Management of Carbon Sequestration by Identification of Soil Limitation Factors That Affect Plants Growing

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Abstract

Organic matter plays an important role in many soil properties. So it is necessary to identify management systems which maintain or increase its concentrations. Different types of soil with its cover plants have different potential in carbon sequestration. For this goal, four sites with different soils (Saline soil, Gypsisol, Calcic soil, Forest Acidic soil) and their vegetation have been studied. In each sites, 12 to 15 points were sampled and analyzed some relative factors that reflect crucial characteristics of each soil. The results show that EC, gypsum and lime are limited factors in arid and semi-arid sites and only tolerant plant as Halophytes and Gypsophytes can be stable. Also, in forest site, soil acidic condition shows limiting for plants growth more than climatic factors. But the amount of growing plants in arid and semi-arid sites depends on climatic factors Mostly. Therefore, identification of limitation factors of soil for different ecosystems can be help to manage their vegetation cover that adjusted the different soil conditions for carbon stocks.

Keywords: Sequestration; Gypsisol; Calcic; Acidic; Halophytes; Gypsophytes;

1. Introduction

Today increasing of human industrial activities and changing the land usage are two important factors to increase the temperature (greenhouse phenomenon) by increasing carbon dioxide gas. According to the experts increasing the temperature of the earth has been 30% in recent decades (Powlson, 2011). Each ecosystem has different components with different amount of carbon stored. Research given that forests have the greatest amount of biomass of any habitat type that type of forest vegetation has crucial effects on carbon stocks. There are varying estimates of this effect: + 33 percent, + 25 percent, and + 60 percent for trees, + 14% for pastures and crops (Intergovernmental Panel on Climate Change [IPCC], 2001). Not only forests ecosystems, other ecosystems have important roles in carbon sequestration, too. Especially in countries where there is little or no forest cover as Iran, carbon storage and protection from arid soils it has crucial role. The traditional management of these rangelands, often associated with stocking density over the carrying capacity, has resulted in floristic and physiognomic changes, losses of soil organic carbon, increase of bare soil and eventually desertification (Golluscio et al., 1998; Lal, 2002). The emergence of a prospective carbon market, as a tool to promote carbon sequestration and offset the increasing atmospheric carbon dioxide concentration, may offer new incentives to restore arid ecosystems, especially in those places where land degradation has led to a decline in economic yields (Prince et al., 1998). In fact, arid and semi-arid regions, here after dry-lands, have been regarded as potential carbon sinks (e.g. Squires, 1998; Lal, 2002; Ardo¨ and Olsson, 2003; Gru nzweig et al., 2003). Dry lands cover _45% of the global land surface and, despite their low soil organic carbon (SOC) concentration; encompass _16% of the global soil C pool (Ojima et al., 1993; Jobba´ gy and Jackson, 2000). Large global extension and widespread degradation give drylands one of the highest potential to sequester carbon. A potential global sequestration of _1 PgC $year^{-1}$, or _30% of current increases in the atmospheric CO_2 concentration (Squires, 1998; IPCC, 2001), denotes the relevance of drylands in the fate and management of the global carbon cycle. Soil is as noticeable component stored carbon in different terrestrial ecosystem. The amount of organic carbon in soil is three times more than in the whole tissue of plants and twice more than atmosphere. The value of carbon stored in soil is estimated between 1500 to 2000 Gton (Girard et al., 2010). Different types of soil with its plant have different potential in carbon stored. In China, the distribution patterns of soil active carbon and soil carbon storage in the soil profiles of *Quercus aliena var. acuteserrata* (Matoutan Forest, I), *Pinus tabuliformis* (II), Pinus armandii (III), *pine-oak* mixed forest (IV), *Picea asperata* (V), and *Quercus aliena var. acuteserrata* (Xinjiashan Forest, VI) of Qinling Mountains were studied. The results showed that forest soils, and the order of the mean SOC (Soil Organic Carbon) and DOC (Dissolved Organic Carbon) along the different soil profiles was V > IV > I > II > III > VI (Wang et al., 2015). However forest biomass and soils are considered to have a large potential for temporary and long-term carbon storage (Gower, 2003; Houghton, 2005), arid and semi-arid regions cover at least 30% of the global continental area and contain 20% of global soil carbon stocks (Bechtold and Inouye 2007; Rasmussen 2006). All soil parameters as physical and chemical conditions influence the soil carbon organic (Rochette et al., 1998; Jabro et al., 2008; Amit Kumar and Sharma, 2015). In different ecosystems, soil component has different types of soil chemical and physical conditions that classify especial species. For example, salinity with different chemical compositions in the soil formed different type of soils that majority of them are located in arid and semi-arid regions. Different chemical compositions of salinity in soil introduce the especial groups of plants that tolerant different conditions with different chemical composition of soils. As, the soil salinity influences the many physiological and morphological activities of plants. The higher the salinity level the more rapidly effects become obvious and the lower the yield that influence soil organic carbon by amount of plant growing and also establish the Halophytes that are salt-tolerant, which means they can accomplish their life cycle in environments where the salt concentration is around 200 mM NaCl or more. Gypsisols are one of other salinity soils that are substantial secondary accumulation of gypsum ($CaSO_4.2H_2O$). Soil gypsum affects the mineral contents of plants. Researchers showed, using water culture, that increasing the concentration of SO_4^{2-} mixture (K_2SO_4 + $MgSO_4$) increased the uptake of NO_3^{1-}, K^+, Mg^{2+} and SO_4^{2-} by corn but decreased the uptake of calcium and phosphorus (Hernando et al., 1964). Studied the mineral contents of 52 natural species growing on Gypsiferous soils in Tunisia, and reported that various species growing under the same ecosystem responded differently to the excess of Ca^{2+} and SO_4^{2-} present in the soils, depending upon their biogeochemical properties. A comparison of field observations, with water culture studies, confirms the behavior of plant species toward nutrient adsorption

(Boukhris and Lossaint, 1970, 1972). Also in salinity soils plants growth are limited by some element as sodium, chlorine, etc. So, only halophytes can grow (Boukhris and Lossaint, 1972). Upper soil layer is important in carbon stored. Recent improvements in understanding of the dynamics of soil carbon have shown that 20–40% of the approximately 1,500 Pg of C stored as organic matter in the upper meter of soils has turnover times of centuries or less (FAO, 2015).

Identification of different factors in different soil physical and chemical properties that have important roles in different plant growing specially limitation factors, can be crucial effect on management of different types of soil to protect all ecosystems with their natural condition also in managing of carbon stocks in different soils so that can be great goal of this research.

2. General Information of Studied Sites

The sites are located in three Provinces in Iran (Figure 1):

2.1 Gorazbon Forest Site (Noshahr City in Mazandaran Province)

Gorazbon forest site located in North of Iran (close to Noshahr city in Mazandaran province [36°34'N to 36ºN, 51° 36' 30" E to 51°39' 30"E]). The altitude sea level is between 55mm to 1380 m. Mean annual precipitation is about 1146mm. Maximum and minimum precipitation are 44.4 mm (July), 200.4 mm (October) respectably. Also, mean annual temperature is 8.55ºC. Maximum and minimum temperature are 15.5ºC (July), -1ºC (January) respectably. According to the Emberger classification (Q=168.6), climate classification is humid with cool winters (Russell, 1977).The soil of Gorazbon site is brown forest acidic soil and forest vegetation is dense with almost Acidophil (Zarrinkafsh, 2010). One of the important species of trees are*: Fagus orientalis, Carpinusbetulus, Alnus subcordatc, Quecus castaefolia.* Other tree species are less than 1percetage and disperse that in term of ecology and diversity is rare. Important indicators of herbaceous are from acidic to neutral condition of soil that have great impact on amount of carbon sequestration in surface forest soil. The number of them that can be called Bioindicator (Zarrinkafsh and Nalbandi, 2013): *Viola sylvestris, Arum maculatum, Asperulaodorata, Epimediumpinatum, Lamiumgaleobdolon, Stachysylvatica, Geranium rotundifolium, Euphorbia amygdaloides, Mercurialiserennis.*

