

- The study recommends that continuous monitoring of the soil, maize grains and leaves for heavy metals pollution
- The County Government through the Ministry of Health should periodically conduct health screening on the farmers and residents to check for some symptoms of heavy metals poisoning.

References

- Filgueiras, A. V., Lavilla, I., and Bendicho, C. (2002). Chemical sequential extraction for metal partitioning in environmental solid samples. *Journal of Environmental Monitoring*, 4(6), 823-857
- Hughes, S., and Samman, S. (2006). The effect of zinc supplementation in humans on plasma lipids, antioxidant status and thrombogenesis. *Journal of the American College of Nutrition*, 25(4), 285-291
- Ibrahim, K. N., Yet, Z. R., Som, A. M., Razali, N., Rahaizah, N. A. M., Othman, E. N., ... & Yahya, T. F. T. (2015). The heavy metal concentration (Pb, Cu, Fe, Zn, Ni) in Plant Parts of Zea Mays L. Cultivated in Agricultural Area
- Lenntech (2012). *Chemical Properties of Cobalt, Health Effects of Cobalt and Environmental Effects of cobalt*. www.Lenntech.com. Accessed on 3rd July, 2012, pp.15.
- Omwoma, S., Lalah, J. O., Ongeri, D. M., & Wanyonyi, M. B. (2010). Impact of fertilizers on heavy metal loads in surface soils in Nzoia Nucleus Estate sugarcane farms in Western Kenya. *Bulletin of environmental contamination and toxicology*, 85(6), 602-608.
- Yeung, A.T., Hsu, C.-N., 2005. Electrokinetic remediation of cadmium-contaminated clay. *Journal of Environmental Engineering*, 131, 298-304.

Acknowledgement

The authors are indebted to the financial support by University of Eldoret Annual research grants

Publication

- Akenga, T., Sudoi, V., Machuka, W., & Kerich, E. (2016). Status of Agricultural Soil Contamination by Heavy Metals in Uasin Gishu County. *Journal of Environment and Earth sciences*, 6(11). Pp 168-175
- Akenga, T., Sudoi, V., Machuka, W., Kerich, E., & Ronoh, E. (2017). Heavy Metals Uptake in Maize Grains and Leaves in Different Agro Ecological Zones in Uasin Gishu County. *Journal of Environmental Protection*, 8(12), 1435.

Contact Details:
 Prof. Teresa Akenga
 Office of the Vice Chancellor
 Email: @uoeld.ac.ke

Published by:
 Directorate of Research and Innovation
 University of Eldoret
 P.O Box 1125-30100
 Eldoret
 Website: www.uoeld.ac.ke
 Email: ridirector@uoeld.ac.ke



Policy Brief – University of Eldoret

- Cadmium causes kidney disease, lung damage, and fragile bones (Mebrahtu and Zerabruk, 2011) and (Yeung and Hsu, 2005).
- Lead toxicity causes dysfunction of reproductive, kidney and, joints problems, lessening in haemoglobin formation, heart, and cancer (Chen et al. 2007).

The status in Uasin Gishu County

Kenya's economy primarily depends on agriculture where over a large percent of the population live in rural areas and derive their livelihoods mainly from these agricultural activities. Intense agricultural activities have been found to be contributing the greatest percentage in the environmental heavy metals pollution in Kenya (Omwoma et al., 2010; Nyairo et al, 2015).

Uasin Gishu County is the major breadbasket of the Country where Maize (*Zea mays L.*) is produced in large scale. Maize (*Zea mays L.*) serves as the main food source for humans and animals around the world. Approximately ninety six percent of Kenyan population consumes maize which provides 40 % of the calorie necessities in Kenya (Omoyo et al., 2015).

The source of Heavy metals

Herbicides, pesticides and inorganic fertilizers contain different levels of heavy metals and thus, their use in an endeavor to achieve and sustain high crop yields contributes greatly to heavy metal contamination in the soils, surface water as well as ground water sources (Ibrahim et al., 2015). Plants bio-accumulate heavy metals from the soil and when they are eaten by human beings and animals, the heavy metal accumulate in the body with serious health effects (John et al., 2010; UNDP, 2006; USEPA, 2002).

The study

This study monitored the level of heavy metals in soil, maize grains and leaves to ensure they do not exceed the WHO permissible limits

Findings from Uasin Gishu County Agro-Ecological Zones

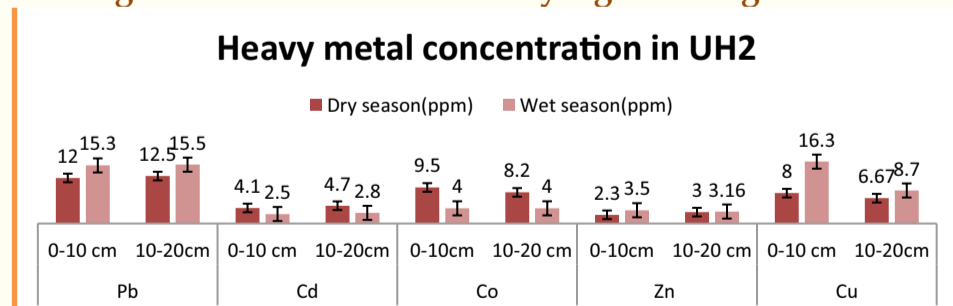


Figure 1: The mean concentration of heavy metals in soil sample in Uasin Gishu County for UH₂

