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Analysis of the Water and Soil Erosion and Infiltration Characteristic in Ziquejie Terrace

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Abstract

The natural gravity irrigation in Ziquejie Terrace has gotten the wide attention of many water conservancy scholars for a long time. Considering the vegetation in the study area, farming, topography, rainfall equipment and representative and other factors in this paper, several typical parcels were selected to set runoff plots (P1、P2、P3). Analyzed the runoff time, ratio of the runoff and sediment yield, infiltration rate, soil infiltration, the process of runoff and sediment yield and the relationship between runoff and sediment yield under different precipitation intensity in three test plots by simulated rainfall experiment, and reveal the influence principle of Rainfall intensity, gradient, vegetation, soil properties and other factors to slope infiltration, runoff and sediment yield, Provide a theoretical basis of soil and water conservation, organization and management work in Ziquejie Terrace.

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Keywords: Ziquejie Terrace, runoff, sediment yield and soil infiltration.

1. Introduction

The natural gravity irrigation in Ziquejie Terrace has gotten the wide attention of many water conservancy scholars for a long time. Clarity the Source, storage forms, supply modes and migration transformation rule of

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the headwater which support the terraces irrigation system and the whole ecosystem, and thoroughly grasp the internal mechanism of this amazing phenomenon, which is not only the necessary theoretical basis for better development, utilization and effective protection Ziquejie Terrace, but also has important reference value for the development and protection of terraced fields in China. Some domestic scholars and experts has to follow a similar research or discussion. Xun Wen-sheng has analyzed the original gravity irrigation process of Ziquejie Terrace from The water flow movement and cycle, based on which the influencing factors on the process are summarized and studied [1]. XUN Zhi-fang has analyzed gravity irrigation system of Ziquejie Terrace comprehensively, and proposed that Ziquejie Terrace is an important example of the human and the nature harmonious development [2]. GAN De-xing has revealed the sustainable use of disaster prevention mechanism of Ziquejie Terrace through analyzing the local ecological and social conditions [3].

The domestic and overseas scholars mainly focused on the research about the development, utilization and protection measures of the ecological landscape in ancient terrace, lacking of the basic theory research. This text conducted the research about regional rainfall, infiltration, runoff and sediment yield in Ziquejie Terrace, reveal self-restraint mechanism and ecological protection mechanism of natural ecological gravity irrigation water in Ziquejie Terrace, lay the foundation for the local soil and water conservation work [4].

2. Materials and methods

2.1. The general situations of study region and testing program

General situations of study region

Ziquejie Terrace is located at Cheshui town, the western mountainous area in Xinhua County Hunan province. Located in east longitude 110°45′-111°41′. The total area of the terrace is 115.5km2, manifested in belts and ramified all over the mountain slopes at an altitude of 500-1200 meters, amount to more than 500 steps, more than one hundred thousand hillocks. The mean width of terrace is 1.75 meters(The narrowest place is 0.2 meter, the widest place is about 10meters), the average elevation difference between every steps is 1.25 meter, average ridge width is 0.3 meter, height is 0.25 meter, terrace across 8 surface slope, 5 ditch, 4 mountains, although the gradient between 25°-40°, without any artificial water conservancy facilities, its water storage and distribution system has been almost perfect, which can make water fill fields all year round, ensure stable yields despite drought or excessive rain without any soil erosion disaster [3,5].

Testing program

Considering the vegetation, farming, topography and rainfall equipment (convenient transportation, water supply, easy to operation) and other factors in the study region, in addition to be representative, several typical parcel was selected to set runoff plots in this tests(table 1). Experimental plot was laid by three pieces of steel plate (15 cm wide, 2 mm thick) parallel insert in the soil and Surrounded by built, specifications are 3 m * 1 m, leave open height is about 5.5 cm. Infundibular sand collecting trough made of metal was arranged at the bottom of experimental plot, Parallel insert slope in the same way, collect slope runoff and sediment.

Topsoil acquisition before the rain: before rainfall test, take samples with cutting ring near the plots, to measure soil bulk density and water index. In addition, collected some soil samples back to the laboratory, and analyze the physicochemical properties of surface soil before the rain.

Rainfall intensity calibration: cover the plots with striped cloth before each rainfall, four rain measuring cylinder are arranged evenly on the cloth, rain for 5 minutes, measure the rainfall, to calculate the rainfall intensity and evenness. Uniformity error within 5-10% can be tested, take the average of the four points as test rainfall intensity, if the error is too big, shower of sprinkler need to be adjusted and calibration again. According to the results of repeated calibration, this research adopts the low (0.65 mm/min), medium (1.15 mm/min), high (1.65 mm/min) rainfall intensity as simulated test.