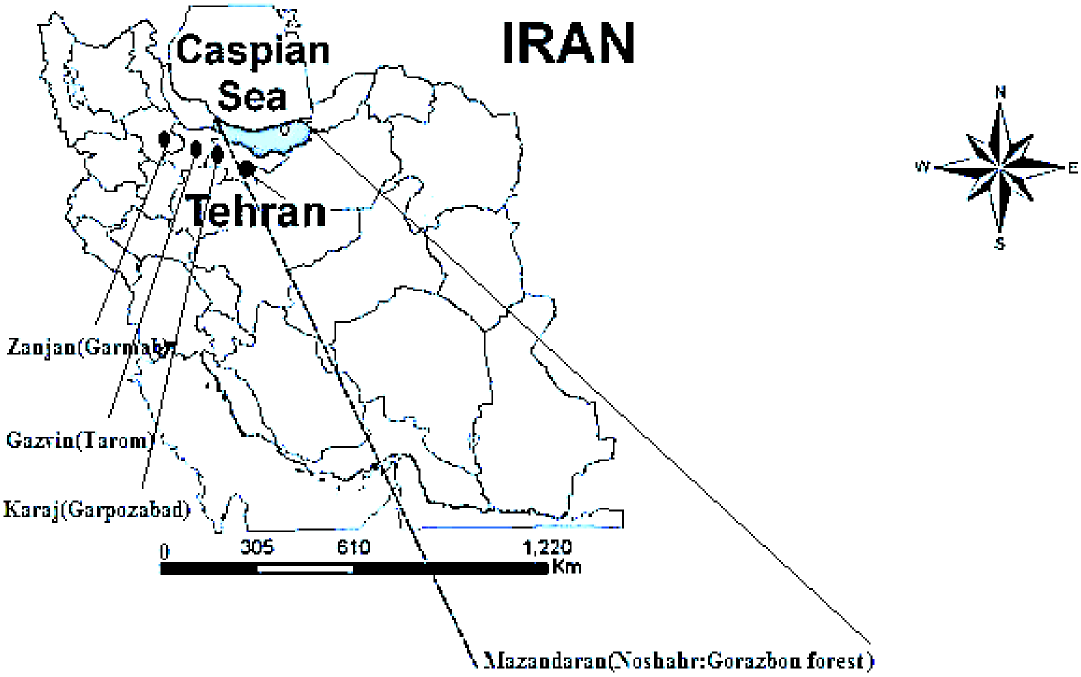


Figure 1. The sites are located in three Provinces of Iran.

2.2 Garmab Site (Near Zanjan Provence)

Garmab land is established the small hills and plains. Garmab or Garmabe is a city (35.8467° N, 48.1971° E) in Khodabandeh Country, Zanjan Province, Iran. (60 Km near Zanjan). Mean annual precipitation of Garmab city is about 420 mm (for 20 years) with cold winter and about hot summer. The driest month is August, with 2 mm of rainfall. The greatest amount of precipitation occurs in April; with an average of 69 mm. Maximum of precipitation is about 350 mm. From the point of climate view three sites (Garpozabad, Tarom, Garmab)do not differ much. Precipitation relation to scalp transpiration ratio is less than 0.5. The evaporation and precipitation in a year is more than two times (Khalili et al., 1993). The Köppen-Geiger climate classification is Csa. The average temperature in Garmab is 12.0 ° C. The warmest month is July, with an average temperature of 24.4 ° C. The lowest average temperature in the year is January, with an average temperature of 4 ° C. The soil of this land has been the formation of limestone and conglomerate. Plant cover crops such as wheat and barley have been formed. Due to lime spots, all soil layers have lime characterizes in 20-60 cm among of lime is 40 percentages (Calcic layer) (Zarrinkafsh, 2010). In American classification is in Calcixerepts group and in WRB classification are in calcic soils group.

2.3 Tarom Site

Tarom area (36º 38´ to 37º 13´ N ,48º 30´ to 49º 14´ E) is located Zanjan Provence (near Zanjan city the altitude sea level is 300m) in Iran. Tarom site has almost hot summer and winter is colder. Mean annual temperature of about 17.4 ºC and mean annual precipitation about 243.2 mm in the Tarom site and also, at 48.5 ° C on average, July is the warmest month. In January, the average temperature is -7.5 ° C. So, Based on the Ambergris formula, the climate of Tarom is determined the dry cold zone. In August, precipitation is at its lowest, with an average of 1 mm. With an average of 64 mm, the most precipitation is in December.

The soil of this land is formed the richness of marl, chalk and sand the point of view of new gene geology (Khalili et al., 1992). Alluvial deposits belong to the fourth period of geology, which consists of several deposits. This soil is classified in Gypsisols in Haplic Gypsisols. There is rich of $CaSO_4$ and there is no possibility of cultivation (Zarrinkafsh 2010). There is rich of $CaSO_4$ and there is no possibility of cultivation so, dominating plants are with tolerant to $CaSO_4$ (gypsophyts) (Zarrinkafsh, 2010). The major species are; *Atriplex paluitum, Astragaus gmmifere, Peganum harmala.*

2.4 Garpozabad Site

Last studied Site is Garpozabad village site that is located Gazvin province in Iran (35° 30' 2'' N and 50°30' 10''E). The altitude sea level is between 1100 to 1500 m. Gazvin's climate is a local steppe climate. There is very little rainfall during the year. According to Köppen and Geiger, the climate is classified as BSk. The average annual temperature in Qazvin is 14.2 ° C. The average annual rainfall is 301 mm. In August, the precipitation reaches its peak, with an average of 1 mm. The greatest amount of precipitation occurs in April, with an average of 75 mm. At 26.0°C on average, July is the warmest month. In January, the average temperature is 1.9°C. It is the lowest average temperature of the whole year. Garpozabad site' climate is about near to Gazvin city'climate that has hot summer and winter is almost cold (Mean annual temperature of about 15.5 ºC and mean annual precipitation about 250.6 mm (for 10 years) and also evatranspiration about 715.2 mm). So we use the Gazvin city data for climate part of this site. That is richening of salt and amount of gypsum and limestone. This soil is arranged in Solowchak the unit of FAO, WRB, 2010 and in American classification is the Salids category (Zarrinkafsh, 2010). Vegetation of land is covered Halophytes species. The majority of tolerant salinity plants in this site are: *Salsola Sp, Peganum harmala, Hordum spontaneum.*

3. Materials and Methods

With the help of topographic and geological maps of studding area per 1000ha are estimated. Based on the scale of 1:25000, about 12 points were selected from each sites (Garpozabad Layers [0-30, 30-60, 60-80 cm],Tarom Layers [0-40, 40-80cm],Garmab Layers [0-20, 20-40, 40-60cm]) randomly because of Topographical conditions that were pretty mild and plant distribution was about same and also 30 points from Gorazbon forest (layers 0-10, 10-20, 20-40, 40-80 cm) were selected randomly that has about hard topographical conditions. In each points up to1 to 1.2 meter were drilled and each soil profile were studied to recognize of soil layers. The samples were analyzed physical and chemical characteristics of soil as following: Bulk Density (BD [gr/cm^3]) by Cylinder method (Sarmadyan and Jafari, 2001), soil texture by densitometry, pH (1:2.5) measure by pH meter (Electrode in clean mud of soil sample that measure the electrical potential of hydrogen ions). Cation Exchange Capacity (CEC [meq/100g]) is a useful indicator of soil fertility as forest soils that leaching of nutrients are more, CEC measure by use of Ammonium acetate and Falam fotometri forest soil samples. Also soil Electrical Conductivity (EC [Ds/m]) measuring by inserting probes EC meters in extract saturation of the soil samples with 1: 2 of water and soil (Values of D_S / m1 EC> on the arid soil samples because the weather conditions will increase evaporation the erosion of mineral ions into the soil solution). Soil Organic Carbon (OC [%]) is measured by Walkley-

Black (cold method). In this method Potassium dichromate ($Cr_2K_2O_7$) is used that Consumption of Potassium dichromate in reaction with organic carbon in soil sample can be realized to the amount of organic carbon (Sarmadyan and Jafari, 2001; Mario and Roades, 1977), For each soil sample, soil bulk density was calculated as the ratio of soil dry weight to the soil cutting ring's volume (i.e., $100cm^{-3}$). The soil samples were air dried and samples that were collected from within the same plot were mixed and sieved to 0.15 mm, after removing plant materials. Soil organic carbon was analyzed through combustion. Finally, amount of carbon sequestration is estimated by below formula:

$Cs = 10000 \times OC\ (\%) \times BD \times e$

Cs= Carbon Organic Sequestration ،(kg/ha)

BD= Bulk Density (gr/cm^3)

OC=Organic Carbon (%)

e= Soil Depth (cm)

Soil lime ($CaCO_3$) (T.N.V [%]) by Titration method and use of Hydrochloric Acid (HCl) (Mario and Roades, 1977; Skarie et al.,1987) and soil Gypsum ($CaSO_4$) [%] measuring with method sediment $CaSO_4$ that is used by $CaCl_2$ (Skarie et al.,1987; ASTM, 2006). Also, for analyzing data is used SPSS (Statistical Package for the Social Sciences) version 15.

