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Short-Term Impact of a Return to Conventional Tillage on Soil Microbial Attributes

Authors : Promil Mehra, Nanthi Bolan, Jack Desbiolles, Risha Gupta

Abstract : Agricultural practices affect the soil physical and chemical properties, which in turn influence the soil microorganisms as a function of the soil biological environment. On the return to conventional tillage (CT) from continuing no-till (NT) cropping system, a very little information is available from the impact caused by the intermittent tillage on the soil biochemical properties from a short-term (2-year) study period. Therefore, the contribution made by different microorganisms (fungal, bacteria) was also investigated in order to find out the effective changes in the soil microbial activity under a South Australian dryland faring system. This study was conducted to understand the impact of microbial dynamics on the soil organic carbon (SOC) under NT and CT systems when treated with different levels of mulching (0, 2.5 and 5 t/ha). Our results demonstrated that from the incubation experiment the cumulative CO2 emitted from CT system was 34.5% higher than NT system. Relatively, the respiration from surface layer (0-10 cm) was significantly ($P<0.05$) higher by 8.5% and 15.8 from CT; 8% and 18.9% from NT system w.r.t 10-20 and 20-30 cm respectively. Further, the dehydrogenase enzyme activity (DHA) and microbial biomass carbon (MBC) were both significantly lower ($P<0.05$) under CT, i.e., 7.4%, 7.2%, 6.0% (DHA) and 19.7%, 15.7%, 4% (MBC) across the different mulching levels (0, 2.5, 5 t/ha) respectively. In general, it was found that from both the tillage system the enzyme activity and MBC decreased with the increase in depth (0-10, 10-20 and 20-30 cm) and with the increase in mulching rate (0, 2.5 and 5 t/ha). From the perspective of microbial stress, there was 28.6% higher stress under CT system compared to NT system. Whereas, the microbial activity of different microorganisms like fungal and bacterial activities were determined by substrate-induced inhibition respiration using antibiotics like cycloheximide (16 mg/gm of soil) and streptomycin sulphate (14 mg/gm of soil), by trapping the CO2 using an alkali (0.5 M NaOH) solution. The microbial activities were confirmed through platting technique, where it was that found bacterial activities were 46.2% and 38.9% higher than fungal activity under CT and NT system. In conclusion, it was expected that changes in the relative abundance and activity of different microorganisms (bacteria and fungi) under different tillage systems could significantly affect the C cycling and storage due to its unique structures and differential interactions with the soil physical properties.

Keywords : tillage, soil respiration, MBC, fungal-bacterial activity
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