CENTRE FOR PESTICIDES IN THE ENVIRONMENT

Agricultural management practices influence mineralisation of the herbicides bentazone and clopyralid

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Introduction

Conservation agriculture (CA) is the combination of the three main interconnected soil-conservation techniques (i) little or no soil disturbance, (ii) permanent soil cover by crop residues and/or cover crops and (iii) diversification of plant species in the crop rotation. Conservation agriculture has been promoted as a way to reduce soil degradation through erosion, increase crop production sustainability and increase soil carbon stocks.

How would a transition to conservation agriculture affect pesticide degradation?

Objective

The objective was to identify management practices that influence degradation of the herbicides bentazone and clopyralid in agricultural topsoils.

Materials and methods

Sampling and soils

Soil samples were taken from the top 5 cm from 38 arable fields (Fig. 1) with a variation in soil properties (Fig. 2). These fields were located at 18 farms in Västergötland, Sweden ("On-farm" approach").

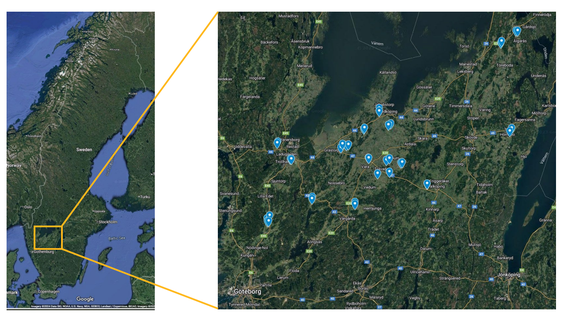


Figure 1. Sampling locations.

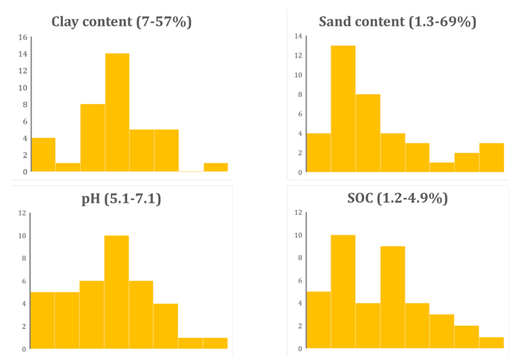


Figure 2. Histograms of soil properties.

Herbicides

Both bentazone and clopyralid (Fig. 3) have been frequently found in surface waters in Sweden and internationally.
Bentazone is non-persistent and mobile in soil.
Clopyralid is non-persistent and very mobile in soil.

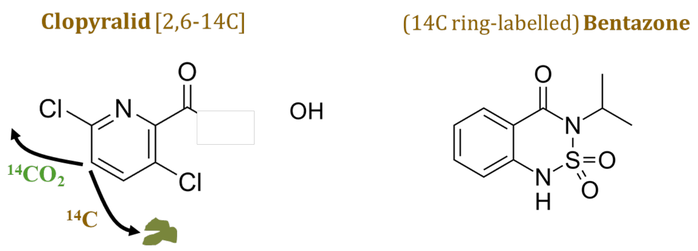


Figure 3. Chemical structure of the ^{14}C-labelled herbicides.

Experimental setup

We carried out incubation experiments using both labelled and unlabelled compounds (Fig. 4). Herbicide residues were extracted with acetonitrile containing 5% formic acid.

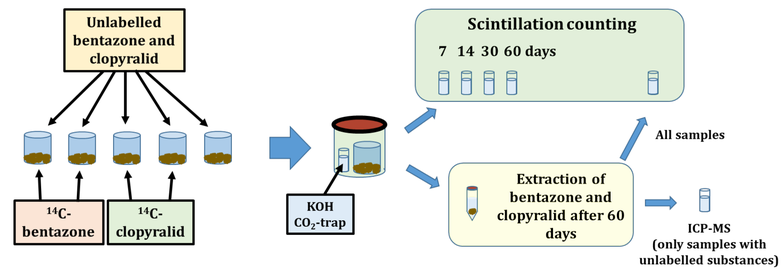


Figure 4. Experimental setup

Management

Data on soil and crop management were collected from farmers (Fig. 5).

