

The potential impact of long-term copper fungicide usage on soil microbial biomass and microbial activity in an avocado orchard

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Abstract

The impact of copper-based fungicides on soil microbial function in an avocado orchard was assessed. Copper (Cu) residues (280 and 340 mg/kg, respectively) in surface soils (0-2 cm) of an established avocado orchard were shown to be significantly ($n = 6$, $P \leq 0.05$) greater than a nearby reference site under natural vegetation (13 mg/kg). The bioavailable fraction of Cu in these soils was also shown to be significantly greater (2.15 and 1.29 mg/kg, *c. pCu²⁺* 8.64) than in the reference site (0.71 mg/kg, *c. pCu²⁺* 9.2), as measured by ion-selective electrode in CaCl₂ extraction. Similar trends were observed for the 2-10 cm soil profile. Data suggest that the Cu residues are responsible for significant reductions in biomass carbon (C_{mic}) even though the orchard soils had similar or elevated levels of total organic carbon (C_{org}). The $C_{mic} : C_{org}$ ratio was significantly lower in all of the Cu contaminated soils, and a significant correlation was observed between CaCl₂-extractable Cu in the surface soils and C_{mic} ($n = 16$, $r^2 = 0.68$, $P < 0.01$). Soil respiration in surface soils from the orchard were elevated (6.04 and 5.57 mg CO₂-C/kg.day) compared with the reference soil (3.04 mg CO₂-C/kg.day), and the metabolic quotient (qCO_2) was also significantly greater.

Keywords: microbial biomass, 'free Cu ion activity', qCO_2 .

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