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Study on Reclamation of Abandoned Residential Land with Different Soil Improvement Methods

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Abstract: The effects of different improvement methods on soil physical and chemical properties, such as soil organic matter, aggregate and bulk density, were studied through a plot experiment. The results showed that adding organic fertilizer could significantly reduce the bulk density of topsoil and increase the content of soil organic matter, it is beneficial to increase the content of soil aggregates of 1-2mm and 0.25-1mm grain size in the surface layer, to the growth of crops, to the improvement of soil fertility, to the improvement of soil biological environment, and to the comprehensive improvement of cultivated land quality and output.

Keywords: Homestead; Soil Improvement; Soil Fertility.

1. Introduction

The rural settlement of Russia usually includes the homestead, which is inseparable from the rural settlement of Russia. in the countryside idle house base reaches a certain proportion, has formed the hollow village, this article abandoned house base renovation research, also does the hollow village renovation research, does not make the strict distinction [1].

As a large agricultural country, China has a lot of people and little land. The quantity and quality of arable land is not enough, and the reserve arable land is not enough and difficult to develop. Residential land reclamation can supplement the amount of arable land, according to the China Rural Development Research report-rural hollowing and its countermeasures, "The current potential of rural hollowing in our country is about 114 million mu, and the theoretical potential of realizing the overall development of urban and rural areas is about 149 million mu." This means that, national abandoned or idle residential land reclamation scale can reach 100 million mu, the potential is huge. Therefore, reclamation of abandoned house land in hollow village is an important strategy to solve the contradiction between land supply and demand, promote the construction of new countryside and promote the coordinated development of urban and rural areas in China's modernization drive. The amount of cultivated land has been increased through the reclamation of Homestead [2]. and the cultivated area of cultivated land has been increased along with it, but soil cultivation is difficult to be used effectively because of the serious destruction of soil physical structure and the loss of soil physical and chemical characteristics, the problem of food security can be solved by improving soil fertility and ensuring the quantity and quality of agricultural products.

Sun Wentao et al [3] found that the combination of organic materials and chemical fertilizers, compared to the single application of chemical fertilizers, can increase yield while also increasing field water capacity, improving soil physical structure, and improving soil fertility. Shaohui et al considered that the application of organic manure and other treatment measures can improve the arable land capacity [4]. By analyzing the mineral and chemical composition of the soil, as well as the contaminated elements and soil chemical property, Yang and his colleagues found that the soil in the reclaimed land was deficient in nutrients, and the improvement effect was good after the addition of fly ash [5]. Scholars such as Zhang xumei have found that soil improvement is a long-term and systematic process, requiring the adoption of biological, chemical and physical reclamation measures in Taicang, constantly improve soil fertility [6].

At present, there is not much research on soil improvement under different treatment methods for the treatment of abandoned residential land. In this paper, three different treatment methods are adopted to improve soil physical and chemical properties and improve soil fertility, increase crop output, for scientific and efficient use of land, to solve the problem of food security reference.

2. Properties

2.1. Overview of Test Plot

The test plot is located in Fuping County test base, Weinan city, Shaanxi province. It is divided into 14 blocks, each block is 2m × 2m Square, the single area is $4m^2$, the total area is $56m^2$, the whole plot is north-south trend. When the plot is arranged, the plough layer is peeled off (0-0.3 m) and then filled into mixed raw soil (the raw soil is mixed evenly with the treated fertilizer), the amount of filling is the same as the amount peeled off.

2.2. Test Design

Three different treatments of fly ash, organic fertilizer and curing agent were used to improve the soil in the plot experiment, the depth of 0-0.1 m, 0.1 m-0.2 m, 0.2 m-0.3 m of different plough layers were expressed as H1, H2, H3 respectively. Different treatment methods were used for

ripening and improvement of raw soil. The setting number is listed in Table 1. The experiment was carried out by simulating daily application of chemical fertilizer.

Table 1. Different experimental treatments

Experimental Numbers	Improvement
T1	maturing agent
T2	organic fertilizer
T3	fly ash
T4	no measure

2.3. Determination Method

Soil bulk density was measured by ring knife method, soil organic carbon was measured by potassium dichromate heating method, soil texture was measured by laser particle size analyzer, and field water capacity was measured by indoor ring knife method. The distribution and stability of soil aggregates were detected by dry-sieving method. Soil aggregates of > 2000 μm, 1000 μm ~ 2000 μm, 250 μm ~ 1000 μm and > 250 μm were obtained by sieving samples. The concrete steps are: evenly mixing the dried soil samples, and sieving 100g of them. Sieving is carried out by using sieve with pore size of 2mm, 1mm and 0.25 mm (sieve with bottom and cover). After sieving, soil particles with aggregate size of 0.25 mm (0.01g) were weighed to calculate the aggregate content.

2.4. Test Calculation

Agglomerate weight W_{wi} calculated from Formula (1):

$$W_{wi} = W_{wit} - W_{wis} \quad (1)$$

$$w_i = \frac{W_{wi}}{50} \times 100\% \quad (2)$$

In Formula (2), W_i is the proportion of the weight of i granule agglomerate.

2.5. Data Processing

Microsoft Excel in Office software was used for data collation, SPSS Software was used for single factor analysis of variance and regression analysis, and LSD method was used for multiple comparisons, significant level $p < 0.05$, very significant level $p < 0.01$.

