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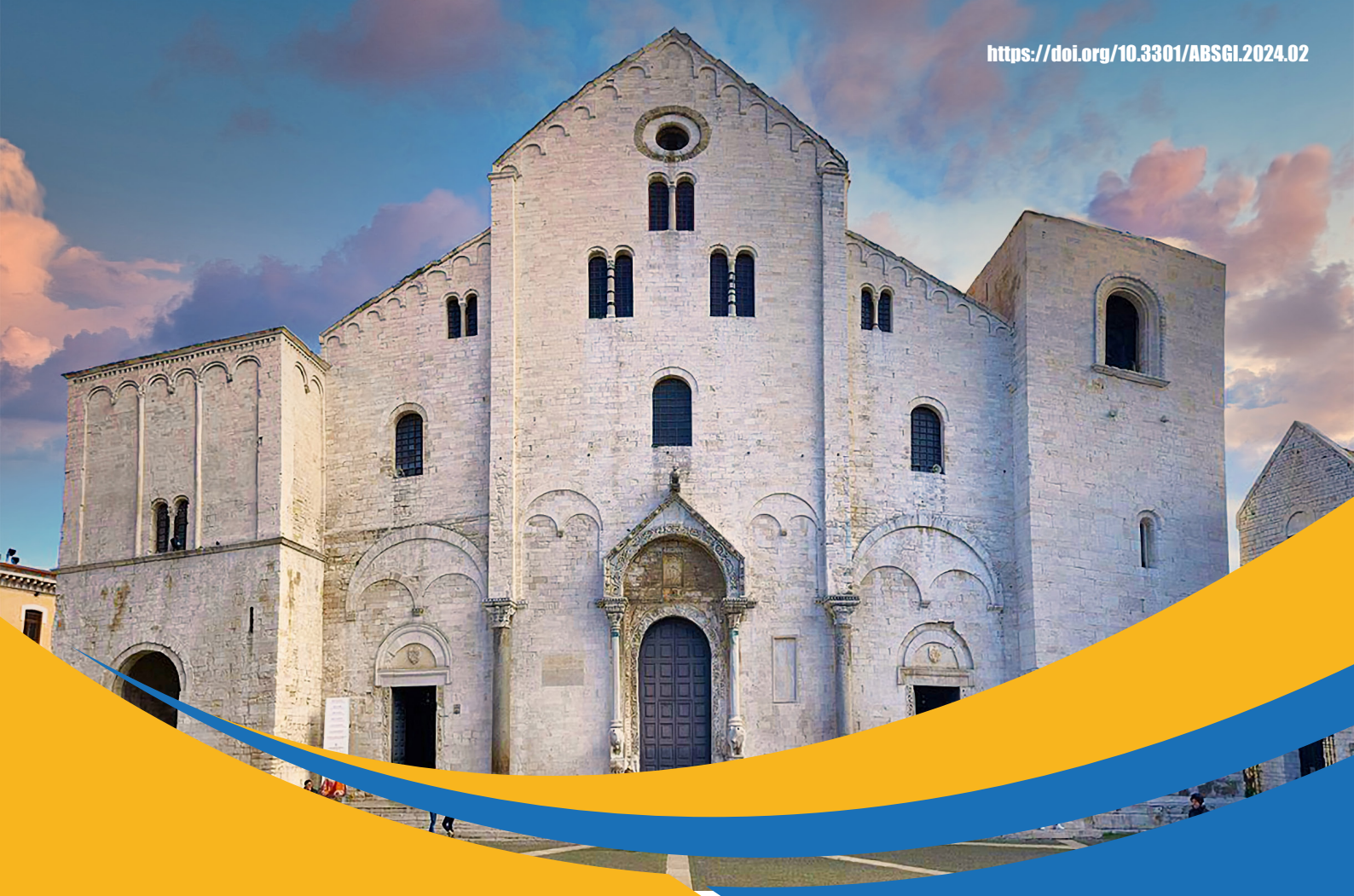

Bari, 2-5 September 2024

ABSTRACT BOOK

a cura della Società Geologica Italiana

BARI 2024

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Multiparameter markers of territoriality: geochemical-isotopic and fluorometric analysis for asparagus characterization

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The coastal environment of the Eastern area of the Emilia-Romagna Region is characterized by sandy soils, typically dry and exposed to salinization phenomena. These challenging conditions, usually critical for plant life, are worsening due to climate change, making it a priority to strengthen territorial resilience by characterizing and enhancing local crops that ensure a better response to saline and drought stress. The "Asparagus of Altedo PGI" demonstrates remarkable adaptability to the local soils making it a cornerstone product of this region, important for both economic valorization and territorial uniqueness and heritage. Sandy-based terrains offer ideal conditions for the emergence of asparagus turions; however, notable variations spanning from sandy-clayey loam soils to lean sandy soils delineate a gradient from inland to coast.

By conducting the multi-parametric analyses of the soil-plant system, we unveil the intrinsic connection between agricultural products and their native terroir. Leveraging geochemical-isotopic techniques alongside advanced plant phenotyping methods it is possible to discern opportunities to detect potential asparagus diversification driven by soil and environmental characteristics.

Soil samples were subjected to XRF analysis for major elements; soil and plant samples underwent ICP-MS-QQQ compositional analysis down to ultra-trace elements and EA-IRMS analysis (Marrocchino et al., 2023). The stable isotopes of light elements present in crops, such as carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$), offer a unique form of 'isotopic signature' reflective of both the geochemical conditions of the soil (D'Archivio et al., 2014) and the metabolic specificity of the plants, including processes such as photosynthesis and nitrogen assimilation. PCA analysis revealed a remarkable differentiation of soils based on geochemical factors achieving resolution even at scales of just a few tens of kilometres. Notably, the abundance of Na2O effectively delineated the coastal fields from the inland ones, while soil samples from the close-to-town Malborghetto field exhibited distinctiveness through elevated concentrations of specific heavy metals (Cr, Ni, Pb), setting them apart from their counterparts. In addition, the turions were subjected to fluorometric analysis by fast chlorophyll *a* fluorescence induction (OJIP) (Ferroni et al., 2022), a non-destructive near-instantaneous method for physiological plant assessment. An interesting correlation emerged between soil diversity and chlorophyll fluorometric parameters. Despite the uniformly excellent photosynthetic functionality of the plants observed across all fields, it was possible to distinguish the asparagus samples based on their geographical origin.

Work is still in progress to achieve a comprehensive understanding of the seamless continuity between soil and plant dynamics in correlation with the environmental attributes of the surveyed fields.

D'Archivio A. et al. (2014) - Analysis of the mineral composition of Italian saffron by ICP-MS and classification of geographical origin. Food Chem., 157, 485-489.

Ferroni L. et al. (2022) - Fast chlorophyll *a* fluorescence induction (OJIP) phenotyping of chlorophyll-deficient wheat suggests that an enlarged acceptor pool size of Photosystem I helps compensate for a deregulated photosynthetic electron flow. J. Photochem. Photobiol. B Biology, 234, 112549.

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