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Enzymes Activity in Response to Veterinary Antibiotics in Presence of Organic (Biochar and Manure) and Mineral (Nano-Zeolite) amendment

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Annually, millions of tons of antibiotics in the world are used in medicine, veterinary and agriculture, and their excessive application have negative impacts on soil microorganisms and biological processes. In the present study, the effect of releasing the mostly used antibiotic in veterinary and ameliorative impact of organic and non-organic amendments was studied in which treatments include (control (without antibiotic), gentamicin, oxytetracycline and penicillin) and different concentrations (50, 100 and 200 mg/kg dry soil) with and without organic and mineral conditioners (cow manure, biochar and nano-zeolite) on soil urease (URE) and alkaline phosphatase (ALP) enzyme activity and their resistance and resilience indices at three time periods including 1-7, 7-30 and 30-90 days during a 90-day incubation time in a split-factorial design which soil conditioners were considered as the main plots and antibiotic types and concentration were as experimental factors. Resistance (RS) and resilience (RL) indices were calculated for enzymes activity. Results showed that in control treatment (without conditioner), application of gentamicin at 200 mg/kg caused a 68.9 percent decrease in soil ALP activity compared to control (without antibiotic), while a decrease in ALP activity in tetracycline-treated soils compared to control (without conditioner), manure, biochar, and nano-zeolite was 17.5, 13.8, 17.5 and 16 percent, respectively. URE enzyme activity at 30-90-days during incubation the period had an increasing trend from 1-7 days and the highest enzyme activity was measured on the 90th day of incubation. According to results, soil enzymes responded differently to antibiotics and conditioners in soil, so that penicillin and oxytetracycline had no considerable negative impact on ALP enzyme activity, while gentamicin and oxytetracycline at all applied concentrations significantly decreased URE activity. To sum up, findings showed that application of soil conditioners could alleviate negative impacts of antibiotics in soil and could improve resistance and resilience indexes of soil enzymes activities in soil.