Relationship between Leaf Phosphorus and Soil Phosphorus： A Case Study of Degraded Grassland in western Jilin Province, NE China

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Introduction

Plant growth should be expected to be limited by phosphorus (P) availability in most terrestrial ecosystems. The previous studies indicate that the leaf P concentrations of Chinese terrestrial plants should be considerably lower than the global average, resulting in a higher leaf N/P ratio. However, how does the content of soil total P and available P influence leaf P and N/P ratio? It has been one of the hotly-discussed issues in the ecological stoichiometry. However, the P stoichiometry in the leaves of Leymus chinensis and soil conditions from the Jiangjiadian grassland in Da'an city in western Jilin Province, NE China, provides insights for the above issue. Our objective is to determine how and to what extent soil total P and available P influence leaf P and N/P ratio in the study region.

Material, Method, Results and discussion

This paper reports the total P and available P contents of 25 surface soil samples and the leaf P contents of 25 Leymus chinensis samples.The results indicate that the content of leaf P ($1.3 \mathrm{mg \cdot g^{-1}}$) is lower than the global average content ($2.0 \mathrm{mg \cdot g^{-1}}$), however, the N/P ratio in Leymus chinensis leaf (15.26) is higher than the global average value (13.8). These findings are consistent with previous findings[1]. Moreover, the contents of soil total P and available P are $0.34 \mathrm{mg \cdot g^{-1}}$ and $5.25 \mathrm{mg \cdot kg^{-1}}$, respectively. The available P content of degraded grassland in western Jilin province is higher than Chinese soils ($3.83 \mathrm{mg \cdot kg^{-1}}$), United States soils ($3.41 \mathrm{mg \cdot kg^{-1}}$) and Australian soils ($2.17 \mathrm{mg \cdot kg^{-1}}$). But, available P is lower than the global soils ($7.65 \mathrm{mg \cdot kg^{-1}}$). In addition, Pearson correlations analyses done by SPSS software indicate that soil total P($r=0.345$) and available P($r=0.25$) do not exhibit evidently positive correlations with leaf P concentrations. The soil total P concentrations has no significant correlation with N/P ratio($r=-0.3$). While the soil available P has significantly negative correlation with N/P ratio($r_{0.05}=-0.416^*$). Taken together, it is suggested that the soil total P and available P can influence leaf P concentrations, but be not necessarily leading factor, because contents of soil total P and available P are not accurately reflect leaf P concentrations. Compared with leaf P concentrations, leaf N/P ratio is more related to soil P concentrations, especially to soil available P concentrations.

Conclusion

Therefore, we conclude that low leaf P and high N/P of Leymus chinensis are caused by low soil P content on one hand, on the other hand they are likely caused by other factors such as plant characteristics, climate, and external environment and so on.

The fate of mercury at a contaminated site

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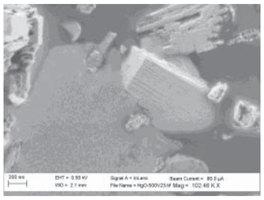
Soils contaminated with mercury present unique challenges for remediation due to the variety of chemical forms in which mercury occurs. Mercury, like many other heavy metals, cannot be degraded in the environment and its remediation must therefore involve either removal or immobilization. The characteristics of the mercury in sediment, i.e., Hg(0) beads with or without coatings of HgO and $Hg(OH)_2$, or oxidized Hg(II) that is attached to sediment minerals, or precipitated Hg as mercury sulfide (HgS), underpins the technologies that can be effective for clean up. When selecting mercury remediation technologies at a given contaminated site it is essential that the form of mercury—especially speciation—is well understood.

During the mercury use era at the Y-12 National Security Complex, Oak Ridge, Tennessee, large quantities of mercury were lost to the subsurface environment[1]. Spilled elemental mercury has undergone complex biogeochemical transformations under both saturated and unsaturated conditions. High-levels of mercury have recently been found in soil collected from a Hg use area (which housed a mercury retort furnace from 1957 until 1962[2]). Hg concentrations, determined by atomic absorption following core collection, sampling and soil digestion, ranged from 0.2 to 19000 ppm. Hg(0) was the dominant form in sediment samples where mercury beads were visually present[3]. Additionally micron-sized Hg(0) beads were also observed. Although the formation process is under investigation, the observed micron-sized beads may have formed in situ due to high vapor pressure and/or disintegrated from the original Hg(0) beads over the last 50 years in the subsurface. New SEM and XRD evidence shows that the coatings of the mercury beads are predominantly HgO, but that native clay minerals are also present. These results are being incorporated into further laboratory tests focused on evaluating the fate and transport of mercury as well as the development of new remediation strategies.



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