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Temperature change affects C mineralization and P availability in tropical soil of Madagascar

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Climate change affects sustainability of agricultural ecosystems by influencing nutrient availability and soil carbon dynamic in tropical soil. Mesocosm experiment was carried out in order to assess the influence of temperature changes on soil C mineralization and P bioavailability in Madagascar. Ferralsol from two land uses: agroforestry system and conventional system such as “slash and burn” were incubated during 15 days, under two different temperatures 25 and 35°C, after 15-day pre-incubation at 25°C. Organic manure (OM) was also added at the end of pre- incubation period. Carbon mineralization was assessed by measuring the CO_2 emission with Microgas Chromatograph while P bioavailability by extraction of inorganic phosphorus by anion exchange membranes (resin P) for different interval times (0th, 1st, 3rd, 7th, 10th, 15th day). Results showed that land-use affected CO_2 emissions. CO_2 emission was higher in agroforestry system than in conventional system. An increase of temperature from 25°C to 35°C over 30 days lead to an increase of CO_2 emission of 790 to 1 064 μg CO_2/g of soil and 887 to 1 167 μg CO_2/g of soil respectively for agroforestry system without and with OM application, and of 634 to 824 μg CO_2/g soil and 691 to 992 μg CO_2/g soil respectively for conventional system without and with OM application. The CO_2 emissions showed consistent responses to added OM. Furthermore, P availability was also affected by land-use. Resin P was higher in agroforestry system that in conventional system. With fertilizer treatment, an increase of temperature from 25°C to 35°C lead to an increase of resin P between 6% to 40% for agroforestry system and between 32% to 66% for conventional system. P availability was relatively insensitive to temperature change when no OM was supplied. Fertilizer application increased resin P regardless of land-use. In conclusion, increasing temperature on the studied ferralsol affects the CO_2 emissions and the P availability by promoting mineralization process highlighted by increase of CO_2 emissions and thereafter leading to nutrient release such as P.

Key words: CO_2 emission, P availability, climate change, land use, Madagascar.