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Effect of the Addition of Biochar on Farmland Moisture and Crop Yield

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Abstract

Biochar is a highly aromatic resumptive substance formed by the cracking of plant biomass under high temperature hypoxia or anaerobic conditions, and biochar has a huge surface area, a highly developed pore structure and a strong ion adsorption exchange capacity, different biochar application gradients are proposed, and the dynamic changes of soil moisture and the infiltration characteristics of soil accumulated infiltration, infiltration rate and wet front transfer distance are studied by combining indoor one-dimensional vertical water head method with field test to improve the soil moisture infiltration process and the efficient utilization of agricultural soil and water resources in this area.

Keywords

Soil; Biochar; Soil Moisture.

1. Introduction

Soil moisture infiltration refers to the process of precipitation or irrigation water entering the soil from the surface, is the central link of soil moisture movement, and has important effects on surface runoff, surface erosion, groundwater recharge, plant root water absorption, etc[1]. Soil infiltration capacity will directly affect soil moisture content, determine the effective storage capacity of soil moisture and crop utilization of soil moisture, and thus affect the growth status and yield of crops[2]. Biochar is a highly aromatic resumptive substance formed by the cracking of plant biomass under high temperature hypoxia or anaerobic conditions, and biochar has a huge surface area, a highly developed pore structure and a strong ion adsorption exchange capacity[3]. These basic properties make it highly adsorbent, anti-biodegradable and antioxidant, so it is widely used in soil improvement and carbon sequestration emission reduction. Studies have shown that the addition of biochar to soil can increase soil porosity, reduce soil weight, increase the number of soil reunions and their stability[4], improve soil infiltration capacity and water holding[5]. Since most of the raw materials for biochar production are waste biomass resources, such as crop straw, poultry droppings, fermentation slag, wine spoils, fruit cores, etc., these waste biomass resources are large and easy to collect[6], so the use of biochar to improve the soil is to improve the soil environment and improve the comprehensive utilization rate of waste biological resources "one-in-one" method. Scholars at home and abroad have done a lot of research on the infiltration of biochar into farmland soil moisture and the improvement of crop yield, such as Yin Xiaoyan, etc. Zhao Chu and others[8]

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analyzed the effects of different concentrations of powder activated carbon and its application on soil infiltration. Ding Jun-man and others[9] studied the effects of biochar on soybean physiological indicators and agrochemical characteristics, and pointed out that biochar treatment would increase the height of soybean strains during each reproductive period. Wang Honglan and others[10] studied the effect of the application of biochar on the hydrometric properties of the soil of the cultivated land on the purple soil slope, and found that biochar can not only increase the water holding of the soil's effective water, but also improve the soil's water conductivity. Thus, biochar has a dual effect on farmland soil and on increasing crop yields[11]. At present, there are few quantitative studies on the influence of biochar on soil moisture in farmland and its effects on soil moisture in the northeast black soil region.

In this study, different biochar application gradients are proposed, and the dynamic changes of soil moisture and the infiltration characteristics of soil accumulated infiltration, infiltration rate and wet front transfer distance are studied by combining indoor one-dimensional vertical water head method with field test, and the application of the soil moisture change and its infiltration law after biochar is applied is analyzed, and the applicability of Philip model, Kostiakov model and Horton model is compared. At the same time, the influence of different biochar application on soil fertility and corn growth and yield is analyzed, and the research aims to reveal the law of soil moisture infiltration after biochar is applied to farmland soil, to explore the influence of biochar on soil moisture and its infiltration performance, and to improve the soil moisture infiltration process and the efficient utilization of agricultural soil and water resources in this area.

2. Research Objectives

In view of the influence of biochar on soil water holding ability and water infiltration characteristics, combined with field test and indoor simulated soil column experiment, the change of soil infiltration performance parameters under different biochar application conditions was quantified, and the simulation effect of Philip, Kostiakov and Horton 3 infiltration models on the process of water infiltration of powdered soil was evaluated. It provides scientific basis for understanding the law of infiltration, constructing soil moisture infiltration model and increasing soil water holding capacity, improving soil fertility and crop yield.

3. Expected Research Results

(1) The soil moisture infiltration process under different biochar application conditions and the corresponding soil moisture infiltration performance parameters are revealed, and the applicability of Philip, Kostiakov and Horton's three infiltration models to the simulation of the water infiltration process of powdered soil soil is determined.

(2) To determine the strength of soil fertility and the level of maize yield under different biochar application conditions, and to determine the optimal threshold range of the impact of biochar on soil fertility and maize yield.

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