Variation Characteristics of Organic Carbon Content and Distribution in Compound Soils with Different Ages

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Abstract. This study explores the development of compound soil. In this study, different planting years and different proportions of sandstone and sand compound soil were studied, and the total organic carbon content and distribution in different planting ages were studied. The results showed that when the planting period was low, the content of readily oxidized organic carbon and the proportion of total organic carbon in sandy soil was the lowest, and the stability of organic carbon was the highest. The easy-oxidation organic matter of compound soil in the ratio of sandstone to sand 1:2 the content of carbon and total organic carbon is the highest, and the stability of organic carbon is the lowest. When the planting period is high, the content of readily oxidized organic carbon in sand is slightly increased, and the content of readily oxidized organic carbon in other proportions of compounded soil is significantly decreased, the stability of organic carbon increased.

1. Preface
Soil organic carbon is an important indicator for evaluating soil quality. It not only determines the soil fertility, but also closely relates to the global carbon and nitrogen cycle and climate change [1-4]. It is composed of different components with different bioavailability. The dissolved organic carbon is easier to be used by microorganisms, and its content dynamics and turnover should be closely related to the mineralization of soil organic carbon [5], while in the solid phase. Organic carbon is more difficult to decompose [6].

Soil active organic carbon refers to the part of organic carbon that has fast moving, poor stability, easy oxidation, mineralization, and high activity on plants and soil microorganisms [7]. Although it only accounts for a small part of the total amount of soil organic carbon, it can directly participate in the soil biochemical conversion process, and is also involved in soil microbial activity energy and soil nutrients, because it can reflect small changes in soil before soil full carbon changes. The driving force [8-9] is therefore important for soil carbon pool balance and soil chemistry and biochemical fertility [10]. Soil
active organic carbon can be characterized by dissolved organic carbon, microbial organic carbon and readily oxidized organic carbon [11]. Under certain biological and climatic conditions, with the development of soil, the soil organic carbon pool and carbon form will reach a stable state. Therefore, the soil organic carbon status can be used as a sign or controller of ecological function [12], studying soil organic the content and distribution of carbon and activated carbon are important for revealing the degree of soil development.

In this study, the content of total organic carbon, dissolved organic carbon and readily oxidized organic carbon in soils of different planting ages were studied by using different proportions of sandstone and sand compound soil.

2. Materials and methods

2.1. Materials
The sandstone and sand for the test were taken from Daji Khan Village, Xiaoji Khan Township, Yuyang District, and Yulin.

2.2. Method

2.2.1. Overview of the test area. The experiment was carried out at the Fuping pilot test base of the Shaanxi Institute of Geotechnical Engineering. Fuping County (108°57'-109°26'E, 34°42'- 35°06'N) is the transition zone between the Guanzhong Plain and the Northern Shaanxi Plateau. It belongs to the gully region of the Loess Plateau in northern Hebei. The terrain is high in the north and low in the south. It slopes from northwest to southeast. The elevation is 375.8-1420.7 m. It belongs to the continental monsoon warm zone with semi-arid climate. The annual total radiation is 5187.4 MJ/m2, and the annual average sunshine the hour is about 2389.6 h, the annual average temperature is 13.1°C, and the annual average precipitation is 527.2 mm (1990-1995). The interannual variation of precipitation is large, and the annual precipitation coefficient of variation (CV) is 21.1%.

2.2.2. Test design. In the experiment the mixing ratios of sandstone and sand with different planting years were set to 0:1, 1:1, 1:2 and 1:5, respectively, and 4 ratios were set for each mixing ratio, for a total of 24 plots. The area of each cell is 2m×2m. In the surface layer of each plot, 30 cm is covered with compound soil of different mixing proportions, and below 30 cm is the local original sand. The experimental field was corn (Jincheng 508)-wheat (Xiaoyan 22), which was made by two crops a year, all of which were artificially sown. The types of fertilizers tested in the experimental field were urea, diammonium phosphate and potassium chloride. The amount of fertilizer applied was N-P2O5-K2O (255-180-90 kg/hm2) per year.

2.2.3. Test indicators and data processing. Soil total organic carbon (TOC): determined by elemental analyzer (Multi N/C OR 3100);
Soil dissolved organic carbon (DOC): Multi N/C2100 analyzer was measured.
Soil readily oxidized organic carbon (ROC) is determined by potassium permanganate oxidation-colorimetric method [13]
The test data was analyzed using software such as Excel.
3. Results and analysis

In the compound soil with low soil age, the total organic carbon content of sandy soil is higher than that of different proportions in all soil layers, which may be due to the low soil organic carbon content of the sandstone in the compound soil. The soil organic carbon content in the soil is lower than that in the sand. The total organic carbon content of the soil in the sand is slightly different between 0-10 cm soil layer and 10-20 cm soil layer, both of which are larger than 20-30 cm soil layer, and the total organic carbon content of 0-10 cm soil layer and 10-20 cm soil layer is 20-30 cm. The soil layer is 30.54% higher and 33.00% higher, respectively. In the compound soil with 1:1 ratio of sandstone to sand, the total organic carbon content of the soil decreased first and then increased with the increase of soil depth. The total organic carbon content was the largest in the 0-10 cm soil layer, which was 2.23 g/Kg, 53.79% and 27.43% higher than the 10-20 cm and 20-30 cm soil layers, respectively. In the compound soil with the ratio of sandstone to sand 1:2, the total organic carbon content of the soil also decreased first and then increased with the increase of soil depth. The total organic carbon content was the largest in the 0-10 cm soil layer, which was 2.04 g/kg, 13.33% and 7.37% higher than the 10-20 cm and 20-30 cm soil layers, respectively. In the compound soil with the ratio of sandstone to sand 1:5, the total organic carbon content of the soil decreased with the increase of the depth of the soil layer. The total organic carbon content was the largest in the 0-10 cm soil layer, which was 2.07 g/kg. It is 9.52% and 38.93% higher than the 10-20 cm and 20-30 cm soil layers, respectively. The mean total organic carbon content in the soils of each compounded soil is sandstone and sand 0:1> sandstone and sand 1:2> sandstone and sand 1:5> sandstone and sand 1:1, the value is 2.46 g/kg, 1.92 g/kg, 1.82 g/kg, 1.81 g/kg. It can be seen that the ratio of the total organic carbon content of the soil of the 1:5 ratio of the sandstone to the sand and the sand of the 1:1 ratio of the sandstone to the sand is smaller than the ratio of the sandstone to the 1:2 compound soil.