3. Condition Tests of Rougher Flotation

3.1. Effects of Different Treatments on Soil Properties

Table 2 is the analysis results of soil bulk density, organic matter and clay (< 0.002 mm) under different treatments. From Table 2, it can be seen that the order of soil bulk density of H 1(0-0.1 m) layer is T4(no measure) > T1(maturing agent) > T3(fly ash) > T2(organic fertilizer), compared with the control group, the application of curing agent, fly ash and organic fertilizer significantly reduced the bulk density of topsoil, decreased the soil compactness and increased the soil bulk density. In soil improvement, fly ash can improve soil structure, adjust the texture of different soil types, and improve soil density and porosity [7].

The soil bulk density decreased with the increase of soil depth under different treatments. The bulk density of soil layers in soil layers h1 and h2 with the addition of organic fertilizer was significantly lower than that without the treatment, the results show that the application of organic fertilizer can effectively reduce the bulk density of soil and change the tightness of soil The soil bulk density did not change significantly in the soil layer below 0.2 m from the surface because it was not affected by tillage. The content of organic matter decreased from top to bottom under different treatments, and the content of organic matter in surface layer was the highest under T2 treatment, there was a significant difference between the treatments with and without organic fertilizer in the same cultivated soil layer, because the organic fertilizer could increase the soil organic matter content significantly.

There was no significant difference in soil clay content under different treatments.

Table 2. Soil bulk density, organic matter and clay content under different field materials

Treatments	Bulk Density /(g·cm^{-3})			Organic Matter /(g·kg^{-1})			Mucilage /(%)		
	h1	h2	h3	h1	h2	h3	h1	h2	h3
T1	1.43cd	1.45c	1.46b	5.65a	5.29a	5.33a	1.28a	1.25a	1.17a
T2	1.39b	1.41b	1.44a	5.83a	6.17a	5.98a	1.36a	1.33a	1.27a
T3	1.42c	1.45c	1.46b	5.54a	5.18a	5.10a	1.29a	1.23a	1.13a
T4	1.46d	1.49d	1.50c	5.38a	4.90a	4.86a	1.24a	1.22a	1.18a

Different letters in the same column mean significantly different 5% level of probability (LSD).

3.2. Effects of Different Treatments on the Distribution of Soil Aggregates

The formation of soil aggregates is an important index of soil properties, the characteristics of soil aggregates significantly affect soil organic matter content, soil pore distribution, soil water holding and permeability, soil resistance to wind erosion, soil microbial environment, etc., the comprehensive influence to the soil fertility condition, then affects the crop yield. Soil aggregates with different particle sizes play different roles in nutrient retention/supply and transformation [8].

From Table 3, it can be seen that the content of soil aggregates with different particle sizes varies with different soil layers, and the content of aggregates larger than 2mm increases from top to bottom of tillage layer, the agglomerates of other grain size classes showed a decreasing trend, which indicated that the surface layer of the tillage layer was favorable for the formation of large agglomerates larger than 2mm due to tillage or other field management measures.

In the same tillage layer, the soil aggregate content of each grain size showed the same rule under different treatments, that is, the order of the soil aggregate content of each grain size from high to low was: ＞2 mm, 1-2 mm, 0.25-1 mm, ＜0.25 mm, and the difference is not significant, which is similar to the conclusion of the distribution of soil aggregates by Li Huixin et al [9].

Different treatments also affected the content distribution of soil aggregates in the same soil layer. According to Table 3, the contents of 1-2mm and 0.25-1mm soil aggregates in all soil layers showed the trend of T2 ＞ T1 ＞ T3 ＞T4, and the contents of 1-2mm soil aggregates in h1(0-0.1 m), there was significant difference between each treatment and control treatment, but no significant difference in h2(0.1 m-0.2 m) and h3(0.2 m-0.3 m). 0.25-1mm soil aggregate content was the highest in h1, T2 treatment, and no significant difference in other layers. The content of agglomerates at ＞2mm and ＜0.25 mm showed significant difference among the treatments. Therefore, applying organic fertilizer for soil improvement is more conducive to increase the surface layer 1-2 mm, 0.25-1 mm aggregates content, is an important material conditions to improve soil fertility [10].

Table 3. Distribution of soil aggressive in different soil horizons under different field materials

Treatments	Soil horizon	Content of aggregates (%)			
		>2mm	1-2mm	0.25-1 mm	<0.25mm
T1	h1	60.38c	14.28ab	12.78a	12.56ab
	h2	63.81bc	13.00a	11.52a	11.67d
	h3	65.61a	11.38a	11.86a	11.15d
T2	h1	57.09bc	15.91ab	13.63a	13.37ab
	h2	61.01b	14.32a	12.51a	12.16d
	h3	62.47a	14.01a	12.76a	10.76d
T3	h1	61.14c	13.46ab	12.62a	12.78ab
	h2	65.32c	12.42a	11.52a	10.74b
	h3	70.59ab	10.38a	9.41a	9.62b
T4	h1	64.37c	12.87a	11.55a	11.21a
	h2	65.99c	11.76a	11.28a	11.05c
	h3	71.40a	9.43a	9.15a	10.02c

4. Conclusion

1) The bulk density of topsoil in topsoil was significantly lower than that in topsoil with no measure>T1 (maturing agent) > T3(fly ash)> T2(organic fertilizer)

2) In the same cultivated soil layer, the organic matter content and soil fertility increased significantly when organic fertilizer was added.

3) Adding organic fertilizer to soil improvement could increase the aggregate content of 1-2mm and 0.25-1mm in surface layer, and significantly improve soil fertility. To sum up, the organic fertilizer treatment measures have the best effect in the treatment project of abandoned residential land.

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