	0.210

Table 3: Phosphorous content of soil in the sites studied

Samples	1st	2nd	3rd	Mean	SD	Min.	Max.
EM	1.83	1.85	1.84	1.84	0.01	1.83	1.85
WM	2.09	2.11	2.10	2.10	0.01	2.09	2.11
PM	2.09	2.10	2.14	2.11	0.03	2.09	2.14
G1	2.20	2.20	2.23	2.21	0.02	2.20	2.23
G2	2.39	2.41	2.37	2.39	0.02	2.37	2.41
CS	3.36	3.40	3.38	3.38	0.02	3.36	3.40

Table 4: Sodium content of soil in the sites studied

Samples	1st	2nd	3rd	Mean	SD	Min.	Max.
EM	0.15	0.15	0.18	0.54	0.020	0.53	0.56
WM	0.18	0.17	0.16	0.17	0.010	0.16	0.18
PM	0.19	0.18	0.20	0.19	0.010	0.18	0.20
G1	0.24	0.28	0.24	0.25	0.020	0.24	0.27
G2	0.25	0.29	0.24	0.26	0.025	0.24	0.29
CS	0.35	0.34	0.33	0.34	0.010	0.33	0.35

CONCLUSION

The data obtained in the study shows that mining reduced/depleted the organic matter content of the soil as well as soil nutrients i.e. nitrogen and phosphorous required for proper crop plant growth.

RECOMMENDATION

It is recommended that the organic matter of the mined soil be built up by adding animal manure and green manure in abundance value to supply organic matter in value more than the value lost to decomposition and erosion due to mining of the iron ore in the study area.

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