PAPER • OPEN ACCESS

Disciplinarian of soil nutrient in the surface of terrace wall

To cite this article: Na Lei *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **300** 022050

View the article online for updates and enhancements.

This content was downloaded from IP address 221.226.175.204 on 10/10/2019 at 19:17

Disciplinarian of soil nutrient in the surface of terrace wall

Na Lei[1,2,3,4*], Qiguang Dong[1,2,3,4] and Zhe Liu[1,2,3,4]

[1] Shaanxi Provincial Land Engineering Construction Group Co., Ltd., Xi'an 710075, China
[2] Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd., Xi'an 710075, China
[3] Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Land and Resources, Xi'an 710075, China
[4]Shaanxi Provincial Land Consolidation Engineering Technology Research Center Xi'an 710075, China

*Corresponding author e-mail: linye2323@126.com

Abstract. In loess tableland area, farmers usually collected the soil in the surface of terrace section (or called "terrace wall") as fertilizer. Actually it contains abundant nitrogen and potassium. As fertilizer, it would be used as new and ecological materials in crop production. In order to analyse the disciplinarian of soil nutrient in the surface of terrace wall, soil samples were divided into three different ages: one year, five years, above ten years; different two slope aspects: sunny- and shady slop; three ground level: 0.2m, 1m, 1.8m above ground; and three vertical depths: 0-1 cm, 1-5 cm, 5-10 cm. The results showed: with the increase of age and ground level, soil nutrients, such as total nitrogen, available phosphorus and potassium were activated and accumulated in the surface of terrace wall under the effect of solar-thermal resources. In the sunny slope, soil nutrients were much higher than those in the shady slope caused by radiation. Soil nutrients were decreased with the increase of sampling vertical depth, most soil nutrients were found in the section surface, which proved soil nutrients were mainly accumulated in the surface of terrace wall.

1. Introduction

As the prerequisites of crop growth, soil provided nutrients and water for plants. Soil quality not only affects the growth and yield of crops, but also restricts the sustainable development of agriculture. To get higher yield, develop ecological agriculture, soil quality must be improved so that the relationship between soil quality and environment should be taken into account [1-3]. In loess tableland, especially in Chengcheng, Pucheng and Xunyi County, farmers usually collected the soil in the surface of terrace section (or called "terrace wall") as fertilizer. Under the direct effect of radiation, wind and water, soil nutrients will be accumulated in the surface of terrace wall, especially nitrogen and potassium. As fertilizer, it would be used as new and ecological materials in crop production. There are three common approaches to evaluate soil restoration:(1) measure the degree of recovery directly after the disturbance, (2) quantize the recovery process of disturbance, (3) measure indicators that reflect the characteristics of the recovery mechanism [4]. In China, the study of soil quality recovery in China mainly adopts space-time intergenerational method. Selecting plots with different recovery years but similar natural

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd

conditions and management methods in the basin to analyze the changes of soil quality and other indicators in selected land use type. Although this method can't guarantee the external environment is constant, but it can get the evolution rule of the long-term time scale, it is a research method widely used in the study of spatio-temporal evolution in the field of ecology [5]. Bao [6] conducted an experiment to analyze the physical, chemical and biological quality of soil in the Nianzhuanggou and Nihegou River basin. The results showed all nutrients were in a medium or low leve, except for total phosphorus and potassiu. Soil quality indexes of terrace will firstly gradually increase and then slowly decrease likes a wav. Xue[7] chose Zhifang Valley River basin in the loess hilly area as study site, space-time intergenerational method was used. It proved that when terraces be transformed, soil indicators showed different degrees of decline or no significant changes. However, with time goes on, soil quality will significantly increase.

