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Research Progress on Soil Nutrient Variation Characteristics

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Abstract

Soil nutrient is the main form of agricultural productivity highland. Studying the change characteristics of soil nutrient content and clarifying its change rule will help to solve the lack of productivity and the decline of soil fertility caused by the lack of certain nutrients in the process of agricultural production.

Keywords

Organic matter; Nitrogen; Available phosphorus; Soil nutrient.

1. Introduction

Nutrients are classified into large, medium and trace elements. In natural soil, it mainly comes from soil minerals and soil organic matter, followed by slope seepage, atmospheric precipitation and groundwater. Soil organic matter under tillage also comes from fertilization, irrigation, etc. According to the difficulty of nutrient absorption and utilization, plants can be divided into late-acting nutrients and fast-acting nutrients. In general, available nutrients account for a small part of soil nutrients, less than 1% of the total. It should be noted that the division of available nutrients and delayed nutrients is relatively, and the two are always in dynamic equilibrium. The complex transformation process of soil nutrients, including plant absorption and utilization, leaching, erosion and loss. At the same time, different nutrient types have different effects on plant growth, and different plant types have different degrees of utilization of soil nutrients.

2. Variation Characteristics of Soil Organic Matter

Soil nutrient is one of the main factors affecting plant growth. Organic matter is an important part of soil and an important source of various nutrients in soil. Because of its colloidal properties, it can adsorb more cations, so that soil fertility and buffering. In addition, it plays a decisive role in the formation of soil structure and the improvement of soil physical condition. Soil organic matter is mainly divided into three parts: First, the decomposition is very little, still maintain the original morphological characteristics of animal and plant residues. Two is the semi-decomposition products of animal and plant residues and microbial metabolites. Three is the decomposition and synthesis of organic matter to form a more stable polymer - humic acid

compounds [1]. The content of organic matter in soil can be obtained by multiplying the content of organic carbon by the percentage of organic carbon, and the content of organic carbon in soil is affected by many factors. For example, Fu [2] studied the main grassland types in Alashan soil organic carbon influencing factors, the results showed that soil organic carbon content in the study area and rainfall, temperature, plant coverage, grassland productivity, soil water content, pH, silt content have a certain relationship. However, the main factors affecting soil organic carbon with the change of soil depth are also constantly changing. The main factors affecting soil organic carbon in 0 – 20 cm soil layer are plant coverage > grassland productivity > annual precipitation. The main factors affecting soil organic carbon in 20 – 40 cm soil layer are grassland productivity > plant coverage. The main factors affecting soil organic carbon in 40 – 60 cm soil layer are soil clay powder content. Under natural conditions, in addition to rainfall, temperature and other factors, the type of plants determines the way of organic matter into human soil and plant residue, but also has a great impact on soil organic carbon content and distribution [3].

3. Variation Characteristics of Soil Nitrogen Content

Nitrogen in soil comes from fertilization, biological nitrogen fixation, atmospheric deposition, soil adsorption and irrigation water and groundwater recharge. Its output is mainly organic nitrogen mineralization, mineral nitrogen fixation and loss, and nitrogen is necessary for crop growth and development [4]. The main factors affecting soil nitrogen content include natural environmental conditions, soil parent material, landform, land use, nitrogen fertilizer application rate and human social and economic activities. The nitrogen content in soil of different land use types in the same region is different. For example, Wang et al [5] showed that the nitrogen content in forest land decreased in a geometric series with the increase of soil profile depth. Contrary to woodland, the change of soil nitrogen content is basically concentrated in the farming layer. The nutrients in dry slope land changed little in the whole profile. The nitrogen content in peach orchard increased first and then decreased. Su et al [6] showed that soil nitrogen content of apricot forest was higher than that of grassland, seabuckthorn, Caragana korshinskii and farmland. From different levels, the nitrogen content in 0 – 10 cm soil layer was higher than that in 10 – 20 cm and 20 – 30 cm soil layer.

4. Variation Characteristics of Soil Available Phosphorus Content

Phosphorus is a large number of essential elements for plant growth and development. Phosphorus needed by plants is mainly obtained from soil phosphorus pool, and its role in plants has attracted more and more attention [4]. The factors affecting soil phosphorus content are mainly affected by soil types and environmental conditions. The soil phosphorus content of the main soil types in China is mainly shown as follows: the soil phosphorus content of the brick red soil type in the south of the Nanling Mountains is the lowest, followed by the red soil in Central China, and the soil phosphorus content of the soil developed by loess sediments and the soil in Northeast China is higher than that of the general soil [7]. The soil surface was covered by plant litter, and there were a large number of fine roots of plants, which further deposited a large amount of organic matter, thereby affecting the soil phosphorus content. The chemical composition and physical state of animal and plant residues, as well as soil temperature, ventilation and humidity will affect the soil organic matter content, thereby affecting the soil phosphorus content [4].

