The variation characteristics of soil temperature in the compound soil

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Abstract. Temperature change is an important aspect of global climate change. By studying the earth temperature at different depths of the composite soil, the vertical belt distribution of the earth temperature is explored, which provides a preliminary theoretical basis for production practice. The temperature of the loess and sand treated 1: 1 is smaller, and the buffer effect on temperature is obvious, and the temperature is higher under this treatment. It can be seen that as the soil layer increases, the buffer effect of the soil on temperature changes. With the increase of soil layer, the treatments with better buffer effect and higher temperature were respectively: soft sandstone and sand 1:2 (5cm), soft sandstone and sand 1:5 (10cm), and loess and sand 1:1 (15cm).

1. Introduction

Soil temperature (ground temperature) refers to the sum of the temperature of the land surface and the temperature of the soil at different depths below the surface. It has obvious daily changes and inter-annual changes [1]. The surface temperature mainly refers to the sum of the maximum temperature, the minimum temperature, and the average temperature of the surface [2]. Nowadays, under the situation of global temperature rise, the surface temperature of the soil has also gradually increased. This is because the atmosphere and the surface are always exchanging energy, so the rise in temperature causes the rise in ground temperature [3]. At the same time, ground temperature is also a physical quantity to measure soil surface heat energy, and its changes are more conservative and lagging than temperature changes [4]. As one of the main indicators of agricultural production and meteorological changes, ground temperature plays an important role in the physical, chemical, and biological processes of soil.

Studies have shown that factors such as ground cover, air temperature, and precipitation can affect changes in ground temperature. After the surface has been exposed to solar radiation for a long time, the surface heat is gradually transferred to the lower layer due to the heat transfer effect. Therefore, changes in soil surface temperature can cause lower layers Changes in soil temperature [5]. Li studied the change of ground temperature over many years in the Xilinguole League, Inner Mongolia, and the results showed that the ground temperature was closely related to the depth of the soil layer, and the increase
in ground temperature decreased with the deepening of the soil layer [6]. At present, the researches on sandstone and sand complex soil mainly exist in the evolution of physical and chemical structure and basic properties, and there are few reports on the temperature response of sandstone to the aeolian sand. Therefore, this article mainly mixes sandstone and sand in different proportions, and conducts preliminary exploration of soil temperature in different soil layers. It is clear that the addition of different proportions of sandstone in aeolian sand can buffer the temperature change, and provide a background for the sustainable development and regional utilization of sandstone and sand compound soil.

2. Materials and methods
In order to simulate the soil temperature change of the sandstone and sand mixed layer in the Mu Us sandy land, the test was set in a flowerpot with a height of 40cm (caliber 38cm × bottom diameter 30cm), and a total of 5 treatments were set up. 1: 1 (C1), 1: 2 (C2), 1: 5 (C3). Loess and sand are prepared according to 1: 1 (C4) volume ratio. Whole sand (C5) is prepared separately. Each treatment setting 4 repetitions.

3. Results and discussion

3.1. temperature change in 5 cm soil layer

![Figure 1. Variations of ground temperature with seasons in different soil layers.](image)

In the 5cm soil layer, the average values of ground temperature in the four seasons of spring, summer, autumn, and winter are 15.67 °C, 30.29 °C, 25.21 °C, and 5.50 °C, respectively (Fig. 1). In spring, the geothermal temperature of the sandstone and sand 1: 2 treatment was the highest at 16.41 °C, followed by the loess and sand treatment 1:1, the whole sand treatment, the sandstone and sand treatment 1: 5, and the sandstone and sand treatment 1: 1 lowest. In summer, the ground temperature was highest in the 1: 1 treatment of loess and sand, an increase of 94.96% over the spring, followed by the whole sand treatment, the sandstone and sand 1: 2 treatment, the sandstone and sand 1: 1 treatment and the sandstone and sand 1 : 5 processing. In autumn, arbor sandstone and sand 1: 2 treatment has the highest ground temperature, followed by whole sand, loess and sand 1: 1, arbor sandstone and sand 1: 5 and arbor sandstone and sand 1: 1. In winter, the sand temperature of the sandstone and sand 1: 2 is the highest, followed by the sandstone and sand 1: 5, the whole sand, the sandstone and sand 1: 1, and the loess and sand 1: 1. Taking spring, summer, autumn, winter and spring as a cycle, the variation of 1:1 treatment
of soft sandstone and sand is 96.24%, 16.98%, 80.50% and 214.85% respectively. The variation amplitude of the arsenic sandstone and sand 1:2 treatment was 85.63%, 15.29%, 71.10% and 120.05%, respectively. The variation amplitude of the sand and sand 1:5 treatment was 92.92%, 17.75%, 78.40% and 191.71%, respectively. The variation amplitude of total sand treatment was 97.52%, 16.70%, 79.54% and 197.00%, respectively. The variation amplitude of 1:1 treatment of loess and sand was 95.00%, 172.59%, 81.52% and 235.46%, respectively. In summary, the temperature variation of the soil treated with sand 1:2 is small, and it has an obvious buffering effect on the temperature, and the temperature under this treatment is high.