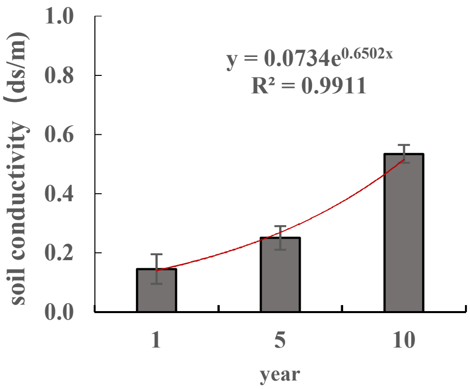
2. Material and method

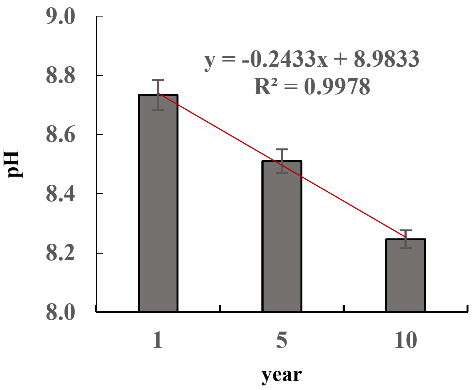
The trial was carried out in Nanniwan County, Yanan, Shaanxi Province, China. The climate was classified as warm temperate sub-humid continental monsoon climate with adequate radiation. The annual mean temperature is 9.4°C, highest temperature is about 39.7℃ in summer and lowest temperature is -25.4℃ in winter. The annual mean precipitation is about 556mm. According to different ages, slope aspects, vertical heights and depth, soil samples were collected in 9th Dec. 2017 and divided into three different ages: one year, five years, above ten years; different two slope aspects: sunny slope and shady slop; three vertical heights: 0.2m, 1m, 1.8m above ground; and three vertical depths: 0-1 cm, 1-5 cm, 5-10 cm. After collection, all the soil samples were dried and sieved. The pH value of each soil sample was measured by conductivity, total nitrogen, available phosphorus, available potassium, active organic carbon.

3. Results and analysis

3.1. Distribution of soil nutrients in different age of terrace wall

Soil nutrients in different age of terrace wall were quite different. It is shown in Figure.1 that the relationship between soil conductivity, available phosphorus and formation age were exponential, while the relationship between total nitrogen, available potassium, active organic carbon and formation age were linear. Soil pH was decreased from 8.7 in one-year terrace wall to 8.2 in ten-year terrace wall as time goes on. Soil conductivity, total nitrogen, available phosphorus, available potassium, active organic carbon increased by 267.0%, 120.7%, 188.4%, 98.4%, 373.3% respectively as compared to those in ten-year terrace wall. Under the long time impacts of radiation, temperature and water, soil nutrients in the surface of terrace wall were activated and accumulated.





