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CAN INTENSIVE CULTURES E.G. VITICULTURE CAPTURE CO_2 WHILE MAINTAINING A HIGH SOIL QUALITY

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Introduction: Soil tillage moves more and more in the focus of agriculturists as well as environmentalists. Background is that tillage in viticulture heavily affects soil quality. Loss of soil organic matter resulting from extensive and/or wrong tillage systems as well as erosion reduces the fitness of soils and their productivity. There arises a need to assess soil quality in the course of development of sustainable viticultural systems. Despite the possible inputs of mineral fertilizers and pesticides, the basic and unique of interest in sustainable soil systems is its capability to cycle nutrients, C and if possible capture CO_2 intrinsic for those systems.
Aims: The objective of this study was to determine whether tillage practices (no-till, permanent grass sod, natural vegetation, extensive tilling) affected soil carbon content, its nutrient levels and five different soil enzyme activities as indicators for soil quality. A special focus is laid on the effects in the alley and the row in the vineyard.
Materials and Methods: A long-time tillage trial was chosen for the investigation: 7 years establishment of the vineyard without any treatment in order to have a stable viticultural system as starting point; then during 20 years 5 different tillage systems [normal tillage: plough and rotary tiller; permanent grass sod and mulching, natural vegetation; extensive and intensive tilling]. At the end of the test period all plots were analyzed for C, N, P, K, Mg, Fe, Zn, Mn, and Cu and five enzymes: Neutral and alkaline phosphatase, α-glucosidase and β-glucosidase and urease.
Results: Treatments favouring growth of grasses or natural vegetation show in the soil profile a distinct zoning for all chemical soil parameters; it is very pronounced for pH, C and N. Soil is reduced in grassed plots whereas C and N are enriched. Permanent grass and natural vegetation store appreciable amounts of C culminating at least in of additional 3.2 t CO_2/ha and year in comparison to the control plots.
Soil enzymatic activity is highest in grass sod followed by natural vegetation. Phosphatase activities are also higher in deeper soil layers. Lowest activities for all enzymes were found in the control and “intensive shallow tillage” plots. Significant differences exist between alley and row for all tested enzymes. Nutrients exert a distinct stratification according to soil depths. Soil enzyme activities are strongly determined by C and N content of soils. Microelements, esp. Cu inhibit soil enzyme activity.
Conclusion: The present work demonstrates very well that tillage systems exert a concise influence on nutrient mobility and soils’ enzyme activity as well as on the storage capabilities for carbon. Microelements (Cu) are strong inhibitors of enzyme and may have on the long run a negative impact on soil quality and fertility.