The average content of easily readily oxidized organic carbon in soils of various compound soils was 0.04 g/kg, 0.73 g/kg, 1.01 g/kg, and 0.81 g/kg, which was characterized by sandstone and sand 1:2> sandstone and sand 1:5> sandstone and sand 1:1> sandstone and sand 0:1; soil readily oxidized organic carbon content in each compound soil accounted for 1.63%, 40.33%, 52.60%, 44.51% of total organic carbon, respectively. With sand 1:2> sandstone and sand 1:5> sandstone and sand 1:1 and both are much larger than sandstone and sand 0:1.
In the compound soil with many years of soil formation, the total organic carbon content of the soil is greatly improved compared with the compound soil with shorter soil age, especially in the 0-10cm soil layer, the total organic carbon content of the soil is greatly improved. After years of planting, the trend of soil total organic carbon increased with the increase of soil depth. The total organic carbon content of soil in 20-30cm soil layer was 0-10cm soil layer and 10-20cm soil layer respectively. The height of soil is 74.26%, 2.03%; the soil layers with long soil age are shallower to deeper, and the sands with shorter age are reduced by 0.63g/kg, 0.75g/kg, 1.49g/kg, and 20-30cm soil layer. The increase in total organic carbon in the soil is most pronounced. In the compound soils with different proportions of sandstone and sand, the total organic carbon in the soil shows a decreasing trend with the increase of soil depth. The total organic carbon content in the compound soil with 1:1 ratio of sandstone to sand is 0- The 10cm soil layer is the largest, 4.41g/kg, which is 28.95% and 40.00% higher than the 10-20cm and 20-30cm soil layers respectively. The soil total organic carbon content of each soil layer with a longer soil age is 1.56g higher than the shorter soil age. 1.65g/kg, 0.93g/kg; the maximum total organic carbon content of the soil in the ratio of sandstone to sand 1:5 is 4.24g/kg, which is higher than that of 10-20cm and 20-30cm soil layers respectively. 21.83%, 44.22%, the soil total organic carbon content of each soil layer with a longer soil age is 2.17g/kg, 1.59g/kg, 1.45g/kg, respectively, which is shorter than the soil age. Except for the 0-10cm soil layer of sandstone and sand 0:1 sand, the compound soil with longer soil age is higher than the compound soil with shorter soil age, and the 0-10cm soil layer has the largest increase.

The average soil organic carbon content in each compound soil was 2.99g/kg, 3.66g/kg, 3.28g/kg, and 3.55g/kg, which was characterized by sandstone and sand 1:1> sandstone and sand 1:5> sandstone and sand 1:2> sandstone and sand 0:1, respectively, compared with the compound soil with shorter soil age, 0.53g/kg, 1.85g/kg, 1.36g/kg, 1.73g/kg. The total organic carbon in the 1:1 ratio of sandstone to sand is the highest, probably due to the fact that the soil in the 1:1 ratio of soil contains more clay and contributes to soil development.

The average content of readily oxidized organic carbon in soils of various compound soils was 0.06g/kg, 0.10g/kg, 0.07g/kg, 0.08g/kg, which was characterized by sandstone and sand 1:1> sandstone and sand 1:5 > sandstone and sand 1:2> sandstone and sand 0:1, respectively, increased by 0.02g/kg, 0.63g/kg, 0.94g/kg, 0.73g/kg, compared with the compound soil with shorter soil age. The oxidized organic carbon in the compound soil with a 1:2 ratio of sandstone to sand is the most likely to decrease.
4. Discussion and conclusion

With the increase of planting years, the total organic carbon in different proportions of sandstone and sand compounding soil increased to different degrees. Among them, the total organic carbon in the compound soil with the ratio of sandstone and sand is the highest; in terms of soil layer, the difference of organic carbon in different soil layers in different proportions of different ages is not significant, and the surface layer is basically high. The bottom layer is low. When the planting age is low, the content of readily oxidized organic carbon and the proportion of total organic carbon in sand is the lowest, the stability of organic carbon is the highest, and the content of easily readily oxidized organic carbon in the compound soil of sandstone and sand is 1:2. The proportion of total organic carbon is the highest, and the stability of organic carbon is the lowest. When the planting period is high, the content of easily readily oxidized organic carbon in sand is slightly improved, and the content of easily readily oxidized organic carbon in the remaining proportion of soil is significantly decreased. The stability of organic carbon is improved.

Planting can significantly increase the total organic carbon content in different proportions of sandstone and sand compound soil, among which the organic carbon content in 1:1 compound soil increases the most, followed by 1:5 soil and 1:1 compound soil, finally, is 0:1 compound soil, while the readily oxidized organic carbon decreases obviously with the increase of planting years, the activity of organic carbon decreases, and the stability increases obviously.

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