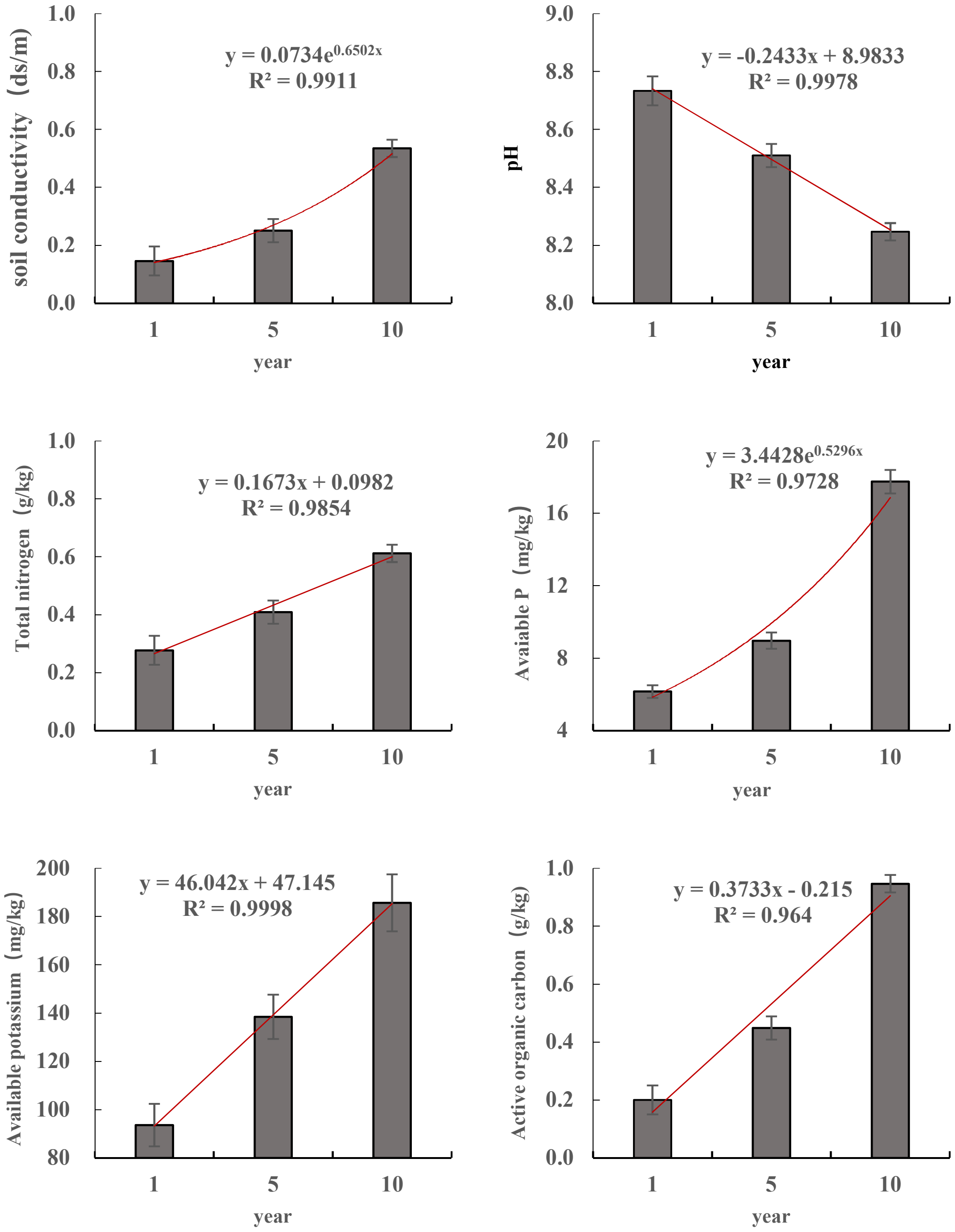


Figure 1. Distribution of soil nutrients in different age of terrace wall

3.2. Distribution of soil nutrients in different vertical heights of terrace wall

The distribution of soil nutrients in different vertical heights of 10-year terrace wall was demonstrated in Figure. 2. Soil pH, total nitrogen, available phosphorus, available potassium and active organic carbon increased with the increase of ground level, except for soil conductivity. The conductivity reduced from 1.216 ds/m at 0.2 m above ground to 0.098 ds/m at 1.8 m above ground, soil pH, total nitrogen, available phosphorus, available potassium, active organic carbon at 1.8 m above ground were 7.2%, 70.8%, 46.4%, 193.3%, 175.5% more than those at 0.2 m above ground. Due to the effect of climate factors and leaching, soil nutrients accumulated in the top of terrace wall which are close to tillage layer.

