

# Effects of Sludge Compost on EC value of Saline Soil and Plant Height of Medicago

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**Abstract.** In this study, the effects of sludge composting on the EC value of saline soil and the response to Medicago plant height were studied by planting Medicago with pots for 45 days in different proportions as sludge composting with saline soil. The results showed that the EC value of saline soil did not change obviously with the increase of fertilization ratio, which indicated that the EC value of saline soil was close to that of the original soil. The EC decreased by 31.45% at fertilization ratio of 40%. The height of Medicago reached the highest at 40% fertilization ratio, and that was close to 60% fertilization ratio, and the difference was significant with other treatments. By comprehensive analyse and compare, the optimum application rate of sludge compost was 40% under this test condition.

## 1. Introduction

Improvement and rational use of saline-alkali soil is a worldwide problem, appropriate soil or added material with value of improved is one of the main ways of saline-alkali soil improvement <sup>[1-3]</sup>. At the same time, urban surplus sludge contains a lot of nutrients needed for crops, and can be used to improve the soil permeability, to provide nutrient exchange <sup>[4]</sup>. After the composting of the sludge, the pathogen is greatly reduced, the bacteria are degraded, the heavy metals are also stabilized, and the organic pollutant content is greatly reduced, thereby reducing the pollution of soil and crops <sup>[5-6]</sup>. However, the salt content of sludge composting is high, and may cause salt stress the growth of plants <sup>[7]</sup>. Therefore, this study uses the sludge compost as the material, and mix it with saline soil in accordance with a certain proportion to carry out pot experiment.

## 2. Materials and methods

### 2.1. Experiment material

The sludge compost used in the pot experiment was taken from a sludge treatment plant in Changchun City. Saline soil was taken from the surface of 0 ~ 20cm cultivated land in Changling County. The plant seeds were Medicago. The pH of the sludge compost was 5.79, the organic matter was 25.38%, the pH of the saline soil was 10.50 and the organic matter was 0.91%.

### 2.2. Test design

The test used  $\phi 14 \text{ cm} \times 11 \text{ cm}$  polyethylene plastic flower pot, and each pot contained 0.8kg soil. Sprinkling 30 Medicago seeds per pot and leaving three seedlings until the seedlings mature. Saline soil and sludge compost were mixed according to the following seven mass ratios: 1: 0, 19: 1, 9: 1, 4: 1, 7: 3, 3: 2, 2: 3, the proportion of sludge compost was 0%, 10%, 20%, 30%, 40% and 60%, each



treatment was repeated three times, and the flower pot was placed in an artificial climate chamber for culture. Light intensity was 8000lx, humidity was 40%, light treatment for 12 hours, dark treatment for 12 hours. Regularly watering until the end of the test for 45 days.

### 2.3. Index determination and method

EC was measured by mass method before and after the test. The height of *Medicago* was measured with a ruler, and was measured every 8 days until the end of the experiment during the test period.

## 3. Results and analysis

### 3.1. Effect of different ratios of sludge compost on EC value of saline - alkaline soil

Conductivity (EC) is an important indicator of the content of soluble salt. EC value is greater, the higher the content of soluble salts<sup>[8]</sup>. Too high or too low of EC value is not conducive to the growth of plants, too high of EC value may cause salt damage, so that plant roots are dehydrated, resulting in burning phenomenon, too low of EC value will affect the plant absorption and utilization of mineral elements from the soil so that plants can not grow normally. Therefore, it is necessary to determine the EC value in the soil to prevent the plant from salt stress.

Before and after the experiment, the effect of sludge compost on the EC value of saline soil is shown in Fig.1. It can be seen from the figure that the EC value is slightly lower than that of the control group at the rate of 5% ~ 20% fertilization, which is close to the EC value of the control group at 30% ~ 60%, and the maximum is 2.29 mS / cm, but still below the limit 4.00 mS / cm<sup>[9]</sup> recommended by some scholars. It shows that the EC value of sludge compost is similar to that of saline soil. After the test, the EC value of the control group, at the ratio of 5% and 10% were 13.6% ~ 20.6% lower than that before the experiment, which was mainly due to the leaching effect<sup>[10]</sup> during the watering process. The other four treatments, *Medicago* from the soil absorb mineral ions to make EC value decreased. At the 20% fertilization ratio, EC value decreased by 39.20%, followed by that at 40% ratio decreased by 31.45%, a significant decline conducive to the growth of *Medicago*.

