Effect of the organic amendment rate on the immobilization of pesticides in vineyard soils

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INTRODUCTION
Pesticides have been currently detected in waters and soils in agricultural areas of La Rioja (Spain) due to their intensive use. Physicochemical strategies to immobilize these compounds in soils could prevent water contamination. The application of organic residues to soil is nowadays an increasingly common agricultural practice due to the environmental problems caused by the uncontrolled accumulation and disposal of such residues and to the well-known benefits for soil fertility in terms of organic matter (OM) and nutrient soil enrichment.

The aim of this work was to study the effect of the spent mushroom substrates (SMS) rate added to vineyard soils from La Rioja on the immobilization of pesticides with different characteristics (cymoxanil, pirimicarb, tebuconazole and triadimenol). The adsorption of these compounds by three vineyards soils amended with SMS at different rates between 2% and 75% by SMS was carried out.

MATERIALS AND METHODS

AMENDED SOILS
Soils prepared by uniformly mixing soils with SMS at rates of 2%, 5%, 10%, 25%, 50% and 75% (w/w), on a dry weight basis.

PERCENTAGES OF PESTICIDES ADSORBED BY UNAMENDED AND SMS-AMENDED SOILS FOR AN INITIAL PESTICIDE CONCENTRATION EQUAL TO 25 µg mL⁻¹

RESULTS

For the most hydrophobic pesticides (tebuconazole and triadimenol) the linearity of the adsorption isotherms increased with the SMS rate, indicating that at higher SMS rates there was a partition of the solute in the sorbent.

The Freundlich adsorption coefficients (Kf) increased between 1.7 and 28.5 times for cymoxanil, 1.1 and 15.6 times for pirimicarb, 1.4 and 16.5 times for tebuconazole and 1.3 and 19.7 times for triadimenol in the amended soils with regard to the unamended soils. The increase depended on the soil type in which the SMS was added and the characteristics of the pesticides.

There was a positive and significant correlation between Kf coefficients and the soil OC content for all pesticides (r²=0.91, p<0.01) and between the percentages of pesticide adsorbed and OC content (r²=0.89, p<0.01), although the more significant effect of SMS on the pesticide adsorption was found for the most high rates (50%-75%).

CONCLUSIONS
Low and high SMS rates could modify the adsorption capacity of pesticides by soils but in different form. The higher adsorption capacity of modified soils could reduce the mobility of pesticides and hence prevent their leaching to the groundwater. Adequate SMS rate could be used to design strategies in order to prevent diffuse or point contamination of soils by pesticides.

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