Study on the Changes of Calcium Carbonate and Organic Carbon in the Soil after the Feldspathic Sandstone and Sand Compounding

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Abstract. By analyzing the changes of calcium carbonate and free iron oxide in inorganic cement materials in different proportions of the feldspathic sandstone and sand compounding soil under different tillage years (2a and 9a), the calcium carbonate and free soil in the soil were determined in two years. The average content and relationship of iron oxide. The results show that the average content of calcium carbonate is the highest in the mixed soil of feldspathic sandstone and sand in the ratio of 1:2, the ratio is more favorable for the accumulation of calcium carbonate in 0-30cm soil surface inorganic colloid. The difference of organic carbon content in 0-10cm and 10-20cm soil layers was significant, but it was not significant in 20-30cm soil layers. After the mixture of feldspathic sandstone and sand for 9a, the highest content of organic carbon in each soil layer is the mixture of feldspathic sandstone and sand according to 1:1. From the mixture soil which has been cultivated for 9a, the soil layers of 10-20cm and 20-30cm, the content of organic carbon tends to be stable in each proportion. The average organic carbon content was 2.00 g/kg in 2a and 3.37 g/kg in 9a, which increased by 68.50% compared with 2a.

1. Introduction
The Maowusu Sandy Land is a typical ecologically fragile area in China. This area has a large land area, rich light and heat resources, and has great potential for arable land excavation. However, sandstone sandstones are widely distributed in the Mu Us Sandy Land [1], and their diagenesis degree, loose structure and easy weathering have a great impact on the local ecological environment. Therefore, at present, many scholars adapt to local conditions and use the complementary properties of ochre sandstone and aeolian sand soil to mix the two in a certain ratio. Zhang Weihua et al. [2] found that when the sandstone and aeolian sand are mixed at a ratio of 1: 2 to 1: 5, compared with aeolian sand, the structure, texture, capillary porosity, and saturated hydraulic conductivity of the mixed soil are...
Significant improvement has been achieved. Because the sandstone is relatively rich in calcium carbonate particles in the aeolian sandy soil, the inorganic carbon in the sandy sandstone and sand complex soil will change to a certain degree in the soil layer. Inorganic carbon will also be converted to organic carbon, and organic carbon will also mineralize under certain conditions to form inorganic carbon [3].

Soil inorganic carbon mainly refers to the occurrence of carbonate mineral carbon in the process of soil weathering to soil. It is an important part of soil in semi-humid to semi-arid soil [4]. The leaching and deposition characteristics of soil calcium carbonate in the profile, as one of the important indicators for judging the formation, occurrence, and classification of soil, are closely related to the study of soil occurrence classification [5]. The solid phase of soil inorganic carbon is mainly carbonate, which is derived from soil parent material, carbonate-rich airborne dust, groundwater, plant debris, and human activities. Generally speaking, soil inorganic carbon refers to soil-generating carbonate [6].

Soil inorganic carbon is closely related to soil organic carbon, which is reflected in the formation of carbonic acid after the CO2 released by the decomposition of organic carbon reacts with water. Carbonic acid combines with calcium and magnesium ions to form soil carbonate. Under drought conditions, with the change of soil water state and partial pressure of CO2, the dissolution and deposition of calcium carbonate will occur reversibly in time and profile space. Studies have found a negative correlation between SOC and SIC in calcareous parent material development in arid areas [7]. Studies have shown that CaCO3 in some soils comes from the decomposition of organic carbon [8]. In the surface soil of Xinjiang, Gansu and other arid regions, the carbon produced by the decomposition of organic residues is involved in the formation of newly deposited calcite [9-10]. Inorganic carbon is mainly distributed in the form of calcium carbonate and is the main cementing agent that constitutes the aggregate structure in the loess [11]. It participates in about 99% of aggregate formation, showing a trend of larger CaCO3 content with larger aggregates. In the past, researches on compounding sandstone and sand mainly focused on the effects of different compounding ratios on parameters such as texture, water, and fertility. Studies on the change of organic carbon and inorganic calcium carbonate with compounding soils were rarely seen. Therefore, in this study, by studying the changes in the content of organic carbon and calcium carbonate in soil under different mixing ratios of sandstone and sand in different planting years, the effect of the ratio of sandstone and sand on the content of calcium carbonate and organic carbon was explored in order to achieve the compound Soil provides theoretical basis for improving soil organic carbon.

2. Materials and methods

2.1. An overview of the area surveyed

![Figure 1. Geographical scope of the study area](image)
The test was carried out in a field plot at the Fuping Pilot Base in Chuyuan Village, Fuping County, Weinan City, Shaanxi Province. In order to simulate the land conditions of the sandstone and sand mixed layer in the Mu Us sandy land, the test plot was laid with a mixture of sandstone and sand at 0-30 cm, and 30-70 cm filled with aeolian sandy soil. The sandstone and sand were taken from Dajihan Village, Xiaojihan Township, Yuyang District, Yulin. The test consists of 4 treatments. The sandstone and sand are mixed at a volume ratio of 0: 1 (CK), 1: 1 (C1), 1: 2 (C2), 1: 5 (C3), and each treatment is repeated 3 times. A total of 12 plots were set up with a plot area of 2m × 2m = 4m2. The layout was “one” from south to north to study the changes of soil cementation substances under different planting years (2 and 9 years) and different compounding ratio.

The experiment uses wheat and corn rotation mode, in which the wheat variety is Xiaoyan 22 and the corn variety is Hudan No. 4. Each community adopts the traditional water and fertilizer management model of local farmers. Before planting, apply a base fertilizer (300 kg / hm2 of urea, 150 kg / hm2 of urea); during wheat growth, irrigate 3 times, each irrigation is 90 mm, and top-up urea is applied once, each time is 150-225 kg / hm2; during the corn planting period, irrigation was performed once, and urea was applied once, each time was 150 kg / hm2.