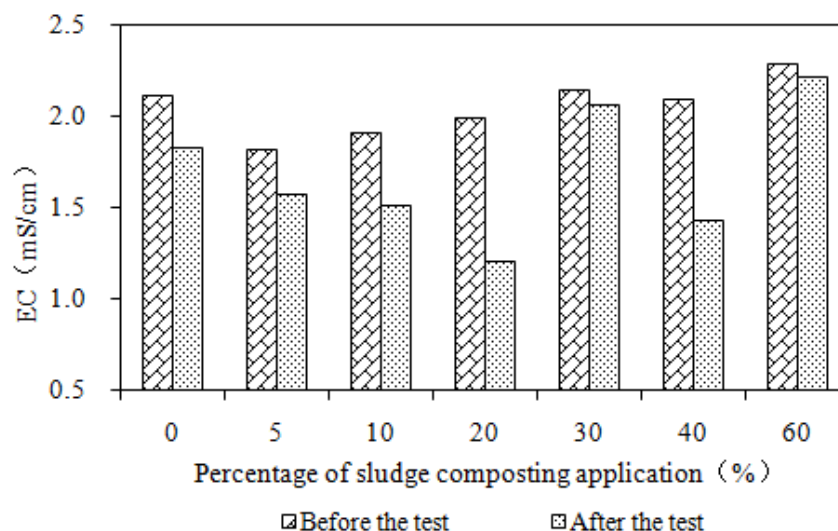


Fig.1 Variation of soil EC value under different fertilization ratios

### 3.2. Effect of different ratios of sludge compost on plant height of *Medicago*

The effect of sludge compost on *Medicago* plant height is shown in Fig.2. Among them, *Medicago* in the control group, 5%, 10% fertilization ratio can not grow. On the one hand, it may be that under these three treatments the pH of the soil was still high, the lowest pH at 10% fertilization ratio was still up to 10.954, which exceeded the pH of *Medicago* growth, thus inhibiting the *Medicago* seed germination and growth. On the other hand, under these three treatments, the soil organic matter content was low,

which could not meet the nutrient requirement of Medicago growth and development. With the increase of sludge composting content, the pH of soil decreased and the content of organic matter increased, which promoted the growth of Medicago. The plant height of Medicago reached the maximum on the October 19th. At 40% fertilization ratio of soil, Medicago's plant height was 5.68 cm, while the plant height of Medicago were 3.01 cm, 3.30 cm and 5.42 cm at the 20%, 30% and 60% ratios of soil, respectively. At fertilization ratio of 40% and 60% of the soil, the plant height was relatively close, and was significantly different from that planted at other two treatments. Medicago grew well at 40% and 60% fertilization ratio of soil than at 20% and 30% ratio showed from Fig.3. Therefore, from the perspective of plant height, the best rate of application of sludge compost was 40%, high or below 40% of the fertilization ratio, Medicago's growth height would be inhibited.

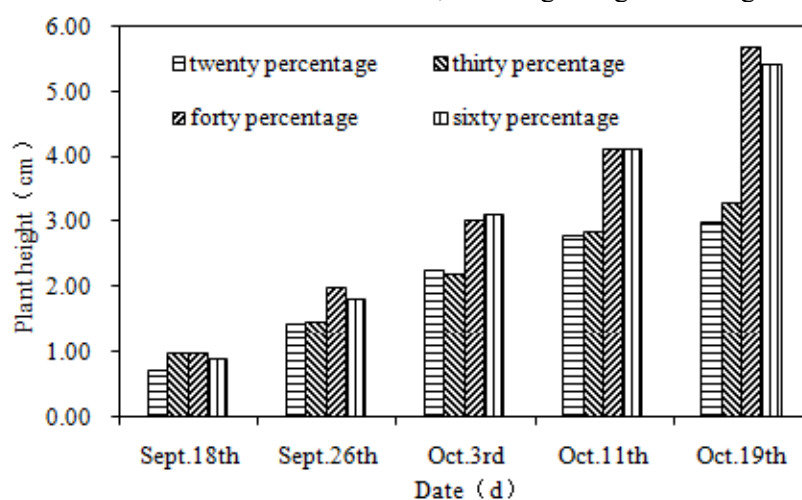
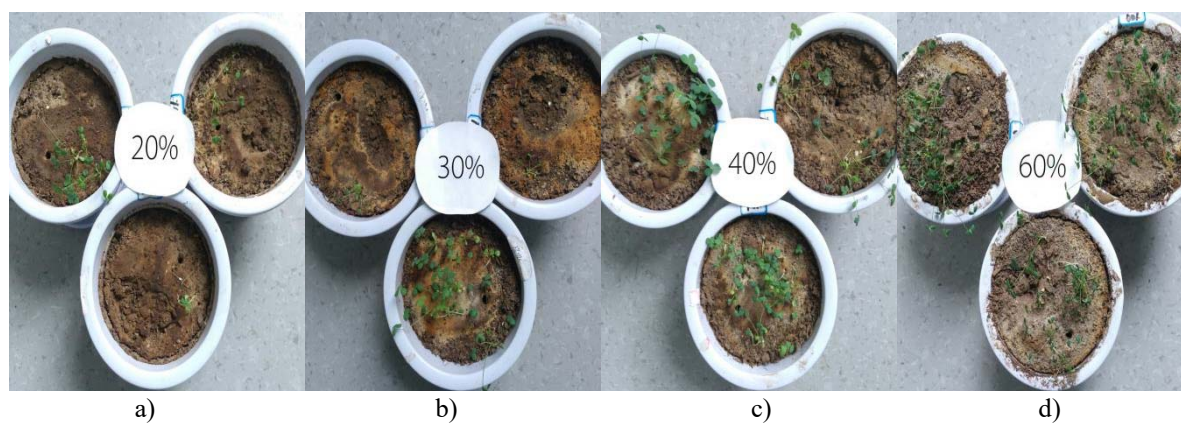


Fig.2 Effects of different proportions of sludge compost on Medicago height



a) Applying sludge compost 20%  
c) Applying sludge compost 40%

b) Applying sludge compost 30%  
d) Applying sludge compost 60%

Fig.3 Plant height of Medicago under four fertilization ratios

#### 4. Discussion and conclusion

Sludge composting contains a large number of nutrients needed for plants, is the ideal resource for plant nutrient recycling. However, considering the salt content of its, when the sludge composting as a substrate for plant growth, should be utilized moderately, not blindly abuse. Under this condition, the EC value at the 40% fertilization ratio of soil decreased greatly, which was beneficial to the growth of Medicago and the Medicago grew best in proportion. So the recommended ratio is 40%.

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