IJABBR- 2014- eISSN: 2322-4827

International Journal of Advanced Biological and Biomedical Research

Journal homepage: www.ijabbr.com

Original Article

Effects of Land use Changes on Some Physiochemical Properties of Soil of Saman Region (Chaharmahal va Bakhtiari Province- Iran)

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ARTICLE INFO

Article history:
Received: 09 Sep, 2014
Revised: 28 Oct, 2014
Accepted: 26 Nov, 2014
ePublished: 30 Dec, 2014

Key words:
land use
POC
POC (mic)
POC (mac)

ABSTRACT

Objective: Soil organic carbon has been the most important soil quality measurement factors and has intense relation with soil physical, chemical and biological characteristics. Organic matter and its components are important factors of soil aggregates constitution and stability and play significant role in its structure. So, this research has been done for achieving this purpose. **Methods:** This area is arounding saman _ one of the charmahalobakhtiari counties in distance 20_30 km northeast. In this study, from 127 point in 3 land uses of fruit garden, degraded range, and dry farming, soil sampling of surface depth 0_30 cm was done. The soil samples were analyzed chemically and physically. Also ,soil organic carbon supply, mean weight diameter, particle organic carbon in macro and micro soil aggregates and total particle organic carbon were measured. For considering lands username type effect on soil characteristics and organic carbon physical distribution in case study area, variance analysis by SAS software and comparing averages by dancon method were done. **Results:** Comparing soil characteristics in 3 land uses of garden, degraded range and dry farming showed that land uses changed on pH, lime and soil bulk density have not been affect significantly but have affected on total soil organic carbon, soil nitrogen, EC, soil organic carbon supply, mean weight diameter, particle organic carbon in macro and micro soil aggregates and total particle organic carbon. In garden land use, most total organic carbon rates, total nitrogen rate, soil organic carbon supply, mean weight diameter, particle organic carbon in macro and micro soil aggregates and total particle organic carbon has been observed. Increasing MWD in garden land use is related to high rate of organic material in this soil.

1.INTRODUCTION

Soil quality includes soil ability and capacity for performing its own duties as a vital system within the ecosystem and under different uses in a way that in addition to keeping its biological production, it would be able to improve the weather quality and provide the health of human, plants and animals (Karlen and Stott, 1994). Some of important indicators of soil quality assessment include organic carbon content, total nitrogen amount, pH, primary particle percentage, bulk density, amount of available water, hydraulic conductivity, soil texture and structure and soil stability (Lal, 2006). Organic material plays an important role in fertility, stability of soil particles, soil sensibility to erosion, food cycle and keeping water in soil (Dai and Huang., 2006). Various managements not only affect the total amount of organic materials of soil, but also cause

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changes in their different components and helps destroying the soil construction, forming crust and increasing erosion (Stott and et al., 1999). There is significant strong relationship between soil structure and plant's root growth as well as significant relationship between organic carbon and soil structure (Lal, 2006). Organic carbon of soil has considerable potential for being changed by climate changes and human arrangements (Pinzari et al., 1999).

This research was aimed to evaluate and compare the effects of land use systems including fruit gardens, dry farming and degraded range on a number of soil quality indicators.

2. MATERIALS AND METHODS

The studied area with about 8660 hectares is located in Saman region of Chaharmahal va Bakhtiari province. This area is located between latitudes of 32° 42' to 23° 55' and longitudes of 50° 86' to 51° 14'. Average annual temperature of the area is 13.2 degree of centigrade and the average annual rainfall is 365 millimeters (weather bureau of shahrekord). Soil moisture and temperature regimes are xeric and mesic respectively. The land uses of the area including degraded range, dry farming and different fruit gardens. Local farmers use about 30 tons of organic fertilizers in addition to 500 kg of chemical fertilizers in each hectare of gardens.

To evaluate and compare effects of existing environmental factors on physical components of soil organic materials, 127 sampling points was randomly selected in a way that they cover all three land uses and their coordites were saved by GPS model Garmin. The soil samples were collected from 0 to 30 centimeters (plowing depth). In addition, some intact clouds were collected for soil bulk density determination.

Typical soil physiochemical analysis including calcium carbonate(Nelson and Sommers., 1982) total organic carbon contents (Page etal., 1982) total soil nitrogen (Gallaher et al., 1976) soil reaction; soil electrical conductivity (Page etal., 1982), cation exchange capacity (CEC) (Rhoades,1982), soil bulk density(Grossman and Reinsch, 2002) and mean weight diameter (MWD) of soil aggregates using wet sieving (Christensen, 2000) were determined.

To determine the particle organic carbon in macro and micro soil grains as well as the organic carbon of the total soil, 9 grams dry soft soil (soil grains on the sieve 1, 0.5 and 0.25) to measure the big particle organic carbon and 10 grams dry soft soil (soil grains on sieve 0.05) to measure the small particle organic carbon and 100 grams of total soil to measure the particle organic carbon of the whole soil was mixed in 25 milliliter cologne and shook for 16 hours. Then, Vespasian is passed across the sieve 0.053 millimeter to separate the sand particles and Particle organic material (POM). After getting dried, with temperature of 50 degree the sand and organic material are weighted. Then, we put them in furnace with 450 degree to burn its organic material; the amount of organic material was obtained from their weight difference (fallahzadeh and Haj Abbasi, 2010).

