Research Application Summary

Determination of uranium concentration in selected agriculture soils of Bah district in Tanzania and its uptake by food crops

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Abstract

This research aims to determine the level of uranium (U) contamination in selected agricultural soils of Bahi District and its uptake by food crops for its proper management. The research will involve determination of spatial distribution of uranium in agricultural soils, its uptake and translocation in plant/crop tissues. In addition, it will involve determination of uranium level in surface and ground water used for drinking and irrigation. The results from this study will be used to create awareness among the famers and other surrounding community about potential risk posed by uranium and its compounds on their lives and the environment.

Key words: *Bahi, uranium,* millet, plant uptake, rice

Résumé

Cette recherche vise à déterminer le niveau de contamination de l'uranium (U) dans certains sols agricoles du district de Bahi et son absorption par les cultures vivrières pour sa bonne gestion. La recherche comprendra la détermination de la distribution spatiale de l'uranium dans les sols agricoles, son absorption et la translocation dans les tissus des plantes / cultures. En outre, il s'agira de déterminer le niveau d'uranium dans les eaux de surface et les eaux souterraines utilisées pour la boisson et l'irrigation. Les résultats de cette étude seront utilisés pour sensibiliser les agriculteurs et d'autres communautés environnantes au sujet du risque potentiel causé par l'uranium et ses composés sur leurs vies et sur l'environnement.

Mots clés: *Bahi, uranium*, millet, absorption par les plantes, riz

Background

In agricultural soils, Urenium (U) is enriched by weathering of parent rocks particularly granites (Sasmaz and Yaman, 2008). Weathering releases this toxic element from the parent rock and makes it available in soils for plant uptake. High level of U in agricultural soils enhances the chance of its assimilation and translocation in various parts of plants (Singh 1997; Anke *et al.*, 2009). According to Anke *et al.* (2009), soils originating from weathered granites like those found in areas where U

deposits have been found in Tanzania tend to produce vegetable forage and food crops that are rich in uranium. This is possible because U in soils is available for plant uptake at the pH range of 4.0 to 7.5, and is most mobile as U^{+6} in hydrolysed forms (Meinrath *et al*., 1996). Its mobility increases the ability to spread in agricultural soils and chance to be taken by many crops and grasses/shrubs used for grazing animals.

Literature Summary

Uranium is heavy metal and does not play any known nutrition role in plants. It is absorbed by plants as hexavalent U^{6+} and that oxidation state does not change (Duquene *et al.,* 2006). Once absorbed by a plant, it is assimilated in different tissues but more in seeds (Laroche *et al*., 2005). Like other heavy metals, it causes toxicity when accumulated in a plant at a high concentration (Ebbs *et al*., 1998). In water, uranium can be found in both surface and ground water and, thus, this tells the possibilities of people and animals that could be exposed to U through drinking water and eating food crops grown in areas with U (Bensoussan *et al*., 2009).

Study Description

The study will be conducted in Bahi District at Bahi, Mpamantwa and Ilindi villages where soil, water and plant tissues will be sampled and analysed for uranium concentration. A topographical map of the study area will be used to select sites for collecting soil samples. The sites will be selected with the assistance of an Extension Officer who knows the area well. Soil samples will be taken with the aid of soil auger starting from elevated area towards the wetlands. At each sample site, soil will be taken at 0-30, 30-60, 60-90 and >90 cm from the surface. This information will assist to model U dynamics and its spatial distribution in agricultural soils. Both surface and underground water will also be sampled. The samples will be analysed by inductively coupled plasma- mass spectrometry (ICP-MS).

Farmers will grow rice, maize, and millet (staple cereal crops) to maturity in their farms and sampling will be carried out after cereal crops have matured in May to June 2012. Systematically, three sets of samples (soils, plant part, and grains) will be taken in each farm at points approximately 30m apart. The rice, maize, and millet shoots will be cut approximately 15cm from ground to avoid soil contamination. Those sets of samples will also be analysed for U concentration using ICP-MS.

Research Application   Generation of information on the level of U contamination in agricultural soils, water and plant tissues in the areas with U deposits and creation of safety awareness to the vulnerable communities will be among the project outcomes. In addition, the project will improve scientific knowledge on uranium soil/plant interactions, mobility, and contamination levels in soils and water. Furthermore, the study will assist in better understanding the ability of food crops to accumulate U in their tissues. Thus, the research will pave way for safe utilisation of available food crops and surface and underground water including possibility of suggesting remedial techniques for U.

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