Changes of Soil Microbes, Enzymes and Nutrition in Artificial Vegetation Restoration in Honghe Dry-hot Valley

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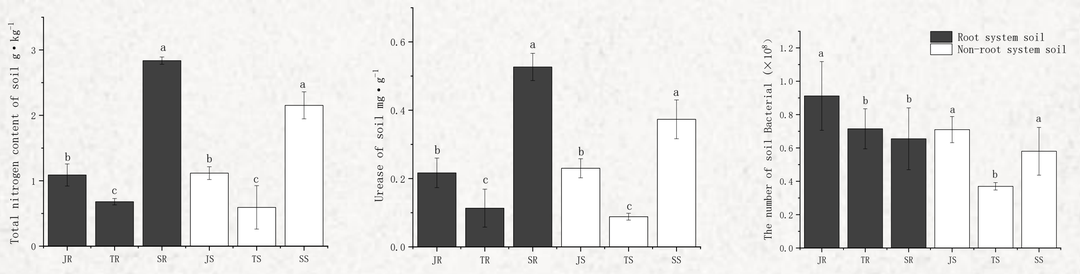
1 Introduction

The ratio of soil C:N:P is vital to the composition of the soil microbes and plays a crucial role in soil-plant interaction and terrestrial nutrients. As the essential part of underground ecosystem, soil microbes drive and influence many important ecosystem functions and processes such as decomposition, nutrient cycles, ecosystem production and plant community structure. The relationship between soil chemical stoichiometry of nitrogen, phosphorus and potassium and that soil microbial and enzymes in the artificial restoration of vegetation is explored in Honghe dry-hot valley. We provide theoretical basis and reference for the influence of different vegetation restoration patterns on soil characteristics in dry-hot valley. In this paper, the relationship between soil chemical properties, enzymes and microbial of two pure plantations, *Schleichera oleosa* and *Cassia siamea*, and savanna with *Woodfordia fruticosa* as the main vegetation types in Honghe dry-hot valley, was analyzed by field sample investigation and indoor control experiments.

2 materials and methods

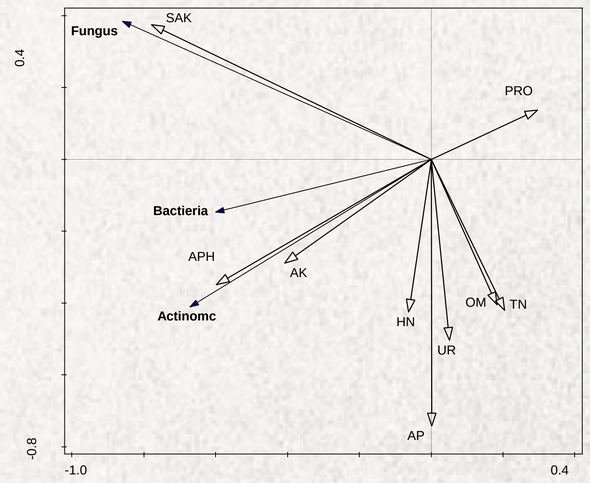
① Experimental site: Honghe Yunnan (23° 19′38″～23° 24′55″N，102° 15′1″～102° 25′36″E);
② Forest types selection: *Schleichera oleosa* of artificial vegetation restoration*, Cassia siamea of* artificial vegetation restoration and savanna with *Woodfordia fruticosa* as the main vegetation types;
③ Plot selection: six 100 m^2 plots (10 m×10 m) were randomly selected in each of the three forest types;
④ Collection of soil samples: root system soil wre collected with trunk 10 cm in range, and non-root system soil were collected outside the scope of near the trunk.

3 Main results



① Differences of soil stoichiometry in different communities. For root system soil, savanna with *Woodfordia fruticosa* as the main vegetation type exceed those artificial vegetation restoration among organic matter content, total nitrogen content, hydrolytic nitrogen content, available phosphorus content and available potassium content. However, slow-release potassium is opposite. For non-root system soil, the nutrients content of soil all showed savanna more than artificial vegetation restoration.
② Differences of soil enzymes in different communities. In root system soil or non-root system soil, savanna is not lowest among protease content, acid phosphatase content and urease.
③ Differences of soil microbes in different communities. For root system soil, savanna is the lowest among fungi number, bacterial number and actinomyces. For non-root system soil, savanna is not the highest in soil microbes.

Both soil chemical factors and soil enzymes variables can explain the changes of microbial function, and it explains 94% of the total variance. The length of the environmental factor arrow can indicate the degree of its impact on microbes, that is the longer the distance of the microbail arrow on the projection line of an environmental factor, the greater the impact of the environmental factor on the microbe. In this research, slow-release potassium, available phosphorus, organic matter and acid phosphatase made great contributions in the two-dimensional sequence diagram of redundancy analysis.



⑴ There were significant differences in the contents of organic matter, total nitrogen, hydrolytic nitrogen, available phosphorus, available potassium, slow-release potassium, protease, urease, bacteria and fungi between root system and non-root system soil of three communities ($P < 0.05$).
⑵ There was no significant difference in the contents of actinomycetes between root system and non-root system soil of different vegetation communities ($P < 0.05$).
⑶ There was no significant difference in acid phosphatase content between three communities ($P > 0.05$).
⑷ The main factors driving community variation were slow-acting potassium, followed by available phosphorus, organic matter and acid phosphatase.

4 Main conclusions

The contents of nutrients, enzymes and microbes have been changed in the soil after artificial vegetation restoration in Honghe dry-hot valleys, and the active of soil was stronger under artificial vegetation restoration. Artificial vegetation restoration forms arbor layer and litter layer, to a certain extent. Most of the nutrients in the soil are transferred to the large tree, and the litter layer may have an impact on the distribution of soil nutrients in the forest land. The utilization rate of nutrients is lower in savanna soil, and most of them are stored in the soil. The structure and characteristics of degraded soil were changed to a certain extent by artificial vegetation restoration in Honghe dry-hot valley. *Schleichera oleosa* and *Cassia siamea* communities were similar in soil nutrients, enzymes and microbial number, but different from savanna with *Woodfordia fruticosa* as the main vegetation type. By researched on the relationship among microbes, enzymes and nutrition of vegetation community in dry-hot valley, it is reflected that soil potassium and acid phosphatase play a key role in community of microbe. The stoichiometry of relationship among soil N, P, K stoichiometry, microbes and enzymes showed that soil microbial stoichiometry was largely controlled by soil nutrient and enzyme stoichiometry. The results provide useful insights into soil nutrient cycling in forest ecosystems.

5 References

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