



From Winery Waste to Bioactive Resources: Circular Economy Valorisation of Grape Pomace from Transylvanian Vineyards (Romania)



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ABSTRACT & FOCUS

Winery sub-products, particularly grape pomace (*Vitis vinifera* L.), represent an elite environmental and industrial challenge. This study maps the valorisation potential of both white and red Transylvanian grape cultivars wine pomace, identifying highly concentrated reservoirs of bioactive phenolics and essential fatty acids for potential pharmaceutical and nutraceutical applications.

Introduction & Objectives

The Transylvanian wine region produces massive amounts of solid organic waste (grape pomace, GP) annually. Rather than being discarded, this research analyzes this waste stream as a sustainable source of high-value compounds, supporting the transitioning of local wineries to circular economy principles.



Fig. 1 Grape Pomace (GP)

Key Research Goals:

- ✓ Phytochemical screening of White and Red cultivars.
- ✓ Identification and quantification of phenolics & antioxidant activity.
- ✓ GPs profiling for high-value fatty acids.

Materials & Methodology

Fresh GP was sourced directly from representative Transylvanian vineyards post-vinification.

1. Optimized Solid-Liquid Extraction

Hydroethanolic extraction optimized for polar antioxidant phenolics.

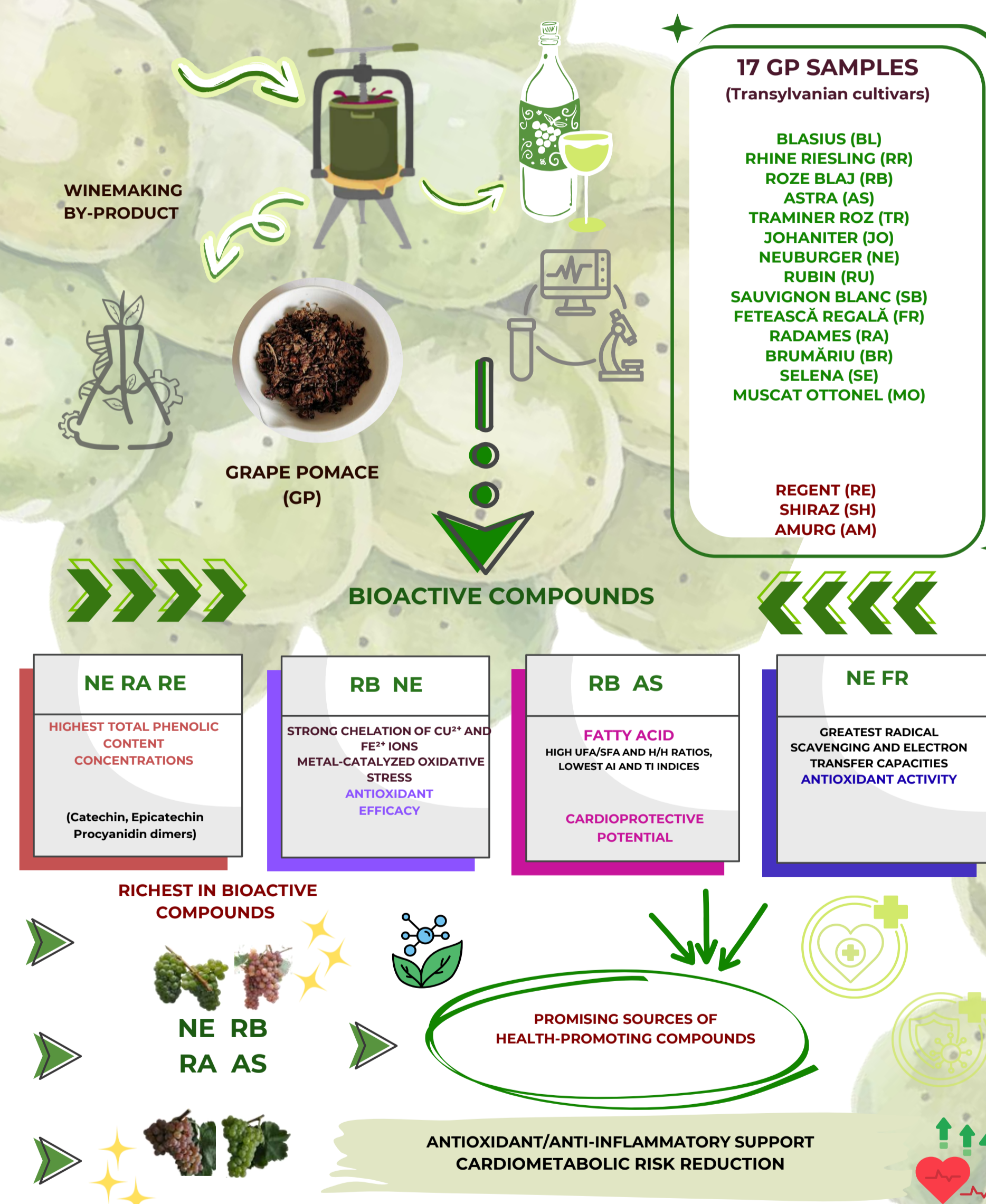
2. HPLC-DAD-MS & GC-FID Screening

Identification of phenolic acids, flavonoids, and fatty acids.

