

Soil Health – fitness tracking for vineyards?



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Introduction

Soil health is one of the important factors determining productivity and resilience of vineyards for a sustainable management. A healthy vineyard soil supports a range of soil functional processes (e.g. water availability, nutrient cycling and mineralization, drainage, stability) allowing for uniform vine growth, support pathogen suppression and facilitate vineyard management. Vineyard management practices and production systems influence soil properties and thereby affect soil microbial communities. Nevertheless, the impact of the management system on soil functions and especially on the soil microbial community is not well understood. Hydrolytic enzymes, mainly those involved in key reactions in the carbon, nitrogen, phosphorus, and sulfur cycles, are commonly used as biological indicators and could be markers for soil “fitness”.

Objectives

- Vineyard management dependent effects on soil enzyme activity
- Determine seasonal effects

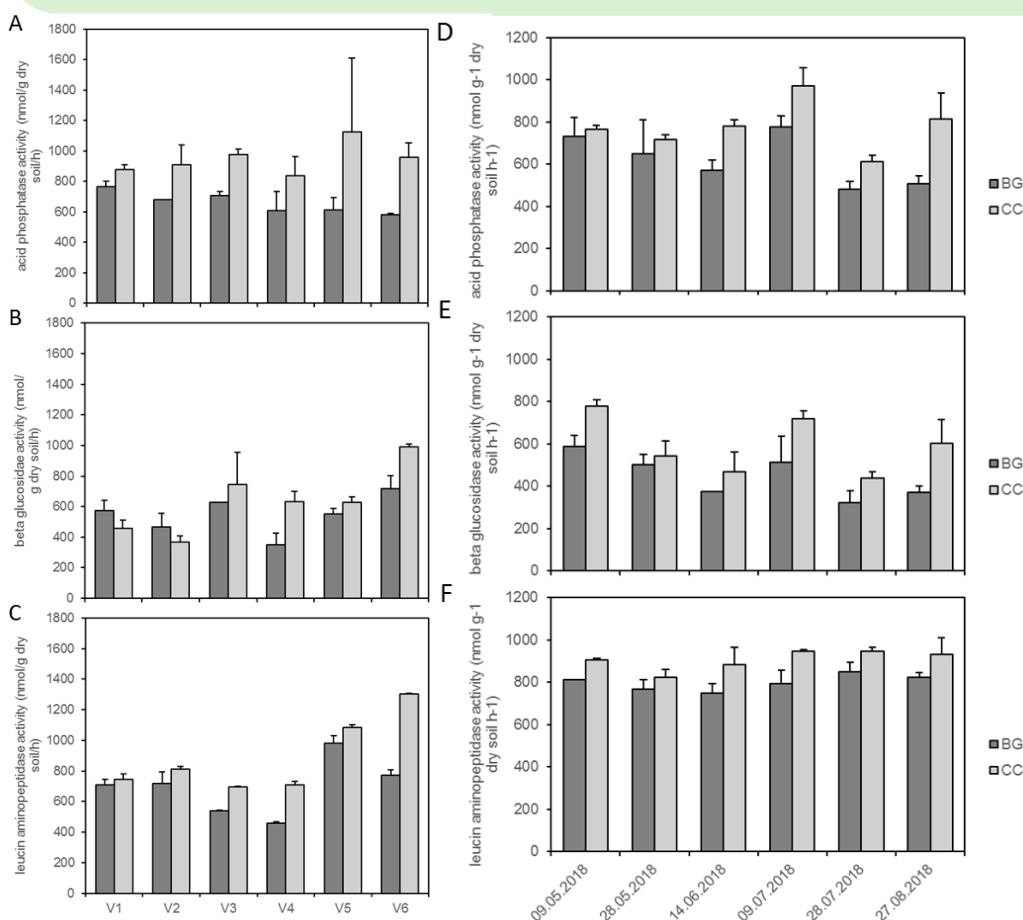


Figure 1: Hydrolytic soil enzyme activity. (A) acid phosphatase, (B) beta glucosidase, (C) leucin aminopeptidase in 6 vineyards 2017, (D) acid phosphatase, (E) beta glucosidase, (F) leucin aminopeptidase in vineyard 1 in 2018

Key results

- ❖ Vineyards differed in their enzymatic activity, especially b-glucosidase and leucine aminopeptidase showed differences
- ❖ Acid phosphatase very similar between vineyards
- ❖ Strong tendency of higher enzyme activity in soils with permanent vegetation cover
- ❖ Acid phosphatase and b-glucosidase shows strong seasonal effects – influencing factors will need to be determined

Conclusions

- ❖ Hydrolytic soil enzymes show differences between vineyards and vineyard management.
- ❖ Seasonal effects need to be considered for some enzyme activity
- ❖ Hydrolytic soil enzymes could be used as system to analyse microbial activity in soil, but standardization is needed for comparison

Materials and Methods

Soil samples were collected in June 2017 in the frame of the BiodivERsA/FACCE-JPI joint project “PromESSinG” in nine Austrian vineyards in Lower Austria (Krems, Langenlois) and Burgenland (Großhönlein, Eisenstadt) three different practices for inter-row management: open bare soil, alternate soil cover, permanent soil cover. Fluorometric enzyme activity assays were performed of soil samples 0-10cm with 4-methylumbelliferone (MUB) and 7-amino-4-methylcoumarin (MUC)-linked substrates (based on modified protocol from Shawna McMahon and Meg Steinweg). Three enzymes were selected to be analysed: b-glucosidase, phosphatase and leucine aminopeptidase. Enzyme activities were expressed as MUB/MUC release in nmol per g dry soil per hour (nmol g⁻¹ h⁻¹).

