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The spread of antibiotic-resistant genes in the soil when it is fertilized with compost

Natasha Danilova, Ilsina Gilmutdinova, and Polina Galitskaya

Kazan Federal University, Institute of Environmental Sciences, Department of Applied Ecology, Kazan, Russian Federation (natasha-danilova91@mail.ru)

Antibacterial drugs are successfully used in large quantities around the world, not only in human medicine but also in animal husbandry for the treatment, prevention, and stimulation of animal growth. Due to weak adsorption in the gastrointestinal tract, up to 90% of the prescribed dose of the antibiotic is excreted in the composition of excrements into the environment. In addition to antibiotics, animal manure contains antibiotic-resistant intestinal microflora. It is known that composting helps to remove the residues of antibiotics and antibiotic-resistant genes from manure, but not fully. Therefore, there is a risk of the spread of antibiotics and antibiotic-resistant genes in agroecosystems when the soil is fertilized with compost.

The purpose of this study was to assess the spread of antibiotic-resistant genes in the soil when it is fertilized with composts containing residues of oxytetracycline and tetracycline-resistant genes tet(M) and tet(X). The following samples were used for the study: soil (control); soil mixed with clean compost; soil mixed with compost containing 300 mg kg-1 of oxytetracycline and soil mixed with compost containing tetracycline-resistant genes tet(M) and tet(X). The presence of antibiotic resistance in the samples was determined by real-time PCR and specific primers.

It was found that control soil did not contain oxytetracycline or possessed resistance to antibiotics. Soil fertilization with compost containing oxytetracycline and compost containing antibiotic-resistant genes led to the formation of antibiotic resistance in soil bacteria. Thus, genes tet(M) and tet(X) were found in this soil starting from the 1st day of incubation, while more intensively antibiotic resistance in soil bacteria was formed under the pressure of oxytetracycline. Interestingly, that the appearance of the tet(M) and tet(X) genes in the mixture of soil with clean compost was found on 14-21 days of the experiment. It is possible that the compost after the composting process contained tet(M) and tet(X) genes at the low levels that were not detected by real-time PCR, and mesophilic temperature conditions in soil appeared to be favorable for bacteria carrying these tetracycline-resistant genes.