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Influence of cultivar on macro- and micronutrient composition, potential toxic elements accumulation and their interrelationships in leaves and fruits of European plum (*Prunus domestica* L.)

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ABSTRACT

This study examined 13 European plum (*Prunus domestica* L.) cultivars developed at the Fruit Research Institute, Čačak, to assess genotypic variability in nutrient content, potential toxic elements accumulation and nutritional balance in fruits and leaves, over a three-year period. Significant differences were observed among cultivars, years and their interactions for all examined parameters. Cultivars such as 'Valjevka' and 'Čačanska Najbolja' demonstrated higher nutrient uptake capacities, whereas 'Krina' and 'Mildora', showed lower mineral accumulation and greater imbalance. Micronutrient deficiencies, particularly for Mn, Zn and Fe were noted in both leaves and fruits. All potential toxic elements concentrations remained within acceptable limits, with notable genotypic variations. Nutritional balance, assessed via DOP and ΣDOP indices, revealed that 'Čačanska Rodna' and 'Pozna Plava' maintained more stable nutrient profiles. Correlation analysis indicated complex interrelationships among nutrients in both leaves and fruits, including synergistic and antagonistic interactions. Principal component analysis highlighted distinct genotype-driven nutrient accumulation patterns, clustering cultivars by mineral composition and nutritional status. These findings emphasize the role of genotype in managing nutrient uptake efficiency, limiting the accumulation of undesirable elements and improving fruit quality. The results may support future breeding strategies and site-specific cultivar selection to improve nutritional quality and promote sustainable plum production.

1. Introduction

Plums rank as the second most widely cultivated stone fruit globally, following peaches and nectarines. According to FAOSTAT (2025), global plum production increased steadily from 8.4 million tons in 2000–10.7 million tons in 2010, reaching 12.5 million tons in 2023. There are between 19 and 40 recognized species of plums originating from Europe, Asia and North America, with the most commercially significant species being hexaploid *Prunus domestica* L. (European or domestic plum) and diploid *P. salicina* L. (Asian or Japanese plum) (Milošević and Milošević 2018). These two species exhibit notable differences in terms of tree growth habits, pomological characteristics, nutritional and mineral content and specific climatic and soil preferences. As a temperate deciduous fruit species, the European plum is especially important in Europe with Serbia, alongside Romania, ranking among the top producers of European plums worldwide (FAOSTAT, 2025).

The European plum is widely recognized not only for its economic

Abbreviations: N_{leaf}, nitrogen in leaf; N_{fruit}, nitrogen in fruit; P_{leaf}, phosphorus in leaf; P_{fruit}, phosphorus in fruit; K_{leaf}, potassium in leaf; K_{fruit}, potassium in fruit; Ca_{leaf}, calcium in leaf; Ca_{fruit}, calcium in fruit; Mg_{leaf}, magnesium in leaf; Mg_{fruit}, magnesium in fruit; Fe_{leaf}, iron in leaf; Fe_{fruit}, iron in fruit; Mn_{leaf}, manganese in leaf; Mn_{fruit}, manganese in fruit; Cu_{leaf}, copper in leaf; Cu_{fruit}, copper in fruit; Zn_{leaf}, zinc in leaf; Zn_{fruit}, zinc in fruit; B_{leaf}, boron in leaf; B_{fruit}, boron in fruit; DOP, deviation from optimum percentage; ΣDOP_{macro}, ΣDOP index for macroelements; ΣDOP_{micro}, ΣDOP index for microelements; DAFB, days after full bloom; PCA, principal component analysis; PTEs, potential toxic elements.

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