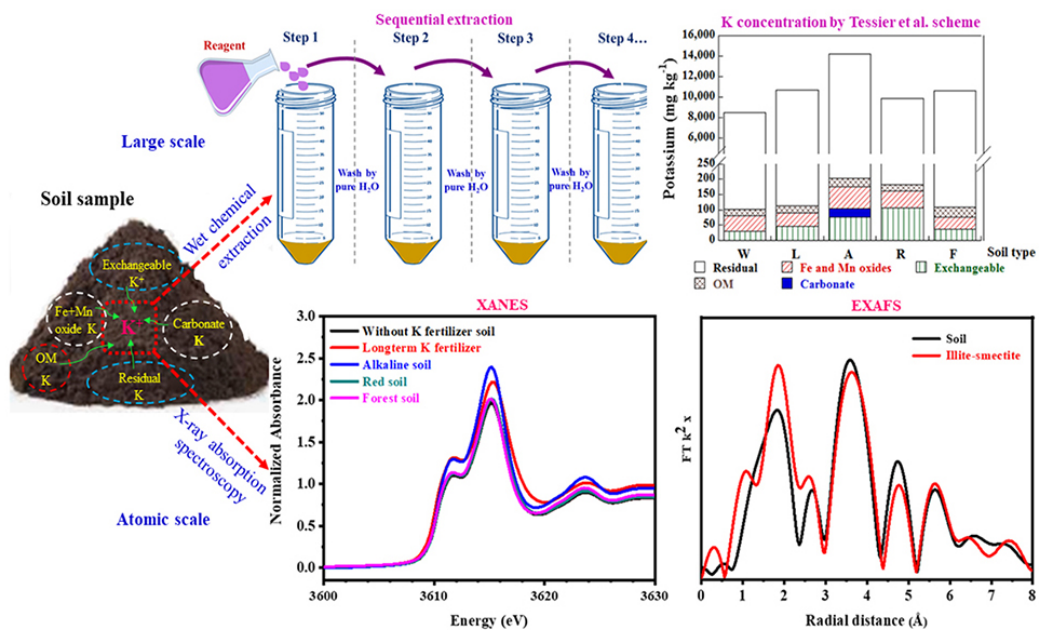




Mapping potassium availability in diverse Taiwanese soils

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Synchrotron-based X-ray absorption spectroscopy reveals the molecular fingerprints of potassium in different soil types, helping researchers distinguish between "locked" mineral forms and plant-available nutrients. Photo courtesy of Yao-Tung Lin, National Chung Hsing University.

Potassium (K) is a vital macronutrient for crop health, influencing everything from enzyme activation to final yields. While soils contain vast amounts of potassium, only a small fraction is readily available for plant uptake. Understanding how this nutrient is stored across different soil types and management histories is essential for developing sustainable fertilization strategies that optimize productivity while preventing environmental loss.

Traditional chemical tests often fail to capture the complex atomic environments where potassium is "locked" within soil minerals. To address this gap, researchers combined conventional sequential extraction with advanced synchrotron-based X-ray absorption spectroscopy to analyze five representative Taiwanese soils, including forest, alkaline, and long-term-fertilized agricultural soils. This dual approach allowed them to identify both the quantity of potassium and its specific molecular binding forms.

Results revealed that more than 95% of total potassium remains in a highly stable residual form, primarily hosted within illite-smectite clay minerals. Potassium availability was highest in alkaline, long-term-fertilized soils while unfertilized, acidic red soils showed the lowest levels. These findings provide a molecular-scale framework for land managers to predict nutrient release better and refine fertilizer applications across diverse landscapes.

Dig deeper

Poonpakdee, C., Weng, C.-H., Wolde, G. S., Tzeng, J.-H., Chen, Y.-C., & Lin, Y.-T. (2026). Integrated assessment of potassium speciation in Taiwanese soils using chemical extraction and X-ray absorption spectroscopy. *Soil Science Society of America Journal*, 90, e70186. <https://doi.org/10.1002/saj2.70186>

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