

Soil microbial communities in vineyards as affected by cover crop management



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Introduction

Soil microbial communities contribute to soil quality and soil health and fulfill a multitude of functions, as there are: cycling and stability of soil organic matter, pathogen suppression, mineralization and aggregate stability among others. These communities are strongly influenced by vineyard management practices by manipulating soil characteristics as water availability, temperature, soil structure and the amount of organic matter in lower soil levels. General conclusions are hard to draw as many factors are influencing environmental conditions for microbial growth in soil and near roots. To broaden our knowledge on the different levels of interaction is essential to evaluate existing techniques and to develop new application to improve and strengthen soil health and use the positive effects for plant growth and resilience.

Objectives

- Establish an relationship between vegetation cover crop management and soil microbial communities
- Identify the drivers of soil microbial diversity

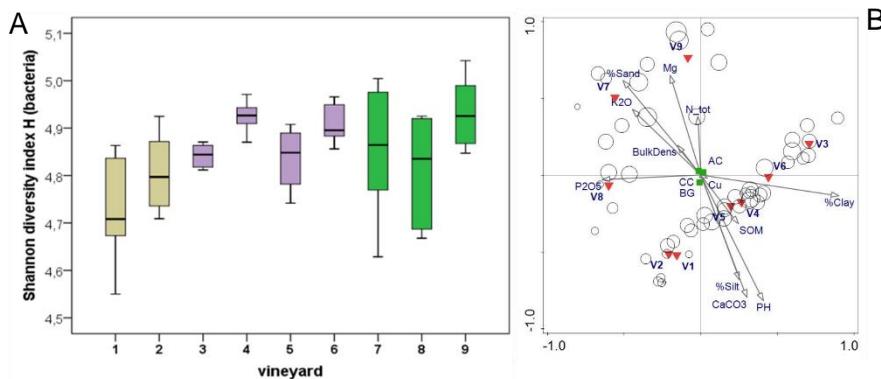


Fig.1: (A) Shannon diversity index for bacterial communities determined in nine vineyards, (B) unconstrained PCA analyses performed with Canoco 5 to determine influencing environmental factors on bacterial Shannon diversity index.

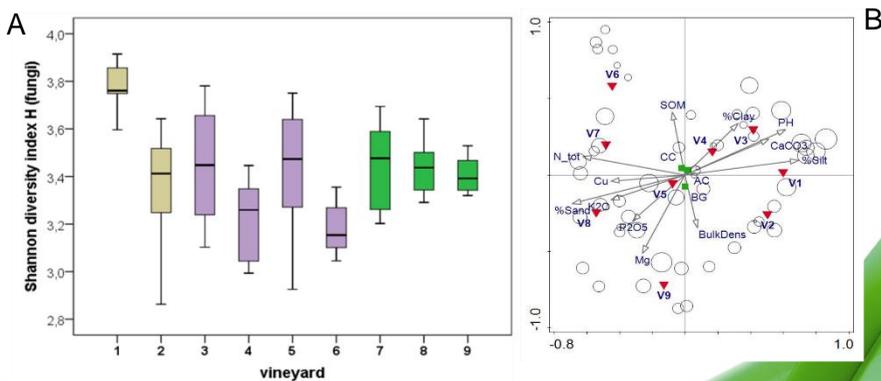


Fig.2: (A) Shannon diversity index for fungal communities determined in nine vineyards, (B) unconstrained PCA analyses performed with Canoco 5 to determine influencing environmental factors on fungal Shannon diversity index.

Key results

- ❖ Shannon diversity index was higher for bacterial (4,5-5,0) as for fungal communities (2,8-3,9)
- ❖ Organic management vineyards (v7-9) had slightly higher bacterial (but not fungal) diversity as in conventional managed vineyards of the same region (v1-2)
- ❖ Bacterial and fungal communities differed in their importance between vineyards (e.g. v1 – below average bacterial diversity but much higher fungal diversity)
- ❖ Vegetation cover management had effects on both bacteria and fungi (Fig.1B, 2B)
- ❖ Main driving factors for diversity were soil texture (% sand, % clay, % silt), Mg content, soil organic matter and bulk density. The total nitrogen content was more important for fungal than for bacterial communities

Materials and Methods

Soil samples were collected in June 2016 in the frame of the BiodivERsA/FACCE-JPI joint project "PromESSinG" in nine Austrian vineyards in Lower Austria (Krems, Langenlois) and Burgenland (Großhöflein, Eisenstadt) three different practices for inter-row management: open bare soil, alternate soil cover, permanent soil cover. Soil samples were collected from all treatments and vineyards in duplicates, whereas each sample represents a pool of 10 core borer (0-10cm) samples. Basal soil respiration was determined at the University of Fribourg from 3.5g water-saturated soil during 20 hours at 22° C with an automated electrolytic micro-respirometer (Scheu 1992).

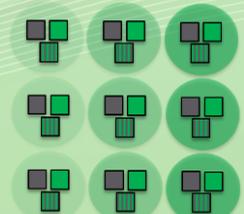


Fig.2: Experimental setup, 9 vineyards, each with 3 inter-row management