Table 1. Sampling table of mixed soil of feldspathic sandstone and sand

| Plot number | Years of cultivation | Volume Sandstone: Volume Aeolian | repeat times |
|-------------|----------------------|----------------------------------|--------------|
| 1           | 2a                   | 1:1                              | 3            |
| 2           | 2a                   | 1:2                              | 3            |
| 3           | 2a                   | 1:5                              | 3            |
| 4           | 2a                   | 0:1                              | 3            |
| 5           | 9a                   | 1:1                              | 3            |
| 6           | 9a                   | 1:2                              | 3            |
| 7           | 9a                   | 1:5                              | 3            |
| 8           | 9a                   | 0:1                              | 3            |

2.2. **Detection index and detection method**

The determination of calcium carbonate in soil is by the gas method; the determination of soil organic carbon is by the external heating method of potassium dichromate oxidation;

3. **Evaluation results**

3.1. **Succession and Change of Calcium Carbonate in Sandstone and Sand Compound Soil**

The relationship between the content of calcium carbonate in each soil layer of the compound soil and the compounding ratio under different cultivation years was explored through the compounding of different proportions of sandstone and sand. The results show that after 2a of sandstone and sand are mixed (Fig. 2), the soil with the highest calcium carbonate content in each soil layer is a mixed soil with a ratio of 1: 1 and between 10-20cm and 20-30cm. The differences in soil layers are significant, and the differences are not significant in 0-10cm soil layers. In the ratio of 1: 2 sandstone and sand, the content of calcium carbonate in each layer of the compound soil showed 20-30cm> 10-20cm> 0-10cm, and the ratio and purity of the sandstone and sand 1: 5 In the sandy land, the calcium carbonate content in each layer of the compound soil showed the opposite rule, that is, 0-10cm> 10-20cm> 20-30cm. After 9a of sandstone and sand mixed, the highest organic carbon content in each soil layer is the soil mixed with 1: 1 sandstone and sand. From the mixed soil cultivated in 9a, the highest calcium carbonate content in the soil layer It is a 0-10cm soil layer with a ratio of 1: 5 in sandstone and sand, followed by a 1-10cm soil layer and a 20-30cm soil layer in a 1: 2 ratio. In general, the average content of calcium carbonate in the mixed soil with a 1: 2 ratio of sandstone and sand is the highest (Fig. 3). Therefore, a 1: 2 ratio of sandstone and sand is more beneficial to the soil surface. Accumulation of calcium carbonate in inorganic colloid in -30cm soil layer.
Figure 2. Calcium carbonate content in different soil layers in different proportions after 2a cultivation

Figure 3. Calcium carbonate content in different soil layers in different proportions after 9a cultivation

3.2. Succession and change of organic carbon in sandstone and sand compound soil

The relationship between soil organic carbon and the ratio of compound soil in different soil layers under different cultivation years was explored through the compounding of different proportions of sandstone and sand. The results show (Fig. 4) that after 2a of sandstone mixed with sand, the highest organic carbon content in each soil layer is pure sandy land, and the difference is significant between 0-10cm and 10-20 cm soil layers, between 20-30 cm soil layers, but the difference was not significant in the 30 cm soil layer. In the ratio of 1 sandstone to sand 1: 1 and 1: 2, the soil organic carbon in each layer of the compound soil showed 0-10 cm > 10-20 cm > 20-30 cm. In the ratio of 1: 5, each layer of organic carbon showed a rule of 10-20 cm > 0-10 cm > 20-30 cm. After 9a of sandstone and sand are mixed (Fig. 5), the highest organic carbon content in each soil layer is the soil of 1: 1 sandstone and sand mixed from the mixed soil cultivated in 9a. For soil layers of 10-20 cm and 20-30 cm, the organic carbon content of each proportion tends to a stable level. The average organic carbon content of Cultivation 2a was 2.00 g/kg, and the average organic carbon content of Cultivation 9a was 3.37 g/kg, which was an increase of 68.50% compared with Cultivation 2a, and the increase was more obvious.
Figure 4. The content of organic carbon in soil layers of different proportions after tillage for 2a after mixing feldspathic sandstone with sand

Figure 5. The content of organic carbon in soil layers of different proportions after tillage for 9a after mixing feldspathic sandstone with sand

4. Conclusion
Based on the analysis of the succession and change of organic carbon and inorganic calcium carbonate in the mixed soil of feldspathic sandstone and sand cultivated for 2A and 9A, the results show that:

First, the average content of calcium carbonate is the highest in the mixed soil of feldspathic sandstone and sand in the ratio of 1:2, the ratio is more favorable for the accumulation of calcium carbonate in 0-30cm soil surface inorganic colloid.

Secondly, the difference of organic carbon content in 0-10cm and 10-20cm soil layers was significant, but it was not significant in 20-30cm soil layers.

Thirdly, the soil organic carbon in each layer of the mixed soil was more than 10-10cm and 20-30cm, and the soil organic carbon in each layer of the pure sand was more than 0-10cm and 20-30cm.

Fourthly, after the mixture of feldspathic sandstone and sand for 9a, the highest content of organic carbon in each soil layer is the mixture of feldspathic sandstone and sand according to 1:1. From the mixture soil which has been cultivated for 9a, the soil layers of 10-20 cm and 20-30 cm, the content of organic carbon tends to be stable in each proportion.

Fifth, the average organic carbon content was 2.00 g / kg in 2a and 3.37 G / kg in 9a, which increased by 68.50% compared with 2a.
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