Determination of pesticides in vineyard soil and air before, during and after applications

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Introduction
In France, viticulture represents less than 4% of cultivated lands but consumes 20% of total pesticide sales. This leads to increasing concerns about the effects of these pesticides on human health for wine-growers and for residents and measures are taken to reduce their use (Saint-Ges and Bélis-Bergouignan, 2009). Bordeaux area is particularly concerned as viticulture represents 50% of cultivated lands. In this context, a preliminary study was carried out in 2011 to document the pesticide levels in vineyard soils. Four sites in a vineyard were studied: three of them were from treated plots and one was from a non-treated plot (control).

Material and methods

Soil sampling
Monthly, one sample from a treated plot and another one from a non-treated plot (reference site) were collected from surface, in the soil’s first 5 cm. More frequent sampling was performed in July 2013 during a treatment week. Upon return to laboratory, samples were frozen and freeze-dried and extracted by focused microwave-assisted extraction and pesticides were analyzed by liquid chromatography-tandem mass spectrometry (LC-MS/MS) or by gas chromatography-tandem mass spectrometry (GC-MS/MS).

Air sampling
Active air sampling consisted in extracting air using a pump during 24 hours: particular phase was collected on filters and gas phase was trapped in Polyurethane Foam (PUF) disks. Samples were collected every day for a week at the beginning of June 2013. PUF disks have also been deployed for passive sampling since February 2013 in a site located at the middle of vines and in a remote site from vines. Two durations of exposure were tested: one and two months. Both filters and PUFs were conserved at -18°C and extracted by Accelerated Solvent Extraction (ASE) and pesticides were analyzed by LC-MS/MS and GC-MS/MS.

Ground Water sampling
Miniaturised Polar Organic Chemical Integrative Samplers (POCIS) were exposed in a piezometer for a month. They were prepared with 80 mg Oasis® HLB sorbent spiked with deisopropylatrazine-d5 (DIA-d5) as performance reference compound (PRC) and maintained by 2 polyethersulfone membranes (0.1 µm pore size) or 2 nylon membranes (30 µm pore size). After exposure, sorbent was transferred into glass cartridges, pesticides were eluted with a mixture of dichloromethane and methanol and analyzed by LC-MS/MS and GC-MS/MS.

Results
The developed procedure for the analysis of pesticides in soil led to good limits of detection (low ng/g range). No pesticides used between April and July 2011 were found at the control
site (DT) whereas trace levels were found in the treated sites (D1 to D3) (Error! Reference source not found.).

![Concentrations (ng/g dry weight) in pesticides in different kinds of soils of a vineyard before (April) and after (July) treatments.](image)

**Figure 1.** Concentrations (ng/g dry weight) in pesticides in different kