

Effect of Arsenic Sandstone and Sand Composite Soil on Plant Morphological Characteristics under Natural Restoration

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Abstract

Through field simulation and laboratory analysis, the effects of arsenic sandstone and sand composite soil with different composite ratios on the morphological characteristics of plants after 60d, 90d, and 120d natural vegetation restoration have been explored. The results showed that the three dominant plants were *Chenopodium album* L., *Eleusine indica*, and *Bassia* under different compounding conditions. The addition of arsenic sandstone is beneficial to the growth of the above-ground part of the plant: when arsenic sandstone and sand are compounded at a ratio of 1:1, it is more beneficial. The plant quinoa and quinoa quinoa grow on the ground part; when the arsenic sandstone and sand are mixed in a ratio of 1:2, it is more conducive to the growth of the beef tendon on the grassland. The addition of arsenic sandstone accelerates the succession process of vegetation under natural restoration, which is of positive significance to the restoration of vegetation in the Mu Us sandy land.

Keywords

Mu Us Sandy Land; Arsenic sandstone and sand; Natural restoration; Morphological characteristics.

1. Introduction

The research on the adaptive mechanism of plants in the process of desertification is of great significance for desertification control. One of the basic ways of desertification control is to strengthen the protection, restoration and reconstruction of vegetation [1], and the reasons that affect the natural restoration of vegetation include climate and soil texture. , Soil water content and other factors, of which soil texture and soil water content play an extremely important role in vegetation restoration. By changing soil texture, increasing soil water holding capacity, and increasing soil water content are important for enhancing sandy soil vegetation restoration [2].

The Mu Us Sandy Land is an important ecological barrier in the sandy areas of northern my country. The arsenic sandstone is widely distributed in this area, which has a greater impact on the local ecological environment [3, 4]. There have been significant changes in the structure and texture of the matched soil [5], and the core technology of arsenic and sand composite soil has gradually formed [6], which is the rational use of land resources in the Mu Us sandy land and scientific advancement of ecological construction. Provides new ideas and technical support [7].

The restoration of plant diversity is an important content and symbol of the restoration and reconstruction of degraded ecosystems. At present, the research on natural vegetation restoration is mainly based on the study of plants and soil properties under natural soil conditions [8-12]. The study on the growth characteristics of herbaceous plants by natural vegetation restoration in arsenic sandstone and sand compound soil under artificial compound conditions No report yet. Based on the physical modification of arsenic sandstone and sand, this article explores the effects of different compound ratios on the types, quantities, and morphological characteristics of herbaceous plants under natural restoration conditions, in order to promote the vegetation restoration of the compound soil in the Mu Us sandy land. Reconstruction provides a scientific basis.

2. Materials and Methods

2.1. Overview of the Study Area

The study area is located in Dajihan Village, Xiaojihan Township, Yuyang District, Yulin City, Shaanxi Province (109°30'8.42", 38°28'34.21"N) on the southeastern margin of the Mu Us Sandy Land. The study area has an altitude of 1200m and belongs to a temperate arid and semi-arid continental monsoon climate. The average annual temperature in the sandy area is 6.0-8.5°C, the average temperature in January is -9.5-12°C, the average temperature in July is 22-24°C, and the annual precipitation is 250-440 mm, concentrated in July-September, accounting for 60- 75%, especially in August. The maximum daily precipitation can reach 100-200 mm.

2.2. Experimental Design

The test area is located in Dajihan Village, Xiaojihan Township, Yuyang District, Yulin City, Shaanxi Province. In order to accurately simulate the actual situation, the test basin was buried deep into the ground. The test basin had a diameter of 15cm and a depth of 15cm. The arsenic and sand used in the test were all taken from the local area. A total of 4 treatments were set up in the experiment. They were arsenic sandstone and sand in a volume ratio of 1:1, 1:2, 1:5. Aeolian sandy soil was used as a control. Each treatment was repeated 3 times, using a random distribution of "four". There are 12 pots in three rows. Observe the species, quantity and aboveground height of herbaceous plants in the composite soil at 60d, 90d, 120d after compounding.

2.3. Data Processing and Analysis

Use Microsoft Excel 2019 to sort out the test data. A one-way analysis of variance was carried out for each plant morphological characteristic index, and the data expression form was mean±standard deviation. Use R for drawing.

3. Results and Analysis

3.1. Analysis of the Aboveground Height of Different Plants in Different Composite Soils

3.2.1 Analysis of the aboveground height of the plant *Chenopodium album* in each compound soil under different restoration stages

Chenopodium (scientific name: *Chenopodium album* L.) belongs to *Chenopodiaceae* *Chenopodium*. Also known as gray ash, white quinoa, etc., an annual herbaceous plant that grows in fields, wasteland and other places, is a kind of plant with strong vitality. Under the restoration of natural vegetation, the plant height of *Chenopodium album* in different compound ratios of arsenic sandstone and sand showed 1:1>1:2>0:1>1:5, and the compound 60d, 90d, 120d all showed similar characteristics. The difference between treatments was not significant ($p>0.05$).

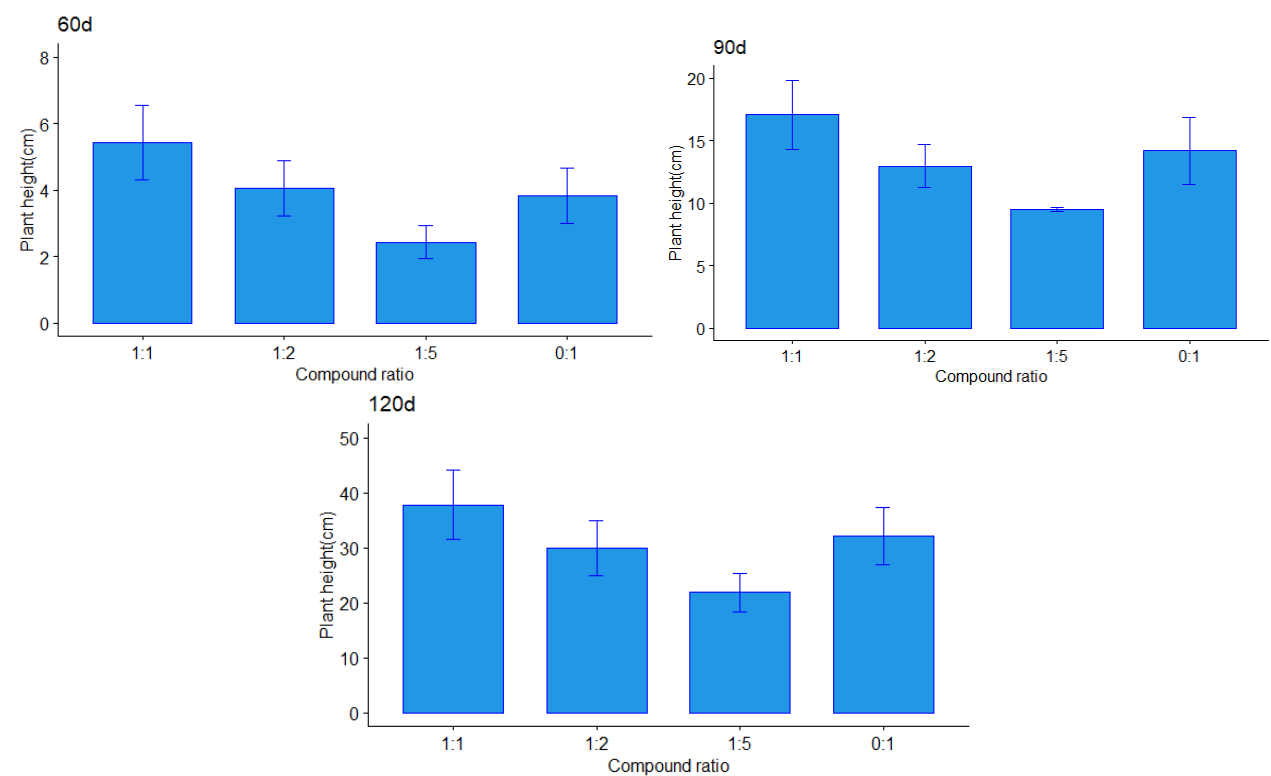


Figure 1. Height characteristics of *Chenopodium album* L. overground part in different restoration time

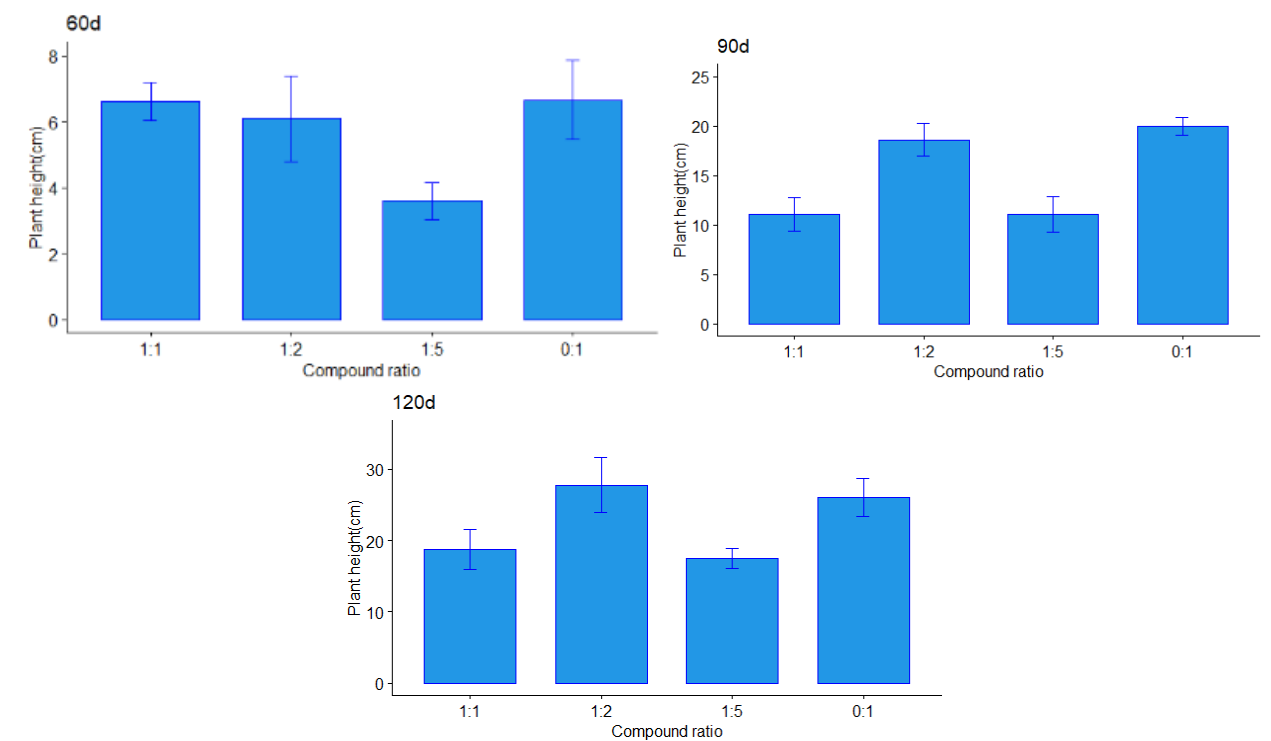


Figure 2. Height characteristics of *Eleusine indica* overground part in different restoration time

3.2.2 Analysis of the height of the plant goose tendon on the grassland in each compound soil under different recovery stages

Eleusine grass (scientific name: *Eleusine indica* (L.) Gaertn.) is an annual herb of the genus Gramineae. The root system is extremely developed. The culms are clumped, and the base is inclined. The leaf sheaths are compressed and ridged on both sides, loose, glabrous or sparsely warty; the lingual length is about 1 mm; the leaves are flat, linear, glabrous or pilose on the base of the warts. After 60 days of natural vegetation restoration, the height of goosegrass plants in different compound ratios of arsenic sandstone and sand showed the lowest 1:5; after 90d and 120d, the plant heights of goosegrass showed similar characteristics, and the height of goosegrass showed 1:5. 2 and 0:1 were higher, 1:1 and 1:5 were lower, and the difference between the treatments was not significant ($p>0.05$).

3.2.3 Analysis of the aboveground heights of the plants in each compound soil under different restoration stages

Kuntze (scientific name: *Bassia dasyphylla* (Fisch. et CA Mey.) Kuntze) is an annual herb of the Chenopodiaceae and the genus Kuntze. The plant can reach up to 50 cm in height, with upright stems, alternate leaves, bisexual flowers, and nearly round seeds Shape, flowering and fruiting from July to September. After 60d, 90d, and 120d natural recovery of arsenic sandstone and sand composite soil, arsenic quinoa grows in each treatment, and the above-ground plant height shows different characteristics in different treatments; after 60d natural recovery, the plant height grows The fastest treatment is 1:2; for 90d and 120d, the highest above-ground plant height is 1:1; for 120d, the above-ground height of the plant shows 1:1>1:2>1:5>0:1 The characteristics of; the difference between the treatments was not significant ($p>0.05$).

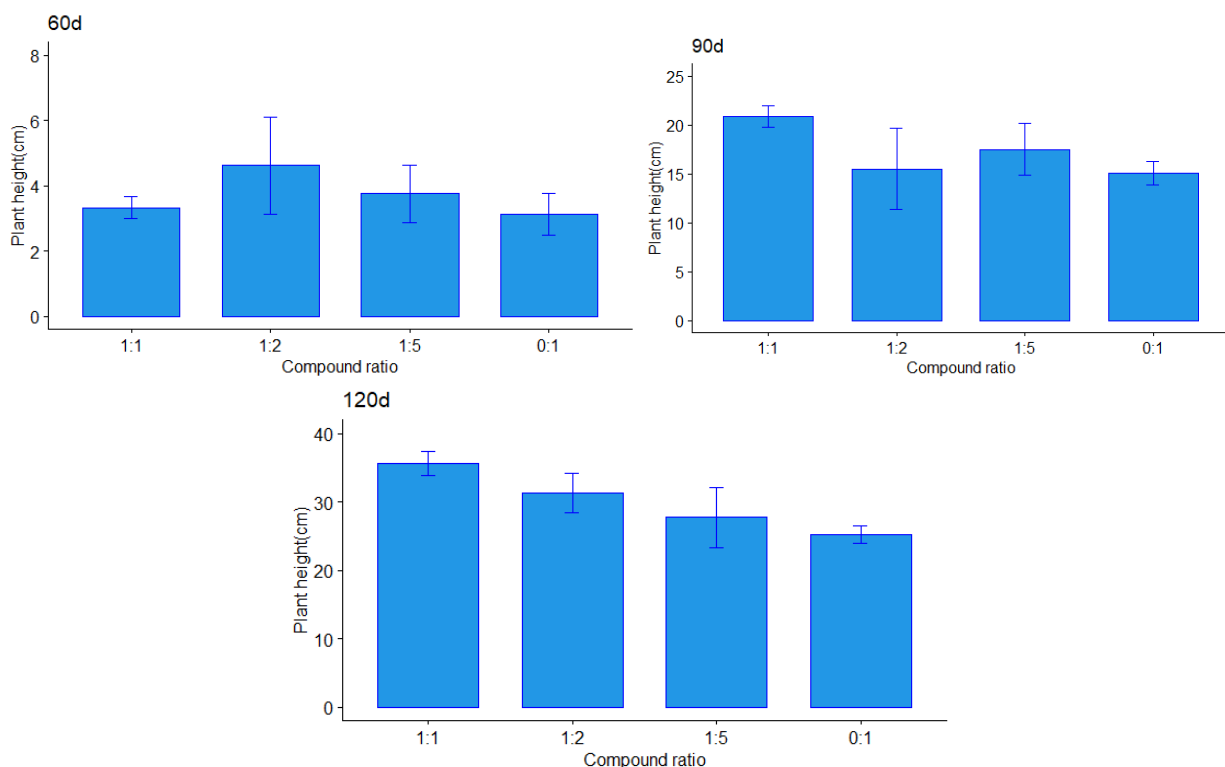


Figure 3. Height characteristics of *Bassia* overground part in different restoration time

4. Conclusion

Through studying the characteristics of vegetation restoration under natural conditions after the combination of arsenic sandstone and sand, it is found that the dominant plants in different proportions of the composite soil are *Chenopodium album* L., *Eleusine indica*, and *Bassia*. Analysis of the above-ground height data of plants under different recovery time shows that

adding arsenic sandstone is beneficial to the survival of plants and the growth of the above-ground part of the plant: when the arsenic sandstone and sand are compounded at a ratio of 1:1, it is more conducive to the growth of the above-ground parts of *Chenopodium album* L. and *Bassia*. When the arsenic sandstone and sand are compounded in a ratio of 1:2, it is more conducive to the growth of beef tendon grass. The results show that the addition of arsenic sandstone accelerates the succession process of vegetation under natural restoration, which is of positive significance to the restoration of vegetation in the Mu Us sandy land.

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