Potassium cycling in soil-plant: Implications for land utilization

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Potassium, as a major nutrition element in land utilization, is of an important indicating implication for reasonable utilization of land. This paper presents potassium contents and variation from different utilizing types of lands and plants located in Jilin province, northeastern China to reveal potassium cycling law between land and plant and further to efficiently utilize lands. The studied soils are chernozem, alkali soil and aeolian sand soil in western part and are mainly brown soil in eastern part. The former chiefly crops sunflower, the latter crops apple-pines. The analytical results of soils indicate that total potassium (Q_k) and available potassium (S_k) concentrations from western soils vary from 1.21 wt.% to 3.23 wt.% (averaging 2.26 wt.%) and from 44 to 405 ppm (averaging 136 ppm), respectively, and whereas those from eastern soils range from 2.25 wt.% to 3.53 wt.% (averaging 2.83 wt.%), and from 37.2 to 564 ppm (averaging 160 ppm), respectively. The analytical results for fruits suggest that the average potassium contents from sunflower seeds (G_k) located in western part and from apple-pines located in the eastern part are 0.75 wt.% and 0.78 wt.%, respectively. Although obvious differences exist in soil types, land utilizing types, and potassium concentrations between eastern and western parts, absorption coefficient (G_k/S_k-y) and conversion coefficient (S_k/Q_k-x) for potassium between soil and fruit exhibit an obviously negative correlation in two studied areas, yielding a regression equation of $y=34.662x^{-0.8463}$ (r=0.9376, n=235). Taken together, it is suggested that although potassium absorption and utilization for plants could be affected by potassium abundance in soil, it will decrease as available potassium concentration increases in soil, which is of important implications for revealling potassium cycling law between soil and plant and evaluating soil quality as well as reasonable utilization of potassium fertilizer.

Role of water availability in source partitioning for desert nitrate: New evidence from mass-independent oxygen isotopic compositions

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Mass-independent oxygen isotopic signatures are powerful tracers for delineating the two sources of nitrate in desert soils: nitrification and atmospheric deposition. We have performed isotopic measurements to detect $\Delta^{17}O$ anomalies in NO_3^- salts from the Atacama (Chile), Kumtag (China), Rajasthan and Mojave (US) Deserts, which indicated the relative importance of these two nitrate sources has been linked to water availability. The most significant $\Delta^{17}O$ anomalies (14-21‰) were observed in the NO_3^- salts from the Atacama Desert (a few mm precipitation on decadal time scales), close to atmospheric nitrate $\Delta^{17}O$ value (~23‰), suggesting the Atacama well-known nitrate deposits are due to long term atmospheric deposition of photochemically produced nitric acid and biology is severely limited by hyperaridity. Surficial nitrate mineral samples from the Kumtag Desert which is similarly hyperarid (precipitation<25mm annually), also have large $\Delta^{17}O$ values (12-18‰), indicating the accumulation of atmospheric nitrate is the primary source of these nitrate ores while minor, but detectable, biotic sources of nitrate are expected. However, the Rajasthan and Mojave Deserts (mean annual precipitation: 50-100mm) caliche NO_3^- samples with somewhat lower $\Delta^{17}O$ values (7-13‰) appear to be partially derived from atmospherically deposited N, but also contain substantial amounts of N from terrestrial nitrification. This shift in nitrate source from Atacama to Mojave reflected a function of the availability of water. This suggests oxygen isotopes in pedogenic nitrate may be used as a proxy for past precipitation and as a marker of the intensity of biologic N cycling.