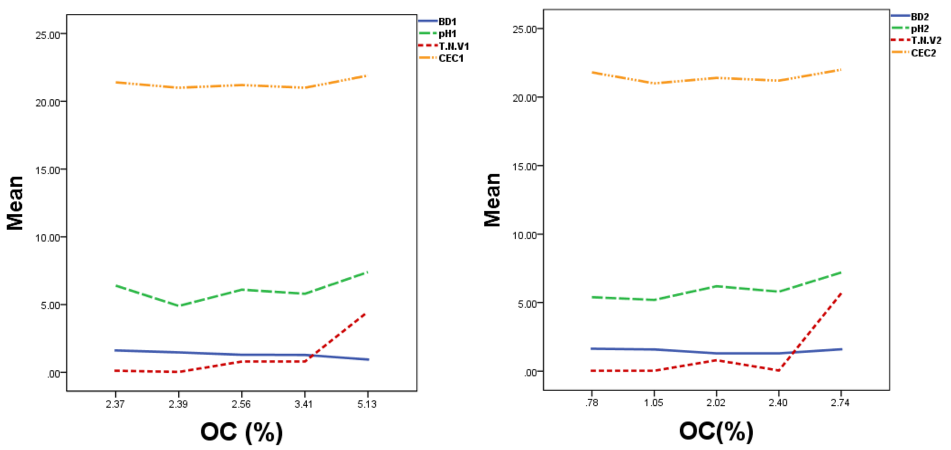
4. Results

The Amount of Carbon Sequestration Depend on Soil Limited Factors is estimated in the each site. For estimating of soil carbon sequestration in different sites organic carbon was measured in different layers. The rates of organic carbon to some soil properties as mean BD, T.N.V, pH, CEC, Soil Gypsum ($CaSO_4$) and EC are analyzed by line Regression multiple in the different depth of soil and results are showed in the Figures.

4.1 Gorazbon Site

In Gorazbon forest site, considering the results of some soil factors as T.N.V, pH, CEC and BD related with the percentage of OC are shown in Figure 2 as line Regression.

a **b**



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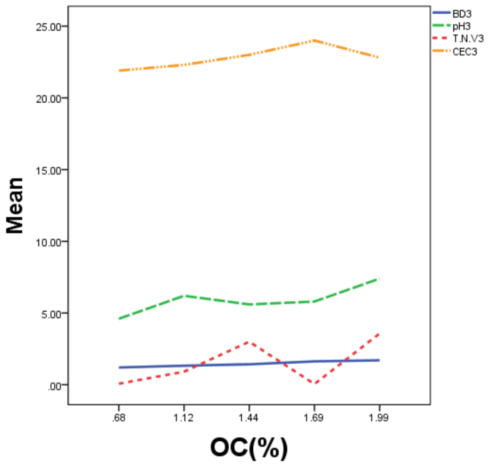

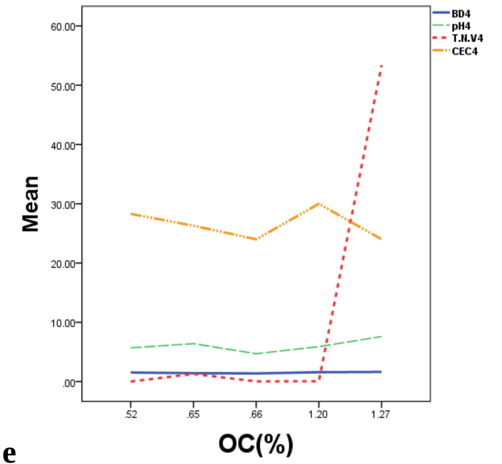

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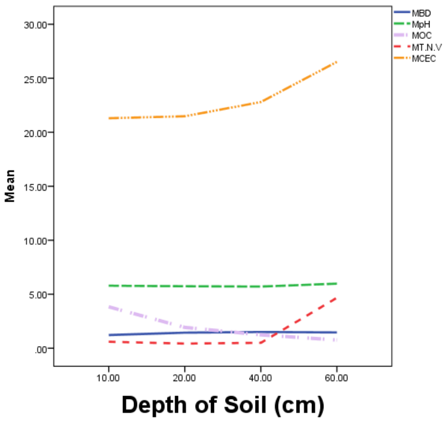

Figure 2. Relation between OC (%) and BD, pH, T.N.V and CEC in Gorazbon forest site in different depths of soil [(**a**: Layer 1 (0-10cm), **b**: layer 2 (10-20cm), **c**: layer 3 (20-40cm), **c**: (40-80cm) e: M (mean)].

The Percentage of Organic Carbon (OC) rises with increasing the amount of T.N.V and pH slightly (Figure $2_{a,b,c,d}$). Low pH and acidic condition can be limited factor for plants growth in forests. pH affects plant growth primarily through its effects on nutrient availability. High or low pH cause deficiencies in essential nutrients that plants need to grow. According to the Clemson Cooperative Extension, acidic soils frequently experience deficiencies in calcium, phosphorus and magnesium. Alkaline soils demonstrate deficiencies in phosphorus and many micronutrients. Explanations of poor plant growth on acid soils have included Al^{3+}toxicity (Barceló et al., 1996; Kinraide, 1993), Mn^{2+} toxicity (Foy, 1984), low N supply (mainly NH_4^+-N rather than NO_3^--N) (Foy, 1984), P deficiency (Foy, 1984), Mo deficiency (particularly in legumes; Hafner et al., 1992) and toxic concentrations of phenolic acids (Baziramakenga et al., 1995; Vaughan and Ord, 1991; Whitehead et al.,1981). Furthermore, soil pH affects the behavior of soil microbes, encouraging or inhibiting the growth of pathogens and affecting how well helpful microbes are able to break down organic material, freeing the nutrients it contains for plant use. So, Gorazbon forest site (Figure 2_e) with acidic condition can be limited factor for plant growth that limited factor is moderated by T.N.V and allowed high amount of growing plants that is origin of soil organic carbon. On the other words, origin T.N.V is parent materials wherever the bedrock materials are closer to the surface or accumulation of calcium carbonate has more effective on soil condition by preventing of increasing acidic condition. Many researches showed that liming can result in dispersion of clay colloids and formation of surface crusts. As pH is increased the surface negative charge on clay colloids increases and repulsive forces between particles dominate (Haynes and Naidu., 1998; Castro and Logan, 1991; Ghani et al., 1955; Kamprath, 1971; Roth and Pavan, 1991; Tama and El-Swaify, 1978). In temperate regions, the conventional aim of liming is to raise soil pH (water) into the range of 5.7 – 6.5, often with a target pH of about 6.0. So, it can be said the high acidic condition of Gorazbon forest soil is a limiting factor for plant growing. Wherever acidic condition of Gorazbon soil is moderated by T.N.V, soil pH is increased. As Figure 2 shows (especially upper layer 1and 2), when soil pH and T.N.V increased, accumulation of OC is increased, too. Also by increasing soil depth up to 40cm, amount of T.N.V is raised sharply because of accumulation soil materials and closer to bed rock (Figure 2_e). Mean of soil pH is increased slightly because of distance from the soil surface as source of organic carbon, reduced roots and microorganisms activities and influenced by soil materials (Figure 2_e).

