

Cadmium in Potato Crops: Differences Among Varieties

Eva Smolnikar, Peter Dolničar, Kristina Ugrinović

Kmetijski inštitut Slovenije, Hacquetova ulica 17, 1000 Ljubljana, e-mail: eva.smolnikar@kis.si

Introduction

Cadmium (Cd) is one of the most ecotoxic metals and is classified as a carcinogen [1]. Cd enters the food chain through contaminated soil and water and accumulates in plants and aquatic organisms [2]. European Commission Regulation 2023/915 sets the maximum Cd level in fresh peeled potatoes at 0.1 mg/kg FM [3]. Potatoes are considered an important dietary source of Cd, and previous studies have reported substantial varietal differences in Cd accumulation in potato tubers [4].

AIM: To evaluate Cd concentration in potato tubers of different varieties grown under identical field conditions, we analysed 19 varieties.

Materials and methods

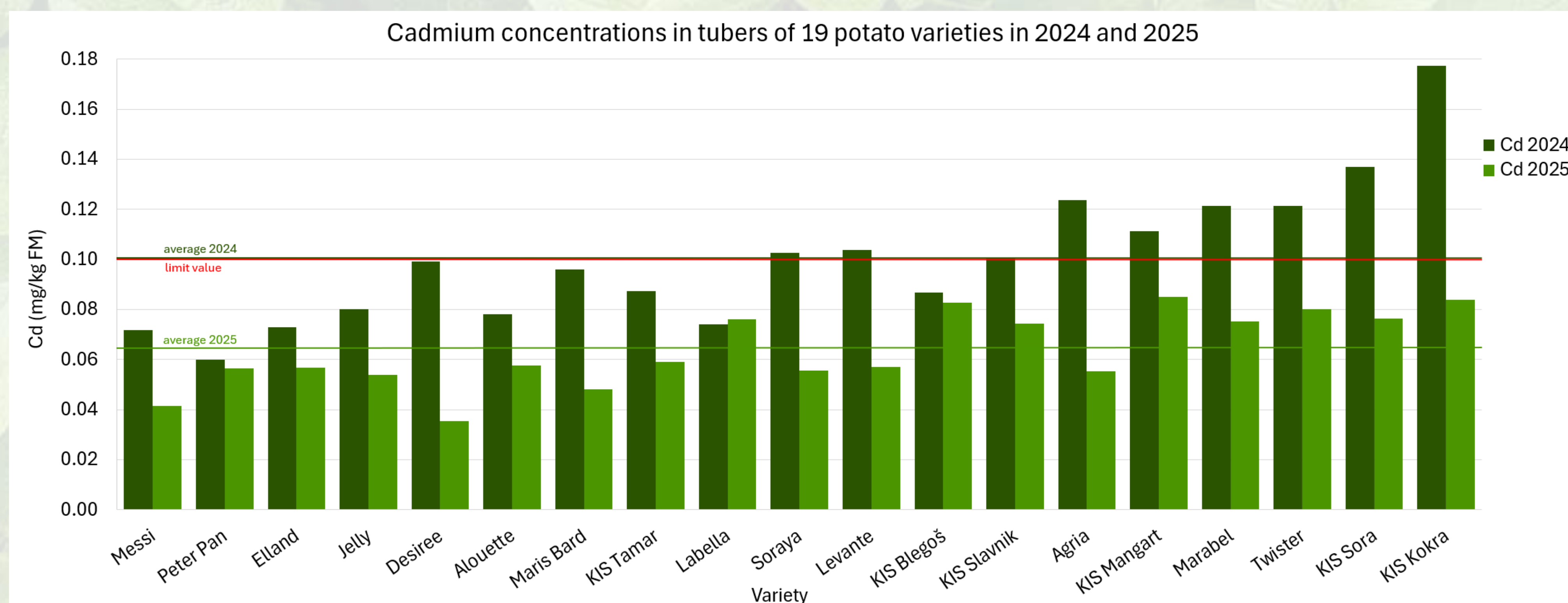
LOCATION: Experimental fields of the Agricultural Institute of Slovenia (IC Komenda). Soil characteristics (March 2024): pH 5.8 in KCl, 3.7 % organic matter, 13 mg P₂O₅/100 g available phosphorus, and 21 mg K₂O/100 g available potassium.

EXPERIMENTAL DESIGN: Potato variety trial in 2024 and 2025, including 19 potato varieties grown in the same field under identical agronomic conditions. Representative tuber sample (1 kg) per variety was collected from merged marketable yields of three replications.

CONDUCTING OF EXPERIMENT: Planting was carried out at the end of April and harvesting at the end of October in both years. Potatoes from the 2024 harvest were sampled in mid-March 2025, while potatoes from the 2025 harvest were sampled in mid-February 2026, after the storage. Tubers were peeled prior to analysis.

CHEMICAL ANALYSIS: Homogenised potato tubers (0.250 g) were digested in a high-pressure microwave oven (Milestone ETHOS 1600) using 5 ml 65 % HNO₃ and 1 ml 30 % H₂O₂ (SUPRAPUR, Merck). Cd concentrations were determined by ICP-MS (Agilent 7900) in helium collision mode to minimize analytical interferences.

Results



Conclusions

- Cd concentration in potato tubers is strongly influenced by varietal differences, even under identical agronomic conditions.
- KIS Kokra consistently showed the highest Cd concentrations and may be considered a high-risk variety for Cd accumulation.
- Varieties Messi, Peter Pan, Elland and Jelly exhibited lower Cd concentrations and may be more suitable for reducing Cd intake.
- Environmental conditions, in addition to genetic factors, significantly affect Cd uptake.
- Cd concentrations were consistently lower in 2025 compared to 2024 across all varieties.
- Year-to-year variability, likely related to soil and climatic conditions, plays an important role in Cd accumulation.
- Selecting low-Cd-accumulating potato varieties is an effective strategy to reduce Cd entry into the food chain, especially in regions with elevated soil Cd levels.

References

- [1] IARC. (2025). List of Classifications Agents classified by the IARC Monographs, Volumes 1–137. Available from: <https://monographs.iarc.who.int/list-of-classifications>
- [2] NIJZ. (2023). Kadmij v živilih. Available from: <https://nijz.si/moje-okolje/varnost-zivil/kadmij-v-zivilih/>
- [3] EC (2023). Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006. OJ EU L 119/103, 2023.
- [4] IARC. (2025). List of Classifications Agents classified by the IARC Monographs, Volumes 1–137. Available from: <https://monographs.iarc.who.int/list-of-classifications>
- [4] Brengi S. H., El-Gindy A.-G. M., El-Sharkawy I., Abouelsaad I. A. (2021). Variation in Cadmium Accumulation among Potato Cultivars Grown on Different Agricultural Sites: A Potential Tool for Reducing Cadmium in Tubers. Horticulturae, 7: 377. Available from: <https://doi.org/10.3390/horticulturae7100377>