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High copper content in vineyard soils promotes modifications in photosynthetic parameters and morphological changes in the root system of 'Red Niagara' plantlets

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1 **High copper content in vineyard soils promotes modifications in photosynthetic**
2 **parameters and morphological changes in the root system of ‘Red Niagara’**
3 **plantlets**

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23 **Abstract** – High copper (Cu) soil contents, due to the continuous vineyard application
24 of Cu fungicides throughout the years, may impair the growth of the shoot and modify
25 the structure of the root system. The current study aimed to investigate the threshold
26 levels of available Cu in the soil causing toxicity effects in young grapevine plants of
27 ‘Red Niagara’ cultivated in clay soils. Grapevine plantlets were cultivated in pots
28 containing vineyard devoted soils with increasing contents of available Cu (25, 80, 100
29 and 165 mg kg⁻¹), for 53 days. Photosynthesis and transpiration rates, and the quantum
30 yield of photosystem II (Fv/Fm) were evaluated during the cultivation period. At the
31 end of the experiment, the plant nutrient and leaf chlorophyll were determined, along
32 with the anatomical analysis of the root system structure and plant dry matter
33 determination. Higher levels of available Cu in the soil increased the apoplastic,
34 symplastic and total fraction of the metal in the roots, reducing the other nutrients,
35 especially in the shoots. Photosynthesis, transpiration rates and Fv/Fm were also
36 reduced. Higher levels of Cu led to anatomical changes in the roots, that increased

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