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Soil microorganisms help prevent non-target effects of pesticides

A new study has investigated the properties of different types of soils which can cause pesticides to cling on to soil and prevent them from affecting non-target species. It demonstrates that microorganisms can play an important role in binding pesticides to soil. Microbial levels can therefore help indicate how much pesticide is freely available in soil.

Pesticides applied during agricultural use can contaminate soil and damage non-target plants and soil organisms. However, soil particles can bind some of these residues and reduce the amount of pesticide that is 'bioavailable'. Researchers tested 5 different types of commonly used pesticides; simazine, carbendazin, acetochlor, chlorpyrifos and diuron on three different types of soils; sandy, brown forest soil with clay and alluvial soil (soil deposited by rivers).

In addition, the study examined the effect of microorganisms on 3 of the pesticides; acetochlor, diuron and simazine, by comparing sterilised soil (with no microorganisms) with natural soil samples containing the pesticide samples.

Each type of soil interacts differently with each type of pesticide. This means that some soils are better at binding the various pesticides. The level of binding was determined by how much of the pesticides could be extracted from the soil samples, using a variety of different chemicals.

The amount of a pesticide that can be stripped from a soil sample gives an indication of how strongly a pesticide has been adsorbed (bound to the surface). Pesticides which are strongly bound to soils are thought to be less bioavailable to animals and plants. Furthermore, they leach less from the soil into surface or groundwaters.

The ability of soil microorganisms, such as bacteria, to bind pesticides to the soil was examined. The study found that the greater the activity of the microorganisms, the greater the amount of pesticide that could bind to the soil. For example, an average of 39.4 per cent of diuron could be extracted from microbiologically active soil compared with between 65-98 per cent extraction from sterilised soil samples.

The researchers suggest that the microorganisms, together with the large quantities of metabolites (substances produced during the living process) produced by the microorganisms, provide extra surfaces for the pesticides to bind to, thereby reducing their bioavailability.

Overall, an aqueous (humic-acid) solution was the most effective at extracting pesticides. The study produced detailed results of the binding properties of the pesticides in the different soils. Of the five pesticides, diuron was the most mobile, binding least to the different soil types. In addition, alluvial soils and brown forest soils adsorbed pesticides more effectively than sandy soils.

Source: Virág, D. and Kiss, A. (2009). Comparative study of accessibility of distinctive pesticides. *Journal of Environmental Science and Health*, Part B. 44:1, 69-75.

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