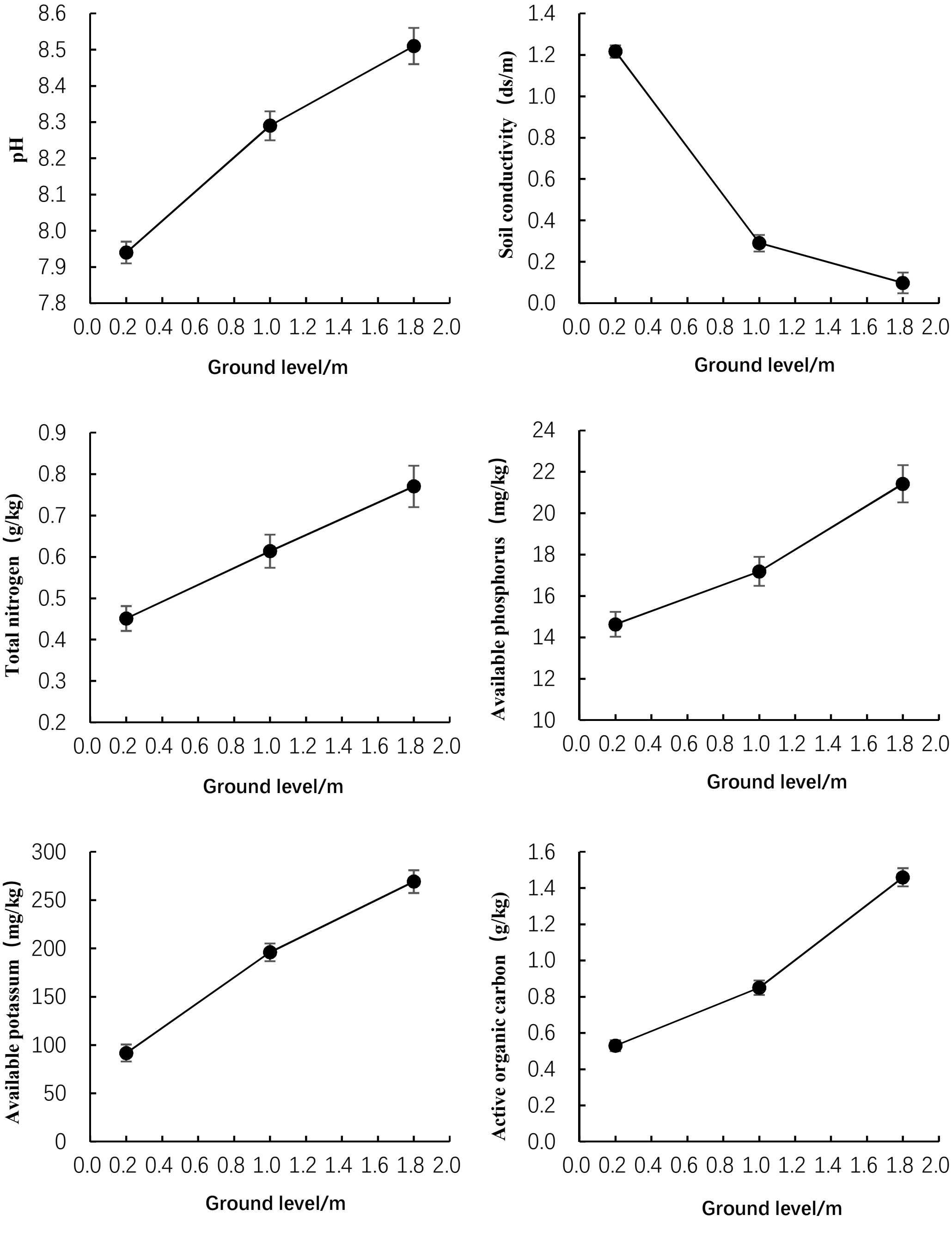


Figure 2. Distribution of soil nutrients in different heights of terrace wall

3.3. Distribution of soil nutrients in different slope aspect of terrace wall

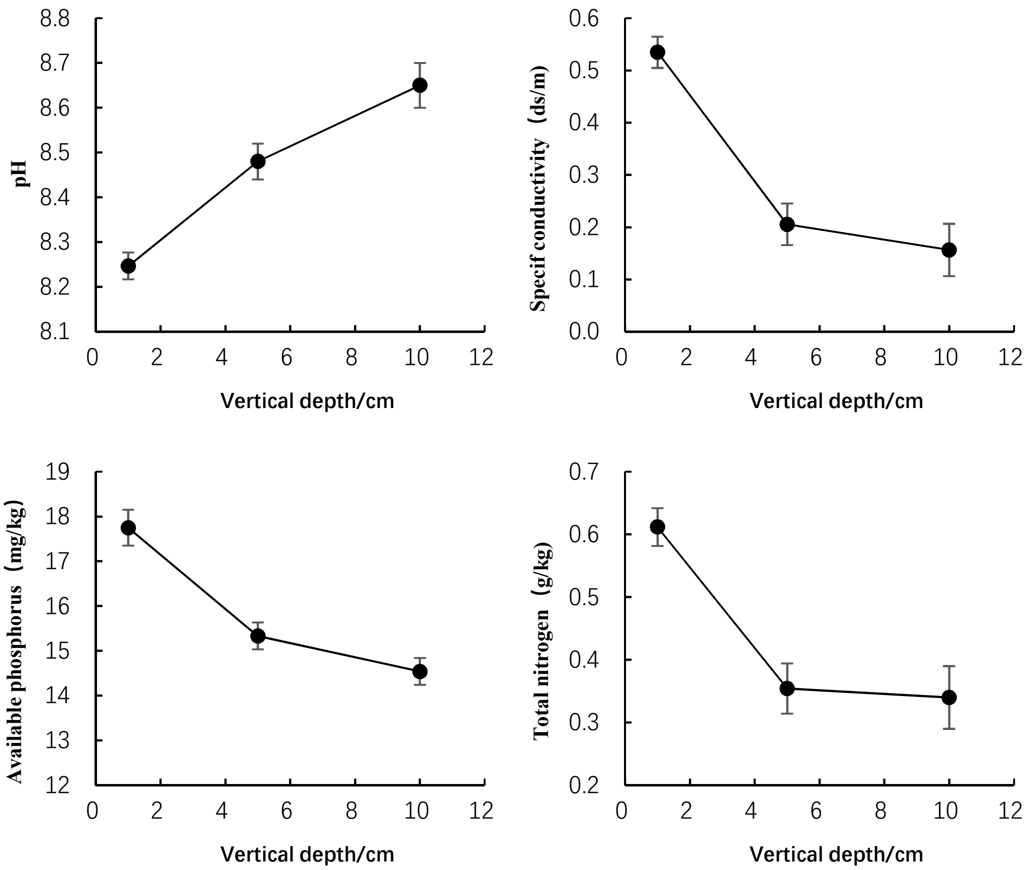
The distribution of soil nutrients in different slope aspect of terrace wall showed if solar-thermal resources have effect on terrace wall. All indexes in sunny slope were much higher as compared to those in shady slope, except soil conductivity. Moreover, soil conductivity in sunny slope was 64.6% less than those in shady slope, while soil pH, total nitrogen, available phosphorus, available potassium, active organic carbon were about 3.5%, 8.0%, 19.1%, 37.5%, 46.7% higher, respectively. Solar-thermal resources can accelerate the accumulation of soil nutrients in the surface f terrace wall.

Table 1. Distribution of soil nutrients in different slope aspect of terrace wall

Slope aspect	pH	conductivity (ds/m)	total nitrogen (g/kg)	available phosphorus (mg/kg)	available potassium (mg/kg)	active organic carbon (g/kg)
Sunny slope	8.8±0.02a	0.101±0.007b	0.27±0.03a	8.80±0.12a	121±4a	0.22±0.01a
Shady slope	8.5±0.01b	0.285±0.010a	0.25±0.02b	7.39±0.08b	88±3b	0.15±0.01b

3.4. Distribution of soil nutrients in different vertical depth of terrace wall

In cross section with the same high level, soil nutrients in different vertical depths showed significantly different (Figure. 3). Soil conductivity, total nitrogen, available phosphorus, available potassium and active organic carbon decreased with in–depth sampling, except pH. Moreover, soil pH with vertical depth 0-1 cm was 4.6% less than that with vertical depth 5-10 cm, soil conductivity, total nitrogen, available phosphorus, available potassium, active organic carbon with vertical depth 0-1 cm were 241.6%, 80.0%, 22.1%, 104.9%, 73.7% higher than those with vertical depth 5-10 cm. The results illustrated soil nutrients were mainly accumulated in the surface of terrace wall due to the effect of temperature, radiation and water.