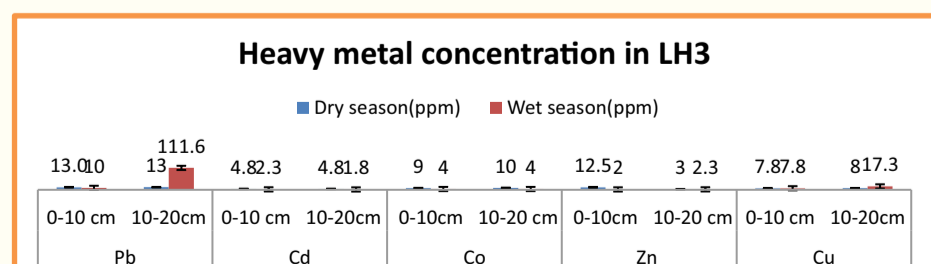


Figure 2: The mean concentration of heavy metals in soil sample in Uasin Gishu County for LM₃

HEAVY METAL CONTAMINATION IN SOILS: A FOOD SECURITY RISK.

A CASE OF MAIZE PRODUCTION IN UASIN GISHU COUNTY



A photograph of maize during sampling of leaves

What is the issue

Heavy metal contamination in agricultural soils reduces its productivity and therefore there is need to adequately protect and restore soils in an ecosystem contaminated with heavy metals. This is done through characterization and remediation based on data that characterize chemical properties of the soil. One of the tools used to enable decision makers to manage sites with contaminants is risk assessment. This is a cost effective way of preserving ecosystem health.

What are the health risks

- Heavy metals are defined as those having a specific density of more than 5 g/cm³, e.g. lead, cadmium, copper, zinc, nickel, cobalt, chromium and mercury.
- Heavy metal contamination is a major concern for ecosystem in general.
- Anthropogenic sources of heavy metals pollution in soil include; mining, phosphate fertilization, lime application, utilization of biosolids, compost manures, sludge, pesticides and through atmospheric depositions (Filgueiras et al., 2002).
- There is no level of exposure to most heavy metals that is known to be without harmful effects.
- High doses of copper cause anemia, liver damage, kidney dysfunction, stomach and intestinal irritation, neurological complications, hypertension and liver and kidney dysfunctions, lung cancer, pneumonia, heart problems and thyroid damage (Lenntech, 2011).
- Long-term consumption of excess zinc may also result in decreased iron stores (Hughes and Samman, 2006).
- Acute exposure to cobalt could cause reproductive and developmental effects (Kim et al., 2006).

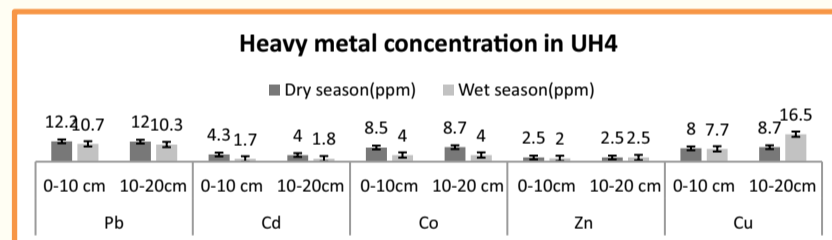


Figure 3: The mean concentration of heavy metals in soil sample in Uasin Gishu County for UH₄

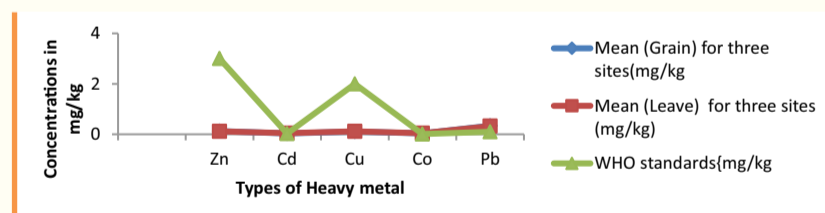


Figure 4: Mean heavy metals in maize grains and leaves in UG County and the maximum recommended concentration in food crops (FAO/WHO, 2001)

- The levels of Heavy metals Zinc (Zn), copper (Cu) and Cobalt (Co) in soil were below the permissible level of World Health Organization (WHO) and pose no risk to consumers and the environment.
- The concentrations of Cd and Pb exceeded the WHO standard in the study area, the high concentration which may pose a risk to consumers and the environment.
- The levels of Heavy metals Zinc (Zn), copper (Cu) and Cobalt (Co) in maize grains and leaves were below the permissible level of WHO and pose no risk to consumers.
- The levels of Heavy metals Zinc (Zn), copper (Cu) and Cobalt (Co) in maize grains were below the permissible level of WHO and pose no risk to consumers.
- Cadmium (Cd), Lead and Cobalt exceeded the WHO standards in both maize grains and leaves.

Recommendations for policy-makers

- The managers of agriculture i.e officers at the county (Uasin Gishu County) to constantly monitor soils in farmer's fields for a number of heavy metals to ensure the levels should not exceed WHO standards.
- Where the heavy metals are detected to exceed the levels recommended remedial measures should be taken to ensure public and ecosystem health is preserved.
- It is recommended that farmers be trained and sensitized on the how to avoid use of chemicals and inorganic fertilizers that cause contamination of Heavy metals in the soils.
- The study recommends that the County Government through the Agriculture extension promotion use of alternative pest control strategies such as application of bio-pesticides and integrated pest management (IPM) to the farmers through campaigns programs.