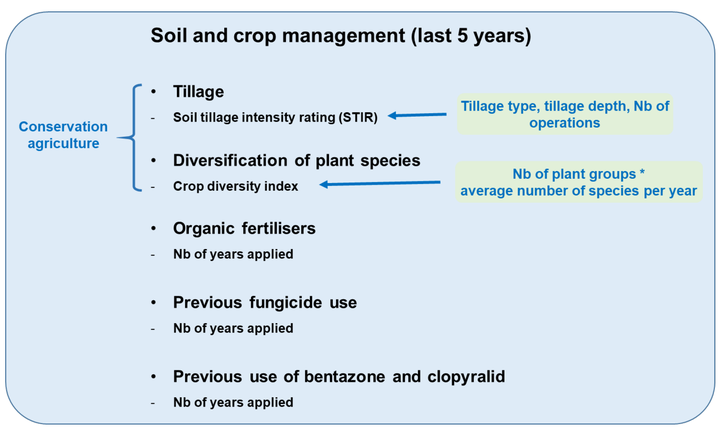
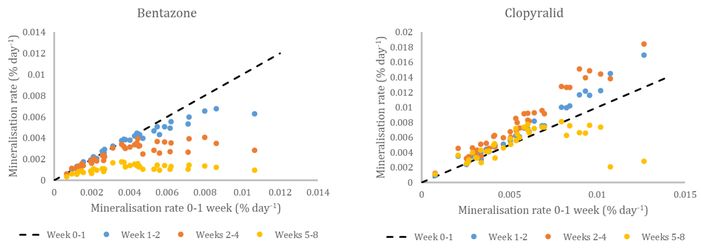


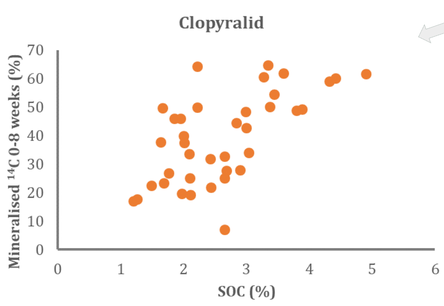
Figure 5. Soil and crop management indices used in the study.

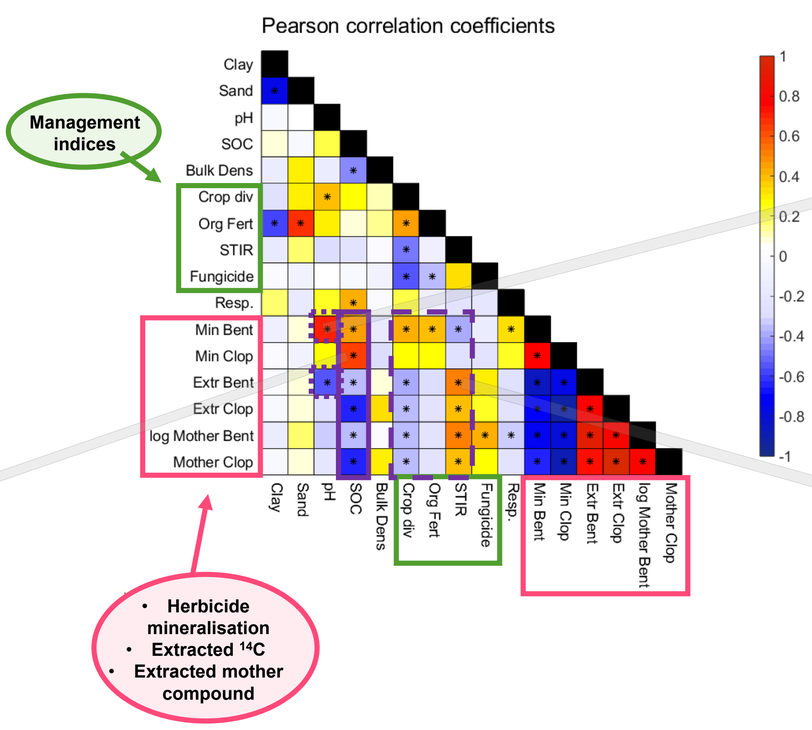
Results

- Mineralisation dynamics were different for bentazone and clopyralid



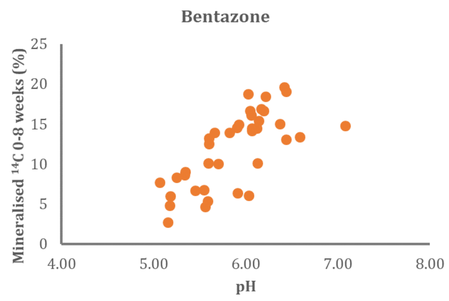
- Mineralised and extracted fractions correlated with SOC for both compounds



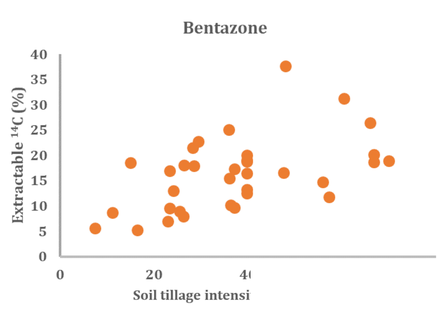


- **Herbicide mineralisation**
- **Extracted ^{14}C**
- **Extracted mother compound**

- Mineralised and extracted fractions of bentazone correlated with pH



- Our data suggest that soil and crop management has an effect on mineralisation/ degradation of both bentazone and clopyralid



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