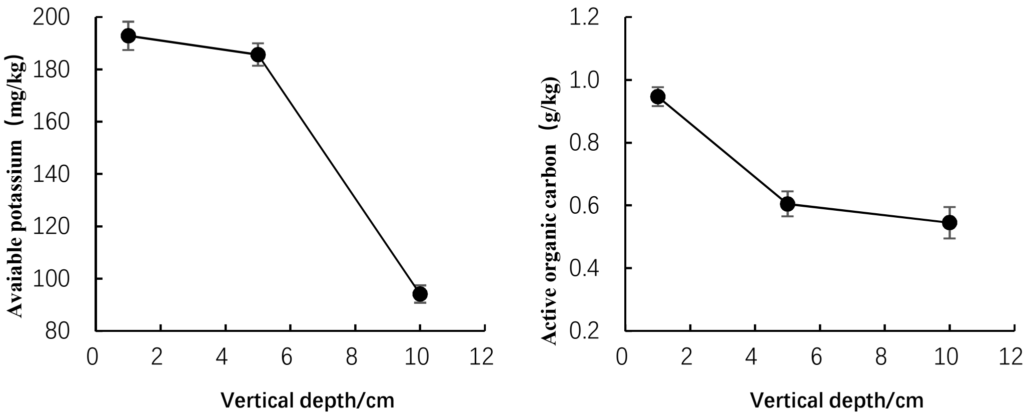


Figure 3. Distribution of soil nutrients in different vertical depth of terrace wall

4. Conclusion

According to analysis the disciplinarian of soil nutrients in different age, vertical height, slope aspects and vertical depth, we concluded that:

(1) With the increase of age, especially above 10 years, soil nutrients will be activated and accumulate in the surface of terrace wall with the effect of climate factors such as temperature, radiation and water.

(2) With the increase of vertical heights above ground, soil nutrients in the surface of terrace wall were increased due to the climate effect and leaching.

(3) In the sunny slope, soil nutrients were much higher than those in the shady slope, which indicates solar-thermal resources can accelerate the accumulation of soil nutrients in the surface f terrace wall.

(4) Soil nutrients were decreased with the increase of sampling vertical depth. Most soil nutrients were found in the section surface, especially the vertical depth 0-1 cm, which proved that soil nutrients were mainly accumulated in the surface of terrace wall.

Acknowledgments

This work was financially supported by internal fund of Shaanxi Provincial Land Engineering Construction Group Co., Ltd. (DJNY2018-18).

References

[1] J.M. Schulte, S. Burkham, J.E. Squires, et al. Immunization status of children born to human immunodeficiency virus (HIV)-infected mothers in two Texas cities. Southern Medical Journal. 93(2000) 48-52.

[2] H. Shen, Z.H. Cao, Z.H. Xu. Effect of fertilization on different carbon fractions and carbon pool management index in soils. Acta Pedologica Sinica, 37(2000) 166-173.

[3] C. Gao, T.L. Zhang. Environmental Management Options Practiced in Europe to Mitigate Agricultural Nutrient Pollution of Ground and Surface Water. Journal of Ecology and rural Ebvironment. 15(1999) 50-53.

[4] H.A. Steinbrecher, A.S. Najmaldin. Endoscopic Surgery in Paediatric Oncology Endoscopic Surgery in Children. Springer Berlin Heidelberg, (1999) 465-474.

[5] S. Xue, G.B. Liu, Q.H. Dai, et al. Dynamics of Soil Microbial Biomass on the Abandoned Cropland in Loess Hilly Area. Scientia Agricultura Sinica, 42(2009) 943-950.

[6] S. Xue, G.B. Liu, C. Zhang et al. Effects of terracing slope cropland on soil quality in Hilly Region of Loess Plateau. Transaction of the CSAE, 27(2011) 310-316.