3. DPPH, ABTS, CUPRAC, FRAP, Reducing Power and Ferrous (Fe²⁺) and Cupric (Cu²⁺) Chelation assays.

Poli-metric verification of antioxidant capacity.

Bioactive profiles and health benefits of the most promising studied grape pomaces



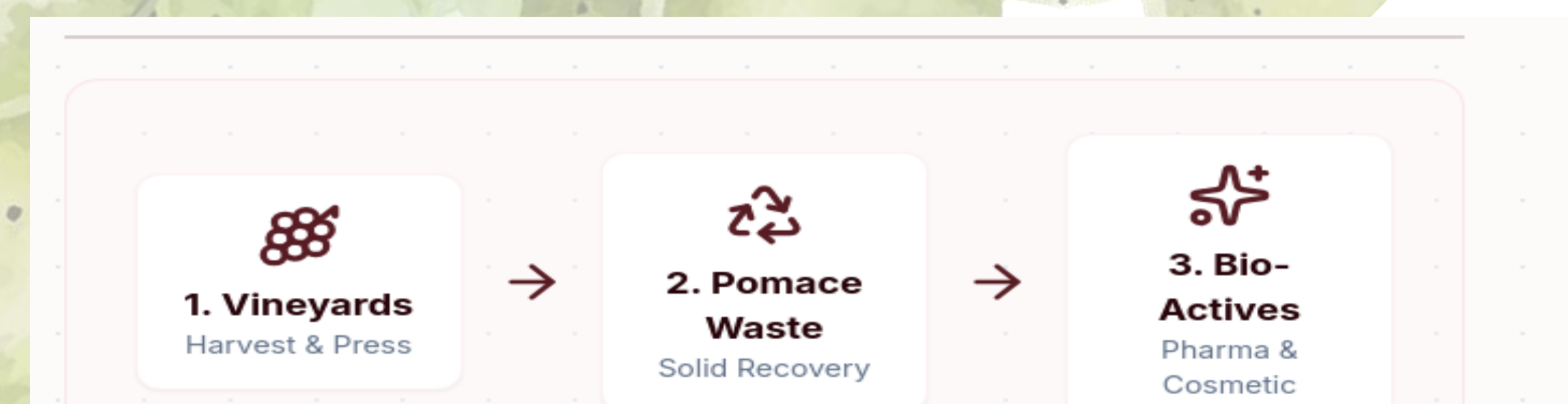
Results

- Neuburger (NE), Radames (RA), and Regent (RE) cultivars showed the highest levels, of catechin, epicatechin, and procyanidin dimers.
- NE and Fetească Regală (FR) demonstrated the greatest radical scavenging and electron transfer capacities.
- Fatty acid analysis revealed that Roze Blaj (RB) and Astra (AS) contained the most favorable nutritional profiles, including high unsaturated-to-saturated fatty acid (UFA/SFA) and hypocholesterolemic to hypercholesterolemic fatty acid (H/H) ratios, as well as low atherogenicity (AI) and thrombogenicity indices (TI), indicating cardioprotective potential.
- RB and NE also exhibited strong chelation of Cu²⁺ and Fe²⁺ ions, enhancing their antioxidant efficacy by mitigating metal-catalyzed oxidative stress.

Conclusions

- Transylvanian grape pomace, particularly from NE, RB, RA, and AS cultivars, the last three being homologated in Transylvania at SCDVV Blaj, is a highly potent, sustainable source of health-promoting bioactive molecules.
- Integration of all cultivars' GP maximizes waste stream economics throughout the harvest season.

Grape pomace's circular loop



ACKNOWLEDGEMENTS

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