The percentage of OC increases with increasing the CEC slightly all layers (Figure $2_{a,b,c,d}$). CEC of soils is one of important factors varies according the clay %, the type of clay, soil pH and amount of organic matter. Pure sand has a very low CEC, less than 2 Meq/L, and the CEC of the sand and silt size fractions (2 µm/2 mm) of most soils is negligible. In addition, Organic matter increases the soil's CEC or its ability to hold onto and supply over time essential nutrients such as calcium, magnesium and potassium. The lower the CEC of a soil, the faster the soil pH will decrease with time. Liming soils to higher than pH 5 ($CaCl_2$) will maintain exchangeable plant nutrient cations. Since the soil pH is one of sensitive factor of Gorazbon forest site, influence the CEC. As increasing pH (in acidic condition as forest site as Gorazbon) means improving condition that cause of increasing CEC in all layers. Soil OC is increased by improving condition and increasing CEC. Research showed that soils with organic matter percentage above 17% are classified as organic soils, and have high CEC, raising the nutritional potential of the surface layers of soil. Generally, soils with high CEC have color ranging from dark brown to black due to the high lignin content of organic matter (Aprile and Lorandi, 2011). As Figure 2_e shows the mean CEC in all layers of Gorazbon forest soil is high that can be said this forest site is fertilizer to growing high amount of plants because of a high organic content, the high percentage of clay and with appropriate soil pH (~5.7) for CEC. However, decreasing OC by increasing soil depth, CEC is increased especially deeper layer maybe cause of other factors as type and the percentage of clay that is accumulated in deeper layers. BD as Figure $2_{a,b,c,d}$ shows, is decreased by increasing OC especially in upper layer (0-10cm) because of high amount of organic matter. In fact, The BD depends on several factors such as compaction, consolidation and amount of Soil Organic Carbon (SOC) present in the soil but it is highly correlated to the organic carbon content (Morisada et al., 2004; Leifeld et al., 2005) that reduce the BD. Soil OC increases stability of soil by reducing compatibility and enhancing in retaining a greater amount of moisture to rebound against compaction as quote by Paul (1974), in a study upon press mud on the soil physical conditions in sandy soil. Soane (1990) in the review on practical aspects of soil tillage stated about the role of organic matter in increasing bound between particles, elasticity, electrical charge change and friction. Also, the result shows that BD is increased by increasing soil depth because of reduced OC (%), compaction and effects of soil texture by increasing amount of clay (Figure 2_e). In the Gorazbon forest soil site, the percentage of clay in the deeper layers is more than upper layers by accumulation of soil clay that can cause of increasing the BD. Similar studies indicated there are positive relationship between BD and percentage of clay (Chaudhari et al., 2013; Catherine Pe´ rie´ and Rock Ouimet, 2007). Soil depth is another factor that influences the soil organic carbon. In the Gorazbon forest site by increasing soil depth, percentage of organic carbon is decreased that many factors are related as reducing roots penetration (Figure 2_e). Similar studies were performed by Nalbandi and Zahedi (2012) for North of forest in Iran (Namkhane Forest). Catherine Pe´ rie´ and Rock Ouimet (2007) determined decreasing OC by soil depth in the forest soils. Main reason to decreasing OC in depth is limited plant roots penetration that depends on many soil properties as BD. At all, Gorazbon site as forest area has about acidic soil that decreasing soil pH is limiting factor to plants activities. Thus, the plants that are established Gorazbon site, are tolerated the acidic soil condition. Any changing in the pH can influence on other soil factors as CEC and OC.

4.2 Garmab Site

Considering the results of some soil factors as T.N.V, pH, CEC, BD and EC related with the percentage of OC are shown in Figure 3 as line Regression in Garmab site. As Figure $3_{a,b,c}$ shows decreasing soil T.N.V, the percentage of OC is increased, especially in upper layers. Also, soil CEC is increased by decreasing T.N.V and increasing OC that indicate soil condition is recovered. In fact, Garmab site is alkaline soil with high pH (Figure $3_{a,b,c,d}$) because of high amount of T.N.V, So increasing T.N.V as Gorazbon site cannot be balanced factor in Garmab site unlike it is limiting factor to growing plants. On the other words, T.N.V is important factor to increasing soil pH that has negative effects on plants growth in the Garmab site. In addition, soil pH is not affected by soil OC mostly because of low plants growing and high accumulation of T.N.V that cause of high mean pH condition in Garmab (Figure $3_{a,b,c,d}$). Major effects of extremes in pH levels include gaps in nutrient availability and the presence of high concentrations of minerals that are harmful to plants. In very alkaline soil, certain micronutrients such as zinc and copper become chemically unavailable to plants and also, most nutrients dissolve less easily, causing calcium, iron and phosphate compounds to precipitate. In general, T.N.V is one of limiting factor that reduces plants growth by increasing in the alkaline soil such as Garmab site. So, in lime soil as Garmab site by increasing T.N.V, percentage of OC is decreased that is limiting factors to plants growing. In addition, result in Figure 3_d shows by increasing the depth, mean of T.N.V is increased (because of accumulation or more closer to parent lime rock) and OC is decreased (low penetrated of roots and microorganism activities) (Figure3_d). Research showed that the amount of calcium is 10 times higher in the lower layer than in the topsoil (Dwivedi et al., 2017). It can be concluded however; reducing OC cause of many factors as increasing BD and reduce the resources (air and water) needed to grow roots, T.N.V maybe other limiting factors to grown plants in soil different depth.

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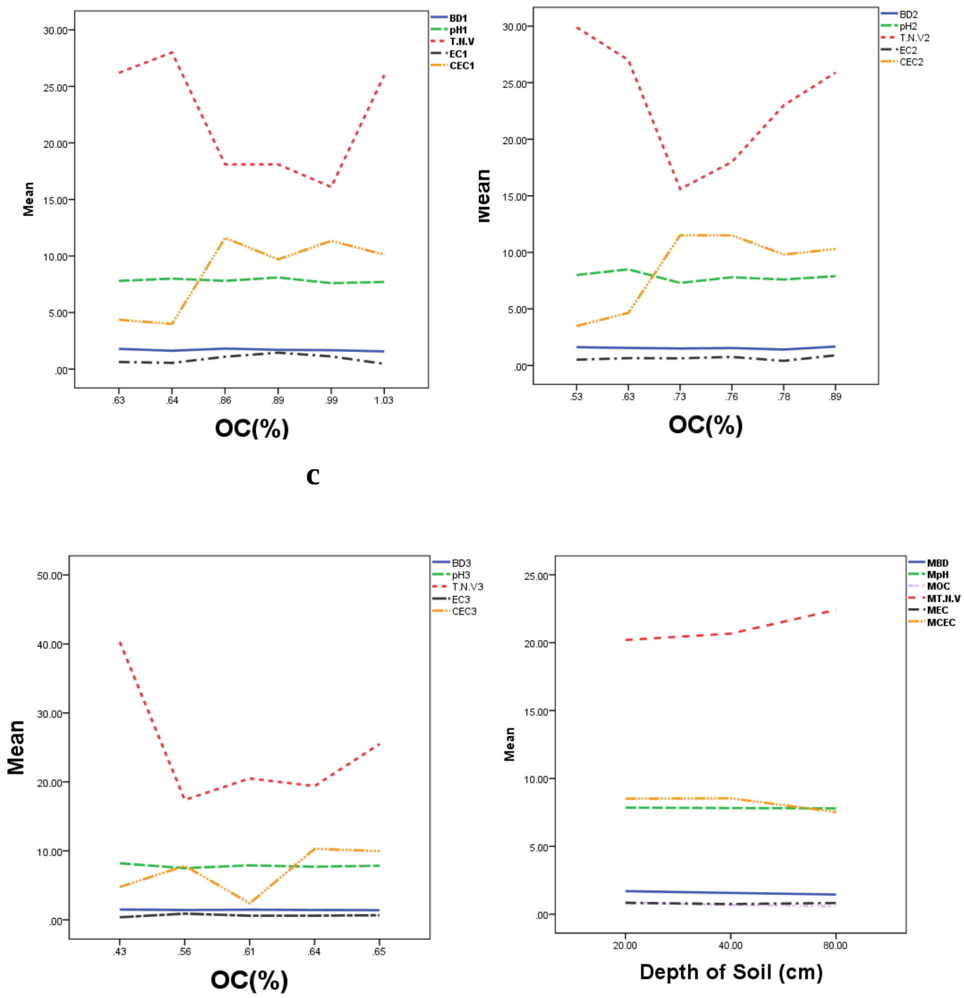


Figure 3. Relation between OC (%) and BD, pH, T.N.V, CEC and EC in different depths of Garmab soil [(a: Layer 1 (0-20cm), b: layer 2 (20-40cm), c: layer 3 (40-80cm), d: M (mean)].

