Response Characteristics of Carbon and Nitrogen Content of Newly Added Cultivated Land to Slope

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Abstract. Research on soil erosion during the construction of newly added cultivated land in mountainous areas can not only ensure the stability of newly added land, but also play an extremely important role in achieving environmental friendliness. After planting soybeans, the SOC content was lower than that of corn planting. Among them, the SOC of the 2° test field was reduced by 13.81%, the 3° test field was reduced by 16.69%, and the 5° test field was reduced by 2.94%. Compared with corn planting, the TN content of the soybean test field was reduced, among which the 2° test field decreased by 3.51%, the 3° test field decreased by 14.86%, and the 5° test field decreased by 4.69%. The cumulative effect of carbon and nitrogen content in the 3° experimental field under the corn planting mode was better.

Keywords: Organic carbon, total nitrogen, slope, slope position, soil layer.

1. Introduction

Soil erosion is soil and parent material of the earth's surface in hydro, wind, freezing and thawing, external force such as gravity and unreasonable human production activities under the action of all kinds of damage, separation (decentralized), handling (mobile), and the phenomenon of deposition, climate, soil, hydrology, biology, geology and physiognomy and other comprehensive factors influence each other, the result of the restriction [1-2]. The huge population pressure urges human beings to reclaim a large amount of slope as cultivated land to meet the needs of food for their survival and development [3]. Combined with the restriction of natural factors, human beings blindly reclaim and deforestation, about 1/3 of the world's slope is threatened by erosion and soil erosion [4].

The area of hills in our country accounts for 2/3 of the total area, and slopes occupies a large proportion of the cultivated land in our country; while in many underdeveloped and fragile mountainous areas, the proportion of agricultural land on slopes is larger [5]. Natural factors of limiting and unreasonable slope using more destructive aggravated soil erosion degree, lead to serious soil erosion, deterioration of soil property, water retention, so that the lake silting downstream river channel, and the earth's surface and underground water pollution and so on, make the slope more fragile ecological environment, seriously limits the sustainable agricultural development [6].
In this study, different slopes were set as the primary treatment test, and different types of crops were planted on different slopes as the secondary treatment, to study the effects of different slopes and crops on soil quality, safety performance and production performance.

2. Test design
The experimental setup is located in the Qinling Field Monitoring Center Station, which is located in Shangwang Village, Tangyu Town, Mei County, Baoji City, Shaanxi Province. This model is planned to have a total length of 64m, a width of 18m, and an area of 1152m$^2$. The model has 4 main test areas, each of which is a rectangle with a length of 14m and a width of 12m, with slopes of 2°, 3° and 5° respectively. Four test plots (length 12m×width 3.5m) are set up in each test area. The crops planted in each plot are corn, salvia, soybean, and ryegrass.

3. Results and discussion

3.1. Soil organic carbon (SOC) under corn planting conditions
Comprehensive analysis of the effects of crop planting system, soil depth, slope position, and slope on SOC, the results show that the 2° and 3° test fields both show that the SOC content of the 10-20cm soil layer is greater than the 0-10cm soil layer. The SOC content in the downslope area is greater than that in the middle slope area, and the SOC content in the upslope area is the smallest (Fig. 1). The SOC content in the 5° test field was 0-10cm>10-20cm, the area on the slope was larger than the area under the slope, and the SOC content in the middle slope was the lowest (Fig. 1). Because the slopes of 2° and 3° are smaller, the intensity of underground runoff is greater than the intensity of surface runoff, which intensifies the transition of SOC to the ground and depth, while the intensity of surface runoff in the 5° test field may be greater than that of underground runoff.

3.2. SOC under soybeans planting conditions
The SOC content of the 2° and 3° test fields both decreased with the decrease of the slope position, while the 5° test field had the highest SOC content in the middle of the slope and the lowest on the slope. In all slopes and slope positions, the 0-10cm soil layer has a higher SOC content. According to a comprehensive analysis, the size distribution trend of SOC content is 5°>3°>2°, which may be due to the large surface runoff effect leading to higher nutrient content in the slope area (Fig. 2). After planting soybeans, the SOC content was lower than that of corn planting. Among them, the SOC of the 2° test field was reduced by 13.81%, the 3° test field was reduced by 16.69%, the 5° test field was reduced by 2.94%, and the 3° test field had the largest decrease. In the 2° and 3° test fields, the 0-
10cm and 10-20cm soil layers for soybean planting showed a decreasing trend compared with corn planting, and the decline range was between 8.52%-12.16% and 18.72%-21.22%, respectively. In the 5° test field, the 0-10cm soil layer and the 10-20cm soil layer increased and decreased by 0.95% and 7.09%, respectively.

![Figure 2. Distribution characteristics of SOC in experimental fields with different slope under soybeans planting conditions.](image)

### 3.3. Total nitrogen (TN) under corn planting conditions

In the case of planting corn on sloping fields, the average TN content is 3°, the next is 5°, and 2° is the smallest. The TN content of 0-10cm soil layer is between 0.58-0.74g/kg, which is higher than that of 10-20cm soil layer (0.57-0.73g/kg) (Fig. 3). In the experimental field treatments with different slopes, the TN content has the same trend of change, which is expressed as downhill>in slope>uphill. In the 2° test field, the TN content in and under the slope is higher than that in the upper slope, and the TN content in the 10-20cm soil layer is higher in the upper slope area, and the TN content in the 0-10cm soil layer is higher in the slope and under the slope. The content is higher. In the 3° experimental field, the TN content of different soil layers increased with the decrease of slope position, and the 0-10cm soil layer was higher than the 10-20cm soil layer. In the 5° test field, the 0-10cm soil layer has a higher TN content, and in the 0-10cm soil layer, the TN content in the lower slope area is higher, and the TN content in the middle slope area is higher than that in the upper slope area, 10-20cm soil layer and 0-10cm soil layer have been changing.

![Figure 3. Distribution characteristics of TN in experimental fields with different slope under corn planting conditions.](image)
3.4. TN under soybeans planting conditions
In the experimental field planting soybeans, the influence of soil layer and slope on TN is consistent with the experimental field planting corn. Among the slope positions of different slopes, the TN content in the upper slope area is higher, followed by the middle slope area, and the lower slope area has the lowest TN content. Compared with corn planting, the TN content of the soybean test field was reduced, among which the 2° test field decreased by 3.51%, the 3° test field decreased by 14.86%, and the 5° test field decreased by 4.69%. Compared with planting corn, planting soybeans reduced the TN content of 0-10cm soil layer by 2.99% and reduced the TN content of 10-20cm soil layer by 14.29 (Fig. 4).

![Figure 4. Distribution characteristics of TN in experimental fields with different slope under soybeans planting conditions.](image)

4. Conclusion
Compared with planting corn, planting soybeans reduces the SOC and TN content of slope farmland to a certain extent. Under the condition of planting corn, the SOC content of the 3° experimental field was higher, and the SOC content of the 10-20cm soil layer was higher than that of soybeans. The accumulation of SOC was more obvious in the lower slope area. The influence trend of soil layer and slope on TN is consistent with the experimental field of planting corn. In different slope positions, TN is concentrated in the downslope area under the corn planting pattern, and TN is concentrated in the upper slope area under the soybean planting pattern. Comprehensive analysis shows that the overall SOC and TN content of the 3° experimental field has a greater advantage.

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