3.2. temperature change in 10 cm soil layer
In the 10cm soil layer, the average values of ground temperature in spring, summer, autumn and winter are 14.46 °C, 29.04 °C, 24.31 °C and 5.75 °C. In spring, the ground temperature of loess and sand 1:1 treatment was the highest at 14.93 °C, followed by shoal sandstone and sand 1:5 treatment. In summer, the ground temperature was highest in the 1:1 treatment of loess and sand, an increase of 96.45% compared to spring, followed by the treatment of sandstone and sand 1:5. In autumn, the highest temperature was found in the sandstone and sand 1:5 treatment and the loess and sand 1:1 treatment, followed by the whole sand. In winter, the ground temperature was the highest when the sandstone and sand 1:5 treatments were followed, followed by the loess and sand 1:1 treatments. It can be seen that the ground temperature treated by 1:1 with loess and sand is the highest in spring, and the ground temperature treated by sandstone and sand 1:5 is the highest in other seasons. Taking spring, summer, autumn, winter and spring as a cycle, the variation of 1:1 treatment of soft sandstone and sand was 107.36%, 16.54%, 79.12% and 176.71%, respectively. The amplituations of the arsenic sandstone and sand 1:2 treatment were 102.76%, 16.84%, 76.21% and 149.24%, respectively. The amplituations of the arsenic sandstone and sand 1:5 treatment were 99.76%, 16.47%, 74.28% and 133.04%, respectively. The variation amplitude of total sand treatment was 98.30%, 15.40%, 76.13% and 149.73%, respectively. The variation amplitude of 1:1 loess and sand treatment was 96.37%, 16.17%, 75.98% and 152.92%, respectively.

3.3. temperature change in 15 cm soil layer
In the 15cm soil layer, the average temperature of the four seasons in spring, summer, autumn and winter was 11.39°C, 25.12°C, 21.58°C and 3.95°C, respectively. In spring, loess and sand 1:1 treatment of the highest temperature. In summer, the ground temperature is maximized by total sand treatment. The ground temperature is the highest when loess and sand are treated at 1:1 in autumn and the highest when loess and sand are treated at 1:1 in winter. Taking spring, summer, autumn, winter and spring as a cycle, the variation of 1:1 treatment of soft sandstone and sand was 137.30%, 16.94%, 83.45% and 206.48%, respectively. The amplituations of the soft sandstone and sand 1:2 treatment were 125.26%, 14.47%, 81.99% and 188.25%, respectively. The amplituations of the soft sandstone and sand 1:5 treatment were 125.27%, 15.39%, 81.39% and 181.88%, respectively. The variation amplitude of total sand treatment was 119.66%, 14.81%, 81.12% and 183.11%, respectively. The variation amplitude of 1:1 loess and sand treatment was 97.99%, 8.49%, 80.60% and 184.43%, respectively.

4. Conclusion
When the ratio of concrete sandstone to sand is 1:2, it has a better buffering effect on the temperature of 5 cm soil layer. When the ratio of concrete sandstone to sand is 1:5, it has a better buffering effect on the temperature of 10 cm soil layer. When the compound ratio of loess and sand is 1:1, it has a better buffer effect on the temperature of the 15 cm soil layer, and the temperature under the soil layer is higher in each treatment, and the trend of ground temperature change in different soil layers is 5 cm> 10 cm> 15 cm, and the temperature difference gradually decreases with the increase of soil layer.
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