Journal of
Current Opinion in Crop Science
Journal homepage: www.jcocs.com; ISSN(O):2583-0392

SHORT COMMUNICATION

Evaluation of heavy metals concentrations in abandoned municipal waste dumpsites used for some arable crop production in Asaba Metropolis

Otite, F.O[1] & Uwuigbe, E.U[2]

[1]Department of Soil and Land Resource Management, Faculty of Agriculture, Dennis Osadebay University, Asaba, Nigeria.
[2]Department of Crop Science and Farm Management, Dennis Osadebay University, Asaba, Nigeria.

Edited by:

Dr M. Jeberson, PhD., Central Agricultural University, Manipur, India.

Reviewed by:
Dr A. O. Ikeh PhD., University of Agriculture and Environmental Sciences, Umuagwo, Imo State, Nigeria; Dr Omoruyi, Ambrose Ali University, Ekpoma, Nigeria.

Article history:

Received: January 27, 2026
Accepted: March 26, 2026
Published: March 31, 2026

Citation:
Otite, F.O., & Uwuigbe, E. U. (2026). Evaluation of heavy metals concentrations in abandoned municipal waste dumpsites used for some arable crop production in Asaba Metropolis. *Journal of Current Opinion in Crop Science, 7*(1), 65-68. https://doi.org/10.62773/jcocs.v7i1.386

*Corresponding author e-mail address: otitefelicity@gmail.com (Otite, F.O.)

ABSTRACT

Abandoned municipal waste dumpsites can serve as important sources of heavy metal contamination in agricultural soils. This study assessed the concentrations of selected heavy metals in soils from four abandoned municipal waste dumpsites currently used for arable crop production in Asaba Metropolis, Nigeria. Soil samples were collected at 0–20 cm depth and analyzed for copper (Cu), zinc (Zn), manganese (Mn), iron (Fe), chromium (Cr), cadmium (Cd), nickel (Ni), and lead (Pb) using atomic absorption spectrophotometry following standard procedures. Results revealed variations in heavy metal concentrations among the locations. Iron and manganese recorded the highest concentrations, while nickel occurred in relatively lower amounts. However, cadmium and lead at Location 1 exceeded recommended limits for agricultural soils. The findings indicate that prolonged waste deposition has contributed to metal accumulation in soils. Continuous monitoring and appropriate soil management strategies are necessary to prevent heavy metal transfer into crops and minimize environmental risks.

Keywords: arable crops; environmental risk; heavy metals; municipal waste; soil contamination,

INTRODUCTION

Municipal solid waste disposal remains a major environmental challenge in many urban areas, particularly in developing countries where waste management systems are often inadequate (Oladele et al., 2021, Mkhonza et al., 2026). Improper waste disposal at open dumpsites can result in the accumulation of heavy metals in surrounding soils, thereby posing potential risks to agricultural productivity and food safety Zhang et al., 2022).

Heavy metals such as cadmium (Cd), lead (Pb), chromium (Cr), nickel (Ni), and copper (Cu) are persistent environmental contaminants that can accumulate in soils and subsequently be taken up by crops. Consumption of crops grown on contaminated soils may lead to long-term health risks for humans and animals Bhardwaja et al., 2023). Abandoned dumpsites are of particular concern because leachates generated from decomposing waste can infiltrate soils and alter their physicochemical properties, thereby increasing heavy metal mobility Adeyemi et al., 2020).

This study therefore evaluated the concentrations of selected heavy metals in soils collected from abandoned municipal waste dumpsites currently used for arable crop production in Asaba Metropolis, Nigeria.

MATERIALS AND METHODS

The study was conducted in Asaba Metropolis, Delta State, Nigeria, where four abandoned municipal waste dumpsites currently used for crop production were selected and designated as Locations 1–4. Soil samples were collected from the surface layer (0–20 cm) at several points within each site and composited to obtain representative samples. The samples were air-dried, crushed, and sieved through a 2-mm mesh prior to laboratory analysis.

Soil physicochemical properties including pH, organic matter, total nitrogen, available phosphorus, and exchangeable cations (Ca, Mg, K, Na) were determined using standard procedures. Heavy metals (Cu, Zn, Mn, Fe, Cr, Cd, Ni, and Pb) were analyzed using atomic absorption spectrophotometry after acid digestion of the soil samples. Data obtained were summarized using descriptive statistics and compared with recommended permissible limits for agricultural soils.

RESULTS AND DISCUSSION

Soil physicochemical properties varied across the study locations. Soil pH ranged from 6.3 to 6.8, indicating slightly acidic to near-neutral conditions suitable for crop growth. Organic matter content was relatively high, particularly at Location 1 (35.60%), reflecting the influence of decomposed municipal waste materials. Total nitrogen ranged from 1.53–3.14%, while available phosphorus ranged from 22.0 to 57.12 mg/kg. Exchangeable cations and cation exchange capacity values suggested moderate to high soil fertility across the sites Table 1.

Heavy metal concentrations showed considerable variation among the locations Table 2. Iron and manganese recorded the highest concentrations across the sites, which may largely reflect natural soil mineral composition. In contrast, cadmium and lead concentrations were notably elevated at Location 1, exceeding recommended limits for agricultural soils reported by the Food and Agriculture Organization. The elevated levels of these metals are likely associated with prolonged accumulation of municipal waste materials and leachates Abba et al., 2025, Wanga et al., 2022).

Higher concentrations of chromium and zinc observed in Location 2 may be linked to localized waste inputs or anthropogenic activities (Smith et al., 2021). The relatively lower concentrations of most metals in Locations 3 and 4 suggest reduced contamination levels compared with Location 1. Soil properties such as slightly acidic pH and high organic matter content may have enhanced metal mobility and availability in some locations (Kumar et al., 2020), increasing the likelihood of plant uptake. Continuous cultivation on such contaminated soils may therefore facilitate heavy metal transfer into crops and ultimately into the food chain (Abdullahi et al., 2021, Kumar et al., 2025).