For separation of particulate organic matter (POM), aggregate fractions were divided into two groups: macro- and micro aggregate, 0.05 – 0.25 and 0.25–2 mm, through sieving. The soils were dried (50o C) in the oven overnight and cooled in a desiccator to room temperature. The POM of the soils were determined by loss on ignition (LOI) following the procedure of Fallahzade and Hajabbasi (2012). Ten grams of each aggregate fraction was dispersed in 25 ml of sodium hexametaphosphate for 16 hour on a reciprocating shaker. Then the suspensions were sieved through 0.05mm sieve to separate sand particles POM. The collected sand particles POM were dried at 55o C and their weights were determined. Then they were subjected to 450° C to measure POM by LOI method and POC was estimated by multiplying the mass difference by 0_58. Thus, by this procedure the POC in macro aggregate (POCmac) and micro aggregate (POCmic) were separately determined.

To identify organic carbon store, the following equation was used: Organic Carbon Store (kg/m^2) = Soil depth (m) * Bulk Density (ton/m^3) * Organic Carbon Content (g/kg) the study was performed through a completely random design. Analysis of variance was done by SAS software (9.1). Comparison of means were performed by Danken method.

3. RESULTS

The results of analysis of variance (ANOVA) of data considering the effects of land uses on some soil physiochemical properties are presented in Table 1. The organic carbon contents of total soil is highest in garden, intermediate in degraded range and lowest in dry farming. Also, organic carbon store of total soil, total nitrogen content, mean weight diameter (MWD) of soil aggregates, total particulate organic matter (POM), particulate organic matter in course and fine aggrigates in garden usage are more than others and in dry farming is lowest. It is suggested that irrigation, increasing in organic material due to leave fallings in autumn, addition of organic and chemical fertilizers to garden lands and occurrences of more tree roots, increase the organic carbon and consequently, carbon store of the soils. Fallahzade and Hajabbasi (2012) concluded that Irrigation and fertilization of desert soils resulted in significant increases in OC associated with aggregates which were corresponded to the changes (increase) in the whole SOC. The lower mentioned indices in dry farming lands may partly be attributed to reduced plant residues input to the soil because of limitations on plant growth in this environment. Also plowing operations in these lands would break aggregates therefore, the soil organic material would have less physical protection to maintain in the soils (Nardi et al. 1996). Carter et al.

(1998) in their studies on adjacent cultivated and forest soils of Eastern Canada concluded that land use changes led to decrease in soil cover (shadow). In addition farming operations have changede soil structure and have increased erosion potential of soils and have affected organic carbon contents of the soils. As it is seen in table 1, the usage hasn't had any effect on pH, EC, lime rate and soil bulk density.

Table 1.

Effects of land uses on some physiochemical properties of soil

Land use	pH	EC (ds/m)	BD ($g/cm^{3)}$	MWD (mm)	Total N (%)	CaCO3	Pool (g/Kg)	SOC*	POC* (g/Kg) Macro	Micro	Total
Garden	7.7 a	0.4 a	1.7 a	0.5 a	0.6 a	290.3 b	5.1 a	10.2 a	1.1 a	0.8 a	1.5 a
Degraded range	7.8 a	0.2 b	1.7 a	0.3 b	0.2 b	320.2ab	2.1 b	4.1 b	0.9 b	0.6 b	0.7 b
Dry farming	7.7 a	0.3 b	1.7 a	0.3 b	0.2 b	345 a	1. 9b	3.8 b	0.7 b	0.5 b	0.5 b

*POC=Particulate Organic Carbon **SOC= Soil Organic Carbon

CONCLUSION

Comparing soil characteristics in three uses of garden, degraded range and dry farming showed that usage change hasn't have any significant effect on pH, EC, lime and soil bulk density; however, it had significant effects on soil organic carbon, nitrogen, organic carbon store, weight average of soil grain diameter, particle organic carbon in big and small soil grains and organic carbon of total particles. The amount of above variables has been the most in garden usage. It seems that garden watering, annual increase of chemical and organic fertilizers to garden lands and therefore, more yearly production of biomass have resulted in the improvement of the above mentioned parameters. The increase of MWD in garden use is related to the high amount of organic materials in the soil. Organic materials which are maintained physically with soil particles, would face microbial oxidation by soil blending and plowing in dry farming. In degraded range use, in comparison to garden use, the soil temperature is more because of shadow made by the trees that results in more quick analysis of organic materials following with plowing; this would result in more sensitivity of soil toward destruction and erosion. It should be mentioned that garden usage is compared with degraded range and if the degraded range are also protected and the facilities used in garden are provided for degraded range as well like watering and yearly increase of chemical and organic fertilizers, high improvements will be seen in this kind of usage which is proper for the native conditions of the area

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