

Glyphosate is a widely used herbicide applied to control weed growth and to dry crops prior to harvesting. It is estimated that 8.6 billion kg of this substance has been applied since it was introduced to the market in 1974. Due to its strong adsorption to soil (and thus limited mobility in the environment) and relatively short degradation time, glyphosate is considered to be safer than other herbicides. Nevertheless, the scale of its use, which increases every year (along with the acreage of glyphosate-resistant, genetically modified plants), raises serious concerns. The presence of glyphosate or its main metabolite - AMPA was confirmed in approx. 60% (out of over 300 analysed) agricultural soils. Recent studies indicate the possible toxic effects of glyphosate and AMPA on animal cells. The effect of the herbicide on the composition and activity of soil microorganisms was also confirmed.

The subject of the proposed project is related to methanotrophic bacteria. These microorganisms are common in soils and their activity is an important element in the global methane cycle. Methane is one of major greenhouse gases. Despite the fact that its atmospheric concentration is low, the high potential for absorbing solar energy makes it one of the most important factors shaping the Earth's heat balance. Thus, methanotrophs, removing methane from the atmosphere, significantly reduce the dimension of the greenhouse effect.

Despite the importance of the issue, the literature lacks information on the effect of glyphosate use on methanotrophic bacteria in soil. Filling this knowledge gap is the main goal of the project. The reaction of methanotrophic bacteria to adjuvants will also be studied. These compounds are found in commercial formulations containing glyphosate, where they are used to increase the durability and effectiveness of the herbicide. Adjuvants are often highly toxic in themselves and their effect on methane oxidation in agricultural soils is also unknown.

The project is interdisciplinary. It includes research in the area of microbiology, toxicology and biogeochemistry. The research material will be soils, communities of microorganisms isolated from them and pure cultures of methanotrophic bacteria. As a result, a multifaceted picture of the influence of glyphosate and adjuvants on methanotrophic activity and the composition of the soil microbiome will be obtained.