Table 1. Some chemical properties of waste samples collected from four locations of the study areas.

Soil variables	Locations			
	1	2	3	4
Soil pH	6.3	6.5	6.3	6.8
O.M (%)	35.60	28.40	31.60	20.30

Total N (%)	3.14	2.25	1.86	1.53
Avail P (mg/kg^{-1})	57.12	38.45	22.00	25.30
Exchangeable Cations (cmol\kg^{-1})				
Ca	5.38	5.25	6.10	8.30
Mg	2.35	3.18	3. 20	5.10
K	0.35	0.47	0.31	0.32
Na	0.02	0.04	0.16	0.16
CEC (cmol\kg^{-1})	23.00	10.35	18.30	20.10
%BS	75.30	62.80	73.10	68.70

Table 2. Heavy Metal Concentrations (Mean ± SD, mg/kg)

Metals	Location 1	Location 2	Location 3	Location 4
Cu	6.30 ± 0.58	3.23 ± 0.01	2.78 ± 0.83	1.83 ± 0.28
Zn	14.28 ± 0.59	4.73 ± 1.52	4.93 ± 1.38	3.23 ± 0.65
Mn	12.25 ± 0.14	21.39 ± 3.48	33.80 ± 4.91	47.89 ± 15.83
Fe	16.50 ± 1.67	32.74 ± 4.37	59.54 ± 9.10	65.74 ± 5.40
Cr	3.33 ± 1.04	6.74 ± 2.08	4.58 ± 1.87	0.92 ± 0.09
Cd	5.44 ± 1.08	2.53 ± 0.59	1.32 ± 0.27	0.69 ± 0.38
Ni	4.73 ± 0.24	1.18 ± 0.53	0.52 ± 0.21	1.01 ± 0.14
Pb	17.53 ± 1.29	3.83 ± 1.43	0.87 ± 0.06	1.95 ± 0.35

CONCLUSION

The study revealed varying levels of heavy metal contamination in abandoned dumpsite soils in Asaba Metropolis. Cadmium and lead concentrations at Location 1 exceeded recommended agricultural limits, indicating potential risks for crop production and food safety. Continuous monitoring and appropriate soil management practices are therefore required to minimize heavy metal accumulation and ensure safe agricultural use of such soils.

ACKNOWLEDGEMENT

Not applicable

AUTHOR CONTRIBUTIONS

All the authors contributed equally to this research work

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

There are no funders involved in this study.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not Applicable

CONSENT FOR PUBLICATION

Not Applicable

AVAILABILITY OF DATA AND MATERIALS

There is no data used for this review study.

REFERENCES

Abdullahi, N., Igwe, E. C., Dandago, M. A., & Umar, N. B. (2021). Heavy metals in food crops: Sources and roles of urban agriculture in facilitating their consumption. *FUDMA Journal of Sciences. 5(2), 520–532.*

Abbas, M. T., Wadaan, M. A., Ullah, H., Farooq, M., Fozia, F., Ahmad, I., Khan, M. F., Baabbad, A., & Ullah, Z. (2025). Bioaccumulation and mobility of heavy metals in soil-plant systems and health risk assessment of vegetables irrigated by wastewater. *Sustainability, 15*(21),15321. https://doi.org/10.3390/su152115321

Adeyemi, O., & Ojo, A. (2020). Heavy metal accumulation in urban soils and crops: Environmental implications. *Environmental Monitoring and Assessment. 192, 345.*

Bhardwaj, P., Sharma, R. K., Chauhan, A., Ranjan, A., Rajput, V. D., Minkina, T., & Wadhwa, S. (2023). Assessment of heavy metal distribution and health risk of vegetable crops grown on soils amended with municipal solid waste compost. *Water, 15*(2), 228. https://doi.org/10.3390/w15020228

Kumah, J., Fosu-Mensah, B. Y., Ofori, B. D., Kwawu, M. A. S., & Gordon, C. (2025). Influence of urban land surface temperature on heavy metal accumulation in cabbage and lettuce across the Greater Accra Metropolitan Area. *Resources, 15(1), 1. https://doi.org/10.3390/resources15010001*

Kumar, R., Singh, S., & Sharma, P. (2020). Heavy metals in soil and crops from urban dumpsites: Human health risk assessment. *Science of the Total Environment,722,*137781.

Mkhonza, N. P., Zondo, S., & Vilakazi, S. (2026). Toxic heavy metals distribution in urban soils of Africa: A systematic review. *Environmental Monitoring and Assessment. 198,* 205. https://doi.org/10.1007/s10661-026-15030-9

Oladele, O. I., Akinola, M., & Bakare, O. (2021). Assessment of soil heavy metals in abandoned municipal waste sites: *Implications for crop production. Environmental Challenges. 3,* 100050.

Smith, J., Brown, K., & Patel, R. (2021). Heavy metal contamination in urban agricultural soils: Sources, mobility, and mitigation. *Environmental Science & Policy.124, 49–60.*

Wang, S., Han, Z., Wang, J., He, X., Zhou, Z., & Hu, X. (2022). Environmental risk assessment and factors influencing heavy metal concentrations in municipal solid waste landfills. *Waste Management. 139,* 330–340. https://doi.org/10.1016/j.wasman.2021.11.036b

Zhang, Y., Li, H., & Wang, X. (2022). Heavy metal pollution in soils from abandoned urban landfills. *Journal of Environmental Management, 320,* 115798.