Soil organic matter can provide more abundant phosphorus and nitrogen pools, and can also improve the availability of soil phosphorus by reducing soil phosphorus fixation and promoting the dissolution of soil stable phosphorus. Lin [8] showed that the contents of soil alkali-hydrolyzable nitrogen, available phosphorus and available potassium increased with the

increase of soil organic matter content. When the soil organic matter content exceeded about 60 g / kg, the increase rate of soil alkali-hydrolyzable nitrogen and available phosphorus slowed down. Pan et al [9] showed that in 0 ~ 15 cm soil layer, farmland and vegetable soil organic matter content is lower than grassland, facilities vegetable soil compared with farmland and grassland ammonium nitrogen content, nitrate nitrogen content, available phosphorus content, exchangeable potassium ions appear obvious accumulation phenomenon.

5. Discuss and Conclusion

5.1. Discuss

Agricultural management measures have great influence on soil organic matter content and nutrients. Wang et al [10] showed that crop straw returning could increase the content of organic matter and total nitrogen in shajiang black soil, but had little effect on the content of available nitrogen. In different straw returning and conservation tillage treatments, straw returning, fire manure returning and no-tillage straw returning had the most obvious effect on the increase of organic matter and total nitrogen content in ginger black soil. Compared with the control, the soil organic matter and total nitrogen contents increased by 4.450 g / kg and 0.131 g / kg respectively after straw returning and fire manure returning. Under no-tillage condition, the soil organic matter and total nitrogen content of straw returning increased by 3.36 g / kg and 0.095 g / kg, respectively. Under the condition of reducing tillage, straw returning and straw crushing returning had no significant effect on increasing organic matter and total nitrogen content in Shajiang black soil. Straw burning could not increase the content of organic matter and total nitrogen in shajiang black soil. Luo et al [11] showed that soil organic matter in long-term ridge tillage was enriched in the surface layer. The organic matter content in 0 ~ 10 cm soil layer was higher than that in conventional flat tillage, and the organic matter content in 10 ~ 60 cm soil layer was lower than that in conventional flat tillage. The content of active organic matter in the surface layer (0 – 10 cm) of flood-drought rotation decreased, other soil layers did not change significantly. The carbon pool management indexes of all soil layers under ridge tillage and no-tillage were all above 100. Except that the surface layer (0 – 10 cm) was less than 100 rotation was less than 100, the other soil layers were all above 100.

Organic matter, total nitrogen and alkali-hydrolyzable nitrogen in soil are important nutritional factors for plant growth, and there is a certain relationship between them. Deng et al [12] analyzed the relationship and distribution characteristics of soil organic matter content, alkali-hydrolyzable nitrogen content and total nitrogen content under different altitudes (1600 ~ 1900 m) and different soil depths (0 ~ 20 cm, 20 ~ 40 cm). The results showed that: (1) The soil organic matter content, total nitrogen content and alkali-hydrolyzable nitrogen content decreased with the decrease of occurrence layer in the same vertical soil profile. At the altitude gradient, the spatial distribution of the three nutrient indexes showed an inverted ' U ' shape, and the maximum values were around 1750 m. (2) Using SPSS regression analysis, it was found that there was a significant correlation between total nitrogen content and organic matter content and alkali-hydrolyzable nitrogen content in upper and lower soil. There was a linear positive correlation between organic matter and total nitrogen, and a nonlinear positive correlation between total nitrogen and alkali-hydrolyzable nitrogen, and the fitting effect was good. (3) The nitrogen supply level of upper soil in mountain meadow was higher than that of lower soil, but the proportion of alkali-hydrolyzable nitrogen content in lower soil was significantly higher than that in upper soil.

Yang et al [13] showed that altitude also affected the distribution of soil organic matter content. Soil organic matter content showed a trend of gradual increase with the increase of altitude. Soil organic matter content was highly significantly correlated with total nitrogen, total

phosphorus and available boron (P values were 0.0000, 0.0098 and 0.0029, respectively), and was significantly correlated with available sulfur, exchangeable magnesium and exchangeable calcium (P values were 0.036, 0.019 and 0.042, respectively).

5.2. Conclusion

Soil nutrients play an important role in plant succession and restoration. Land use, farmland management, and geographical location have an important impact on the dynamic changes of soil organic matter and nutrients, and have an important impact on the whole ecosystem structure and agricultural utilization pattern. Therefore, understanding the dynamic change characteristics of organic matter is the basic condition for agricultural production management, precision agriculture and sustainable development of agriculture.

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