Effect of living winter cover crops on pesticide concentrations in soil and soil solution in temperate agro-ecosystems

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Introduction

Living winter cover crops (*catch crops*) are known to reduce nitrate residue leaching during the aquifer recharge period. Their comparable effect on pesticide residue leaching remains a generally under-explored area of research.

This poster presents a study on the potential extension of catch crops to the removal capacity of pesticide residues, by assessing the influence of living winter cover crops on residual pesticide levels in agricultural soils.

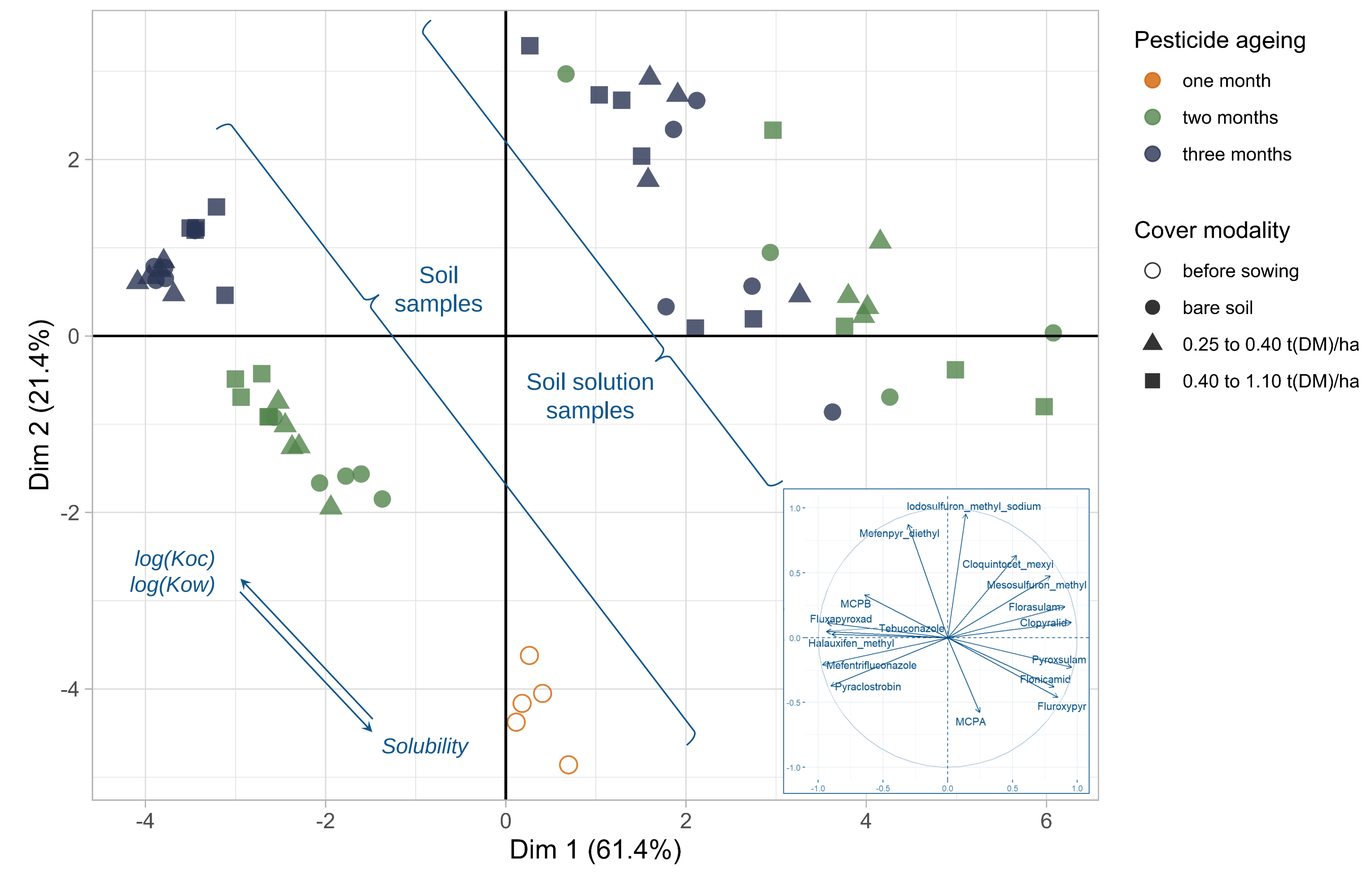
Method

We quantified by (QuEChERS) LC-MS/MS the concentrations of 20 pesticides (11 herbicides, 5 fungicides, 1 insecticide, 2 safeners, 1 metabolite) in 5 replicates of both soil and soil solution samples and compared their evolution over time in 10-litre pots in a greenhouse under three conditions:

1. a bare soil (control);
2. a thin winter catch crop (reaching 0.40 t(DM)/ha after 3 months);
3. a winter cash crop (reaching 1.10 t(DM)/ha after 3 months).

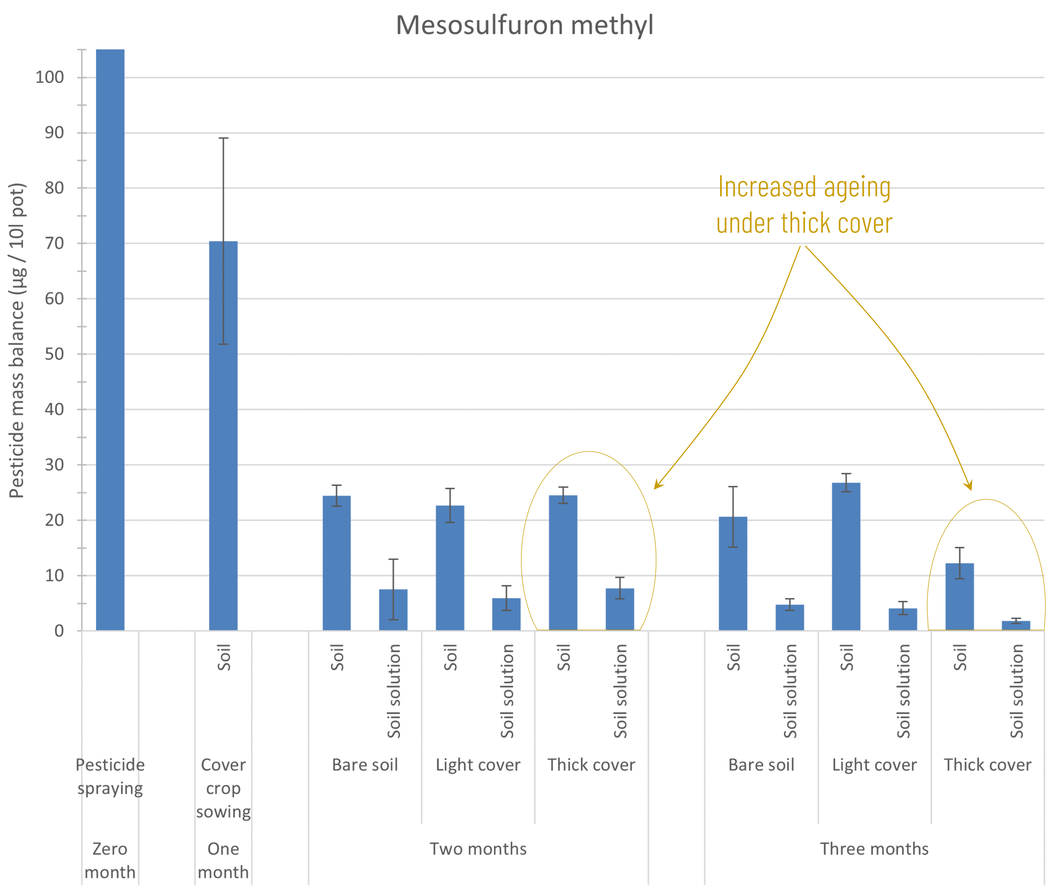
Results

The ageing of the pesticide residues depends on the compartment...