As said above, CEC is influenced by soil OC and T.N.V that decreasing soil T.N.V and improved soil condition to plants growth cause of increasing soil CEC (Figure $3_{a,b,c}$). Organic matter increases the soil's CEC or its ability to hold onto and supply over time essential nutrients such as calcium, magnesium and potassium. Organic matter has a very high CEC ranging from 250 to 400 Meq/L (Moore, 1998). Also, research showed that soils with organic matter percentage above 17% are classified as organic soils, and have high CEC, raising the nutritional potential of the surface layers of soil (Aprile and Lorandi, 2011). In compared with Gorazbon forest sit, the mean of CEC (Figure 3_d) in Garmab is less. Garmab site is approximately low CEC because of high pH and also T.N.V is as poison that no allow to more plants growing. Soils with a low CEC are more likely to develop deficiencies in potassium (K^+), magnesium (Mg^2+) (Credit Union Compliance Expert [CUCE], 2007). Not only soil OC effects on CEC, soil pH and T.N.V influence the soil CEC, too. As Figure $3_{a,b,c}$ shows CEC is increased by decreasing percentage of T.N.V and pH. High soil pH as one of negative effects on CEC can decrease soil fertilization and soil OC. Low organic matter with very high calcium carbonate and phosphate, thus make it infertile. In addition, CEC is decreased by increasing soil depth that some factors as decreasing SOC, increasing T.N.V and pH can be cause of low fertilization and CEC (Figure 3_d). However, BD has important effects on soil organic carbon that depend on soil texture (Erdal Sakin, 2012; Chaudhari et al., 2013; Tanveera et al., 2015) in arid-semi arid soils and also similar studies is showed in forest soils (Catherine Pe´ rie´ and Rock Ouimet, 2007), BD in Garmab site is not more effected by soil organic carbon maybe because of low organic carbon and sandy particles condition (Figure$3_{a,b,c}$). So, Garmab BD is affected by soil texture mostly. Arid soil is mostly sandy soil (90–95%) found in low-rainfall regions (Dwevedi et al., 2017). Soil texture of Garmab site is about Sandy-Clay-Loam and compared with Gorazbon site has high mean BD in the different depths (Figure 3_d). The studies indicated that the BD was highest in Katumani luvisols at 1.4 and 1.3 g/cm^3 and lowest in Gituamba Andosols at 0.6 and 0.8 g/cm^3 for the 0-15 and 15-30 cm depths, respectively and seems to reflect the texture of respective soils. The soils with low in clay content and high in sand content like Katumani luvisols are tend to exhibit higher ρb and vice versa (Chaudhari et al., 2013;Sakin, 2012;Catherine & Ouimet, 2007;Sakin et al., 2011). However, influence of organic matter content on ρb in these soils cannot be ruled out, type of soil texture influence the mean soil BD more. Although soil organic matter is decreased by increasing soil depth, BD is decreased very slightly that is concluded BD is affected by soil texture more than other factors in semi-arid soil as Garmab site (Figure 3_d). Soil electrical conductivity (EC) is a measure of the amount of salts in soil (salinity of soil). Soils containing excess salts occur naturally in arid and semiarid climates. $EC_{1:1}$ readings less than 1 dS/m, soil are considered non-saline and do not impact most crops and soil microbial processes. So, EC in Garmab site is less to effects on crops (Figure 3 $_{a,b,c,d}$), but it has been effected on soil organic carbon. As results show OC (%) is increased by increasing soil EC. In fact, this positive relationship between EC and OC may be depending on types of plants. The type of plants can tolerant to high amount of lime in Garmab site, perhaps they are salinity tolerance plants. So, they maybe have positive reaction to less salty condition as Garmab site. Less amount of salt in high lime may be balance condition by many chemical reactions that need much research about this goal. And also by increasing soil depth, EC is increased because of moving the salty soil elements from upper layers to down. Totally, Garmab site with high T.N.V content as soil limiting factor, keep the soil pH high, so only tolerant plants to this soil condition can be established. It should also be noted that plants can tolerate calcareous conditions somewhat. If calcareous materials are too high, soil organic matter will not be affected by fluctuations the soil calcareous materials. So, the amount of plant growth and soil organic matter is influenced by other environmental factors including climate factors.

4.3 Tarom site

In Tarom site, considering the results of some soil factors as T.N.V, pH, CEC, BD, EC and soil Gypsum related with the percentage of OC are shown in Figure 4 as line Regression. As results shows Tarom site is one of Gypsum soils because of high percentage of Gypsum (Figure $4_{a,b,c}$). OC is increased with decreasing the percentage of Gypsum however, soil T.N.V is increased about in the Layer 1 (the layer 1 is main layer of roots accumulation that is influenced with amount of gypsum) (Figure 4_a). Wherever soil T.N.V is maximum and Gypsum is minimum, the percentage of T.N.V influenced soil OC by increasing soil pH (Figure 4_a). So, Gypsum can be limiting soil factors in Tharom site for many plants growing that are main origin of soil OC. Many research show the different amount of soil gypsum influence the plants growing.

As Van Alphen and de los Rios Romero (1971) conclude that up to 2 percent gypsum in the soil favours plant growth, between 2 and 25 percent has little or no adverse effect if in powdery form, but more than 25 percent can cause substantial reduction in yields. They suggest that reductions are due in part to imbalanced ion ratios, particularly K:Ca and Mg:Ca ratios. Hernando et al., (1964) studied the effect of gypsum on the growth of corn and wheat by varying the gypsum level in the soil up to 75 percent. They show that high levels of gypsum caused poor growth of corn, especially as the soil moisture was maintained at 80 percent of field capacity. However, wheat showed minimum growth where the soil contained 25 percent gypsum at all soil moisture levels ranging from 15 to 100 percent of field capacity. Bureau and Roederer (1960), report that 30 percent gypsum content in soils of Tunisia is toxic to plant growth. Van Alphen and de los Rios Romero (1971) state, from field observations in the Ebro Valley of Spain, that plant growth is reduced where the gypsum content exceeds 20 to 25 percent. Soil gypsum affects the mineral contents of plants. Boukhris and Lossaint (1970, 1972) studied the mineral contents of 52 natural species growing on gypsiferous soils in Tunisia, and reported that various species growing under the same ecosystem responded differently to the excess of Ca and SO_4 present in the soils, depending upon their biogeochemical properties.

In general, the chemical composition of the leaves or aerial parts of plants is influenced by the plant family. A comparison of field observations, with water culture studies, confirms the behaviour of plant species toward nutrient adsorption. A high level of SO_4 in the soil can raise the SO_4, level in the gypsum tolerant species (called Gypsocline); but to a lesser extent in the species (so-called Gypsophytes) found on natural gypsum soils. However, there are some gypsophytes called thiophores which have great ability to accumulate high levels of S in their leaves. Thus, results of Tarom show when the percentage of Gypsum is high (Figure $4_{a,b}$) as toxin and limiting factors to plants. From intensive field observations of gypsiferous soils in Iraq, Smith and Robertson (1962) found that root growth was inhibited where the gypsum content of soil was over 10 percent. This is apparently because of the poor transmission of air and water caused by poor structure. They also found that soils containing more than 25 percent gypsum in the rooting zone give poor growth. pH in the Tarom is about neutral (Figure $4_{a,b}$) because of interaction between gypsum and T,N.V. By increasing the percentage of T.N.V, soil pH and OC are increased slightly (Figure $4_{a,b}$) that is indicated increasing pH by soil T.N.V is important to improve soil condition for plants growing especially in first layer (Figure $4_{a,b}$ [soil OC in layer 2 is not more influenced by soil Gypsum and T.N.V because of organic matter is very less and Gypsum is very high to interact between them]). Also, CEC is increased slightly by increasing soil OC, T.N.V and pH that emphasize improving the soil condition by impacts of T.N.V in gypsiferious soil of Tarom. In the neutral soil, Gypsum application reduced the soil pH slightly (Lee and Mudge, 2013) but lime can increase the soil pH. Perhaps gypsum can improve some acid soils even beyond what lime can do for them, which makes it possible to have deeper rooting with resulting benefits to the crops (Hopkins, 2013). The following relationships have been observed by the authors: Gypsum is precipitated and accumulates when the electric conductivity is less than 60 mS cm^{-1}. The possibilities of concentrated solutions and the formation of deposits of gypsum will increase gradually with the drop in conductivity. The ionic product $(Ca^{2+})(SO_4^{2-})$ of the solution will not be attained if the electric conductivity is higher than 60 mS cm^{-1}. As the gypsum content increases, the calcium carbonate content tends to decrease and vice-versa. However, the forms of $CaCO_3$ and gypsum, as well as the presence of soluble salts, influence this relation. In Tarom, EC (Figure $4_{a,b}$) is less than 60 mS cm^{-1}, process precipitation is occurred slightly (because of low rainfall), so by increasing soil OC, soil EC is decreased very slightly in first layer but soil OC is not influenced by EC in deeper layer because of very less percentage of soil OC to be influenced by soil EC (Figure $4_{a,b}$). Moreover, EC in deeper soil layers is influenced by soil properties and environmental factors (amount of rainfall and other water sources effect on soil EC). If amount of EC is high, it can be more effects on soil factors and plants growing. So, EC in Tarom is low and is no more effects on plants.

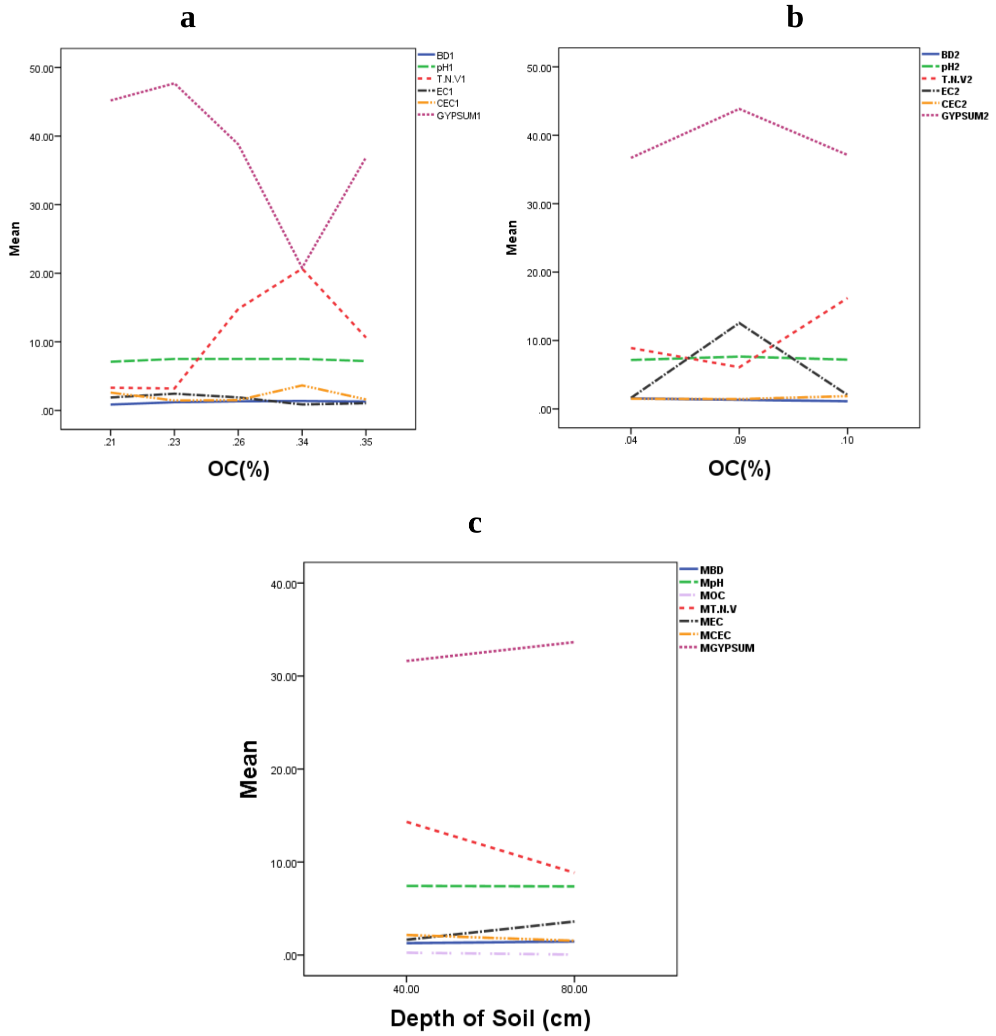


Figure 4. Relation between OC (%) and BD, pH, T.N.V, CEC, EC, Gypsum in different depths of Tarom soil [(**a**: Layer 1 (0-40cm), **b**: layer 2 (40-80cm), **c**: M (mean)].

By increasing soil depth, soil OC in Tarom site as other sites is decreased because of reducing the penetration of roots. However, the percentage of soil gypsum is increased as limiting factor to plants growing; it cannot be only factor to prevent of roots penetration in Tarom soil depth (Figure 4_c). Also, BD is not influenced by soil organic carbon more expect in second layer (Figure 4_a) and BD is decreased by increasing soil OC in second layer (Figure 4_b). First layer may be is influenced by many soil factors and environmental factors as climatic on soil surface that reduce impacts organic carbon on BD especially in arid and semi-arid area as Tarom that have less percentage of OC. For example, soil factors like Gypsum, studies show that a great variety is evident in the texture of gypsiferous soils. In the Ebro Valley, Spain, samples taken from the non-gypsic surface layer of gypsiferous soils showed the clay content to range from 2 to 40 %, and in the Euphrates Basin, Syria, from 2 to 35 %. Gypsic subsoil layers do not, in general, contain more than 15 % clay. The texture depends largely on the nature of the parent material from which the soil is derived, e.g. clays, silts, sands or marls, and on their degree of interbedding in gypsum deposits. Absolutely, soil surface will be influenced by amount of rainfall and organic matter if amount of organic matter and rainfall are enough to change soil surface. In addition, as Figure 4_c shows by increasing soil depth, BD is increased and decreasing OC slightly that can be limiting factor for roots penetration. Thus, BD condition of Tarom site can be one of limiting factor of plants growth that needs to improve to fine texture by increasing organic matters. Summarizing, the physical properties of gypsiferous soils, as a medium for plant growth, depend on the surface gypsum content, the depth of the gypsic layer and its degree of induration (Rozanov, 1961; Kurmangaliyev, 1966).At all, the high percentage of Gypsum in Tarom soil influences both chemical and physical soil conditions that due to establish only tolerant plants as gypsophytes to this soil conditions. However, the amount of soil organic carbon is influenced by the percentage of soil gypsum especially in first layer; other soil factors no effect on soil OC directly and the amount of plants growing that is important source of soil OC, depends on climatic factors mostly.

4.4 Garpozabad site

In Garpozabad site, considering the results of some soil factors as T.N.V, pH, CEC, BD, EC and soil Gypsum related with the percentage of soil OC are shown in Figure 5 as line Regression. In the hot and dry regions of the world the soils are frequently saline with low or not agricultural potential. A saline soil is generally defined as one in which the electrical conductivity (EC) of the saturation extract (EC_e) in the root zone exceeds 4 dS m^{-1} (approximately 40 mM NaCl) at 25 °C and has an exchangeable sodium of 15%. The yield of most crop plants is reduced at this EC_e, though many crops exhibit yield reduction at lower EC_es (Munns, 2005; Jamil et al., 2011). However, the threshold value above which deleterious effects occur can vary depending on several factors, including plant type, soil water regime and climatic condition (Maas, 1986; Rengasamy, 2003). Excess salt has the same lethal effect on plants as drought: the high concentration of salt reduces the ability of plants to take up water, which interferes with their growth and reduces their vitality. Soil salinity limits plant growth due to the presence of soluble salts in soils which hold water more tightly than the plants can extract it. By this description, Garpozabad site is arid area with less rainfall and has very salinity soil because of electrical conductivity is high (Figure $5_{a,b,c,d}$). Also, growing plants are very less even if impossible that is cause of low percentage of soil organic carbon (Figure $5_{a,b,c}$) that only Halophytes species can be tolerant and established. As Figure 5_a shown soil OC is increased by decreasing soil EC in first layer that is important part of soil layer for roots growing (Figure 5_a). Because many plants growing is reduced in very high soil EC (Maas, 1986; Rengasamy, 2002; Munns, 2005; Jamil et al., 2011). On the other soil layers, soil OC is not influenced by soil EC (Figure $5_{b,c}$). Since percentage of organic carbon is very low (reduction of roots penetration) and soil salinity is very high, influencing of organic carbon by soil EC is hard. In the other words, changing EC is depended on other factors as climatic factors. In fact, the amount of soil organic carbon is not enough to change EC. Also, heterogeneous dispersion of soil salinity (Figure $5_{a,b,c}$) reflect the Garpozabad site as very high salinity soil. It means that average of EC cannot use to indicate salinity condition of Gorazbon soil. Only point is considering, however, there was not significantly different, high concentration of plants are located in very low EC condition as first layer shows (Figure 5_a). So, EC is one of important soil limiting factor is arid area as Garpozabad.

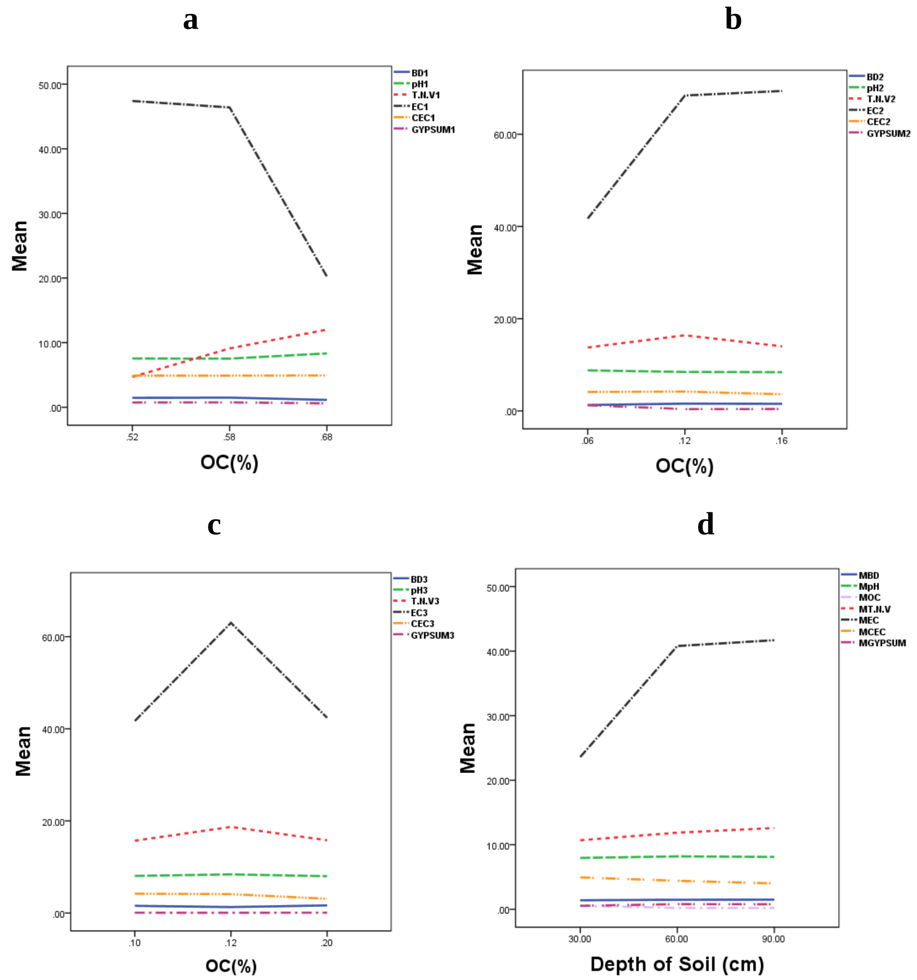


Figure 5. Relation between OC (%) and BD, pH, T.N.V, CEC , EC, Gypsum in different depths of Garpozabad soil [(**a**: Layer 1 (0-30cm), **b**: layer 2 (30-60cm), **c**: layer 3 (60-80cm) **d**: M (mean)].

The percentage of T.N.V is increased by increasing soil OC that is said T.N.V is as moderated factors when EC is decreased and soil condition is better to plants in first layer (Figure 5_a), the percentage of gypsum no effects on soil OC mostly. Also, on the lower layers soil OC is no influenced by T.N.V, Gypsum (Figure $5_{b,c}$). By increasing soil depth, amount of soil salinity, T.N.V and gypsum are increased because of leaching and soil OC is decreased due to reduction of roots penetration as other sites that mention above. Overall, the amount of soil salinity, T.N.V and gypsum are not interaction with soil OC mostly, but climatic factors as amount of rainfall can be more effect on soil salinity, T.N.V and gypsum. So, in this soil condition with high EC, only halophytes can be established and amount of growing these plants depend on climatic factors mostly that made soil condition better for more growing as first layer of Garpozabad shows concentration of soil OC somewhat in lower soil EC (Figure5_a). In addition, the mean pH in the Garpozabad is alkaline (Figure 5_d) because of high amount of soil salinity. Sodic soils generally have a pH > 8.5 and saline/sodic soils range between 7.8 and 8.5 (Winkler et al., 2018). In alkaline soils, pH usually increases with an increase in salinity due to the presence of sodium-bicarbonate carbonates (Gupta et al., 1989). As Figure $5_{a,b,c}$ shows there was not relative between the percentage of OC and soil pH in Garpozabad site. Soil salinity affected the pH values depends on type of salts and the soil texture in arid conditions. if irrigated saline water to sandy soil, the pH increased significantly because the main salts in soil extract were sulphate and chloride which have alkaline properties remain in soil extract, and main cations (Sodium) less exchangeable on soil surface. While if irrigated the saline water to clay soil which high cation exchangeable capacity, the pH affected but some time was not significantly depends on how much sodium can be exchangeable on clay surface. In general, the salinity affected the soil pH values. Since Gorazbon site has Clay-loam texture and very low soil organic carbon, so pH is depend on soil salts and texture not soil organic carbon because of low and also by increasing soil depth, soil pH is increased because of increasing soil salts (Figure 5_d). Garpozabad soil CEC is low (Figure 5_d) and is not affected by the percentage of OC in first layer (Figure 5_a). However, first layer is high percentage of OC than other layers, not effects on soil CEC because other soil (like the amount of clay) and climatic factors are more effective than organic matter on arid soil CEC as Garpozabad site. As clay and organic matter are the main sources of CEC (Peinemann et al., 2000). In the other soil layers as Figure $5_{b,c}$ shows by increasing soil OC, CEC is decreased slightly that determine CEC is influenced by soil and environmental factors as soil texture or rainfall and etc in Garpozaban site. In addition, by increasing soil depth and decreasing soil OC, CEC is decreased maybe influence by increasing gypsum, EC and T.N.V that shows soil condition is not appreciate to increasing CEC and roots penetration. Approaches that incorporate additional environmental parameters such as parent material and vegetation type have also been shown to be effective on BD (Jalabert et al., 2010; Sakin, 2012). Having said this, any pedotransfer function or model predicting BD for top soils must also incorporate some information about organic matter content, as variation in this single soil characteristic has a stronger effect on BD than any other. But in our results show that the percentage of soil OC is not influenced by soil BD in Garpozabad site (Figure $5_{a,b,c}$). It can be said that percentage of OC is very less to influence the soil BD. Also, by increasing soil depth, OC is decreased and BD increased due to concentration of soil particles as clay and decreasing organic matter (Figure 5_d).

5. Comparison of Soil Organic Carbon in the Different Sites

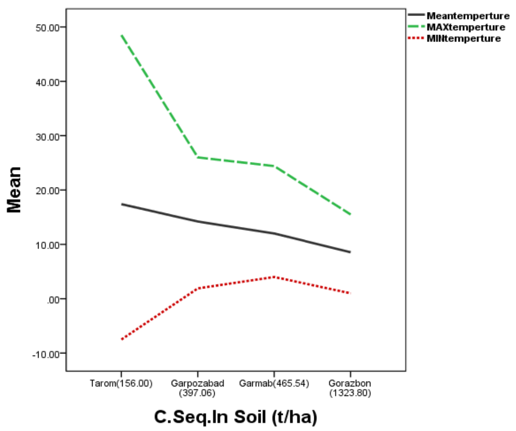
With different climatic and edaphic factors shows, highest amount of carbon stock is in forest site (Gorazbon) with 1323.8 ton/ha and then Garmabe 465.54 ton/ha, lowest is Garpozabad 397.07 ton/ha and Tarom 156 ton/ha respectably (Table1).

Table 1. Amount of Carbon Sequestration (Cs) in different soil sites.

Site	Cs(ton/ha)
Gorazbon$_{(0\text{-}60cm)}$	1323.8
Garmab $_{(0\text{-}60cm)}$	465.54
Garpozabad $_{(0\text{-}80cm)}$	397.07
Tarom $_{(0\text{-}80cm)}$	156

Different ecosystem conditions (different vegetal cover) have different amount of carbon stock in soil because of limiting edaphic and climatic factors for plants growth. For instance, Salinity is one of the most brutal edaphic factors limiting the productivity of plants in Garpozabad because most of the plants are sensitive to salinity caused by high concentrations of salts in the soil that only Halophytes are able to tolerant and also accumulation of Gypsum in Tarom soil as another soil limiting factor reduce the plants growth too that caused to establishment of Gypsophytes. Salinity like limiting factor are indicated in many Similar studies (Amira and Qados, 2011; Shrivastava and Kumar, 2015; Kumar et al., 2017) and Gypsum (Hernando et al., 1963, 1965;Van Alphen and de los Rios Romero, 1971). It is important to mention whether climatic factors are more effective or edaphic factors. Results show that humid site as acidic forest soil with low temperature and high amount of rainfall, stock organic carbon in soil is more than lime soil as Garmab, gypsum soil as Tarom, salinity soil as Garpozabad that shows climatic factors are more effective than edaphic factors on soil carbon organic in different ecosystems (Figure $6_{a,b}$). Because, growing of established plants in each site depend on climatic factors in first step. As Figure $6_{a,b}$ shows by increasing rainfall on each site, carbon sequestration increased. Gorazbon site as forest site has high carbon sequestration in the soil with high amount of rainfall. On the other words, decreasing rainfall on each site (from Gorazbon [highest] to Tarom [lowest]), carbon sequestration is decreased. Because precipitation influences soil moisture and hydrological processes such as surface runoff and ground water infiltration (Heisler and Weltzin, 2006), which are important controlling factors in SOC cycling, changes in precipitation patterns have great potential to influence SOC content and its dynamics (Aanderud et al., 2010). For example, Meier and Leuschner (2010) observed that soil OC decreased by ~25% more in beech forests with annual precipitation >900mm year^{-1} than in those with precipitation <600mm year^{-1}. It has also been reported that on the one hand, soil moisture could affect soil OC accumulation by influencing the quantity of plants' C input to soils (Zhou et al., 2008), as well as the decomposition rate of those C inputs (O'Brien et al. 2010). Also, temperature of each site as other climatic factors is influence the soil carbon sequestration. Gorazbon site as forest site has high amount of carbon stocks in the soil with low temperature compared to other sites. On the other words, decreasing temperature on each site (from Gorazbon [lowest] to Tarom [highest]), carbon sequestration is increased. However temperature is important factor for growing plant, in the arid area is limiting factor for plants. As range from 0 to 150 kg C/ha per year in dry and warm regions (Armstrong et al., 2003), and 100 to 1000 kg C/ha per year in humid and cool climates (Grace et al. 1995; West and Post, 2002) that in dry area carbon sequestration is lower than humid and cool area. In the continental United States, east of the Rocky Mountains, the general trend is that soil organic matter content increases from west to east and from south to north. The west-to-east trend is because of increasing rainfall, while the south-to-north trend is because of lower temperatures preserving the organic matter that is produced.

a



b

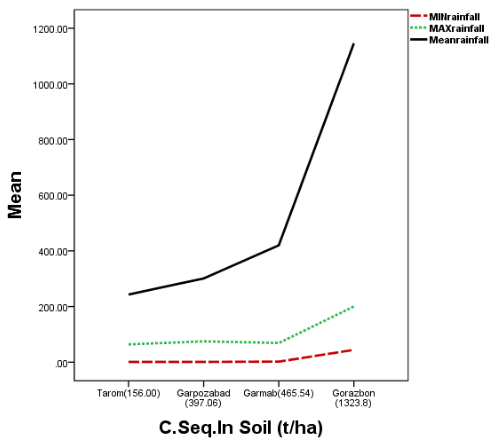


Figure 6. The changes of Carbon Sequestration (C.Seq) in each site the relative to the rainfall (**a**) and temperature (**b**).

Thus, temperature and rainfall on each area are important climatic factors for plants growth and establishment. So, Forest site as Gorazbon with better conditions for growing plants compared to other sites, has more percentage of soil organic carbon that show the important of forest ecosystem in carbon stock. It is noticeable however, the soil limiting factors are influenced type of plants that are able to establish and tolerant soil especial condition, climatic factors influence the amount of plants growth directly (provide temperature and humid requirement for growth) and indirectly (moderate or made better soil condition).

6. Conclusion

The climatic factors can make different condition for soil and plants. Also, Soil can be influenced by many ecological factors that make different condition for plants. Plants with growing their roots in soil are main source of carbon stock in soil. So by estimating the amount of organic carbon in soil can be accessed information of soil limitation factors to their plants.

Many soil and climatic factors control amount of growing and type of species. Also, type of soils in different climatic conditions has especial growing factors for plants that some of them are limiting factors for plants. As our considering shows the salinity in Garpozabad soil site or the percentage of Gypsum in Tarom soil site as arid and semi-arid area and lime in Garmab soil site and soil acidification in forest humid site as Gorazbon can be limited of growing establishing plants in each site that decrease carbon stock in the soil. In addition, each site has especial climatic factors for growing and establishing plants that is observed the arid area as Tarom (plants cover is Gypsophytes) and Garpozabad (Halophytes) sites, semi-arid area as Garmab (wheat and barley) site and humid as Gorazbon (temperate forest cover) site. So, climatic condition with especial soil characters establish adjustment plants in each site, but percentage of this plants growing depend on soil and climatic limiting factors that are different in each site and also it is crucial which limiting factors are more effective needs to consider. For example, salinity and gypsum are important limiting factors for growing in arid sites that are influenced by climatic factors. On the other words, climatic limiting factors as temperature and rainfall are more effective than soil limiting factors on plants growing in arid area. In fact, climatic factors are moderated soil condition for high growing plants that caused of increasing the soil organic carbon. By increasing soil organic carbon, interaction between soil limiting factors and the percentage of soil OC is increased. As our study shows interaction between soils limiting factors and soil organic carbon is weak because of the amount of soil organic carbon is very less to influence by soil limiting factors strongly especially in arid sites. Therefore, in first, growing plants is influenced by climatic factors and in next the edaphic factors are effective in our arid and semi-arid sites. In these areas due to lack of rainfall and dry climate, they accumulate salt and gypsum in the soil, so only tolerant plants as halophytes and Gypsophyte can stand. The concentrations of salt and gypsum have made special condition in Garpozabad and Tarom respectably that only halophytes and gypsophyte can distribute but for other plants, this concentration of salinity and gypsum have been limitation factors. In addition, growing of halophytes and gypsophyte in this sites depend on other ecological factors may be precipitation because of less rate of precipitation. Lime in the agricultural soil is harmful, because it increases soil pH and consequently prevents the absorption of some nutrients by plants. So Arid and semi-arid country like Iran if the amount of lime was more than 10% say it calcareous soil that can be imitated factors to distribute plant species. Garmab site with suitable soil condition to some limiting agriculture products and also approximately precipitation is enough to this product but increasing precipitation improve soil condition for more agricultural product.

According the forest site (Gorazbon) that shows variety of plant species and the amount of growing are high that lead to high amount of carbon stock. The same result showed in Namkhane forest soil in Iran with average carbon content is 400.35 ton ha^{-1} (Russell, 1977). Over time, soil of forest has made by humid climate for growing high density and high diversity of plants that exit density of roots in soil and penetrate them in deep of soil, the result, more organic carbon is transferred to soil special deep by increasing of microbial activity and root density in forest soil. So, climatic factors are appropriated for many plants grown and cannot be more limiting factor for them. But soil limiting factors as pH and other environmental factors as plants competition can be limited growing mostly. Therefore, Gorazbon as forest site shows the crucial role of carbon stock in the forest soil ecosystem that depend on climatic and soil condition. Finally, in the different ecosystems limiting factors for growing are depend on type of ecosystems which are dominated by soil or climatic factors. Knowing this limitation factors for correct management of plant and also restoration of each site with especial ecosystem characters is necessary. In fact, organic matter was recovered soil conditions to spread roots and increasing of microorganism activity in soil by decreasing of negative effects of salinity and reduced of pH and BD. Researchers show that increase the organic matter and clay in the soil cause of increasing soil CEC (Russell, 1977). On the other word, carbon organic increases the fertility of soil in distribute many species. Therefore, for managing of many soil especially in the soils are located in arid area with less precipitation, have knowledge of limiting soil factors for selected plants that can tolerant condition is crucial. Growing tolerant plants (as halophyte and gypsophyte) in arid area cause of increase organic carbon in their soil. Overall, it can be result that different amount of growing plants (select of plant species by soil and amount of growing control by other climatic factors) provide different rate of carbon stocks in their soil and also, identification of limited factors plants growing in soil helps to managing plants in different ecosystem to carbon stocks.

7. Acknowledgement

In this paper is grateful from cooperation of Tehran University and Mehrshahr University in Iran, also assisted by Prof. Manochehre Zarrinkafsh, the head of Mehrshahr university.

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