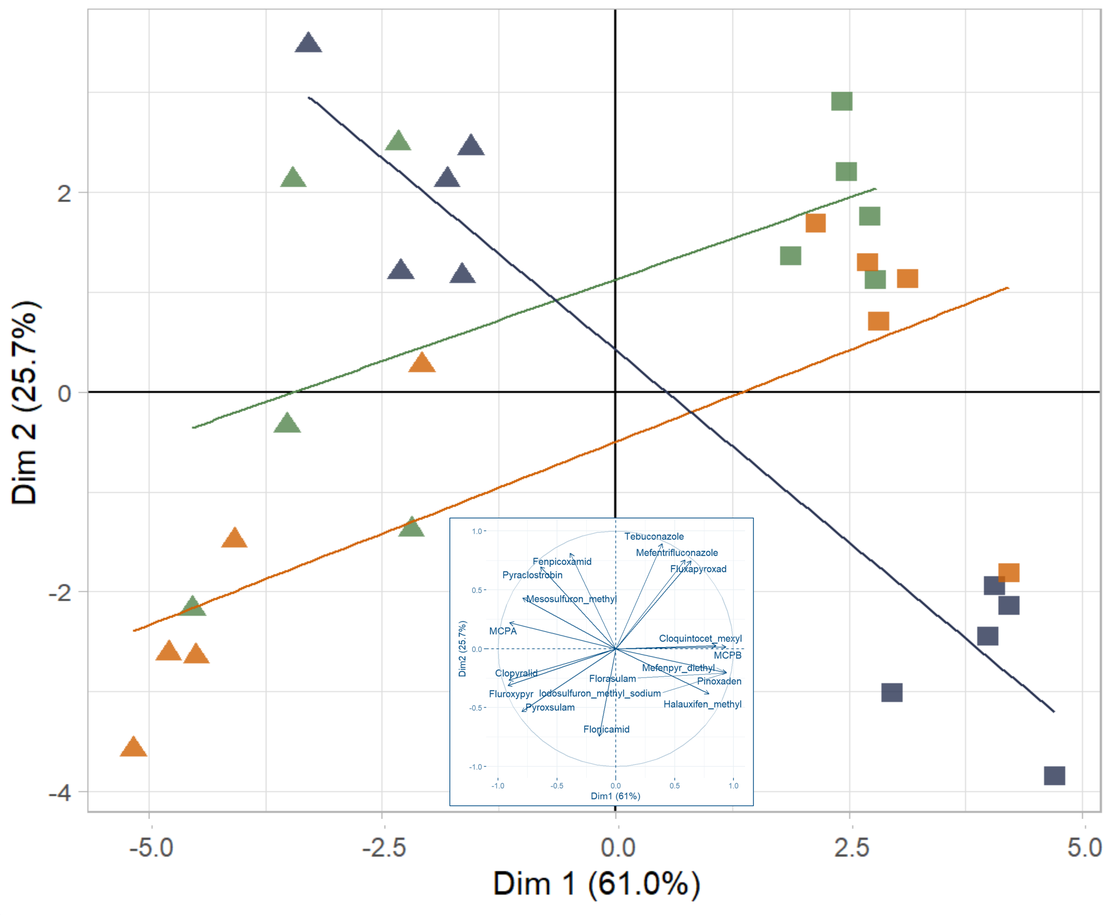


The ageing behavior of pesticide residues in the two compartments monitored —soil and soil solution— is generally similar, with a shift towards a mixture of less soluble and more adsorbed residues after three months compared to two months after spraying.

Mesosulfuron methyl (*herbicide*) displays a typical evolution:



...and on the cover crop modality



Under bare soil and light cover crop (*from 0.25 ton of dry matter one month after sowing to 0.40 ton of dry matter two months after sowing*), both soil and soil solution residue mass balances remain similar. Under thick cover crop (*from 0.40 ton of dry matter one month after sowing to 1.10 tons of dry matter two month after sowing*), both soil and soil solution pesticide residue mass balance decline over time.

Conclusion

The presence of a sufficiently developed living winter cover crop on agricultural soil leads to a further ageing of the pesticide residues. Whether this is due to faster biodegradation of the pesticides within the rhizosphere of the thicker cover crop needs to be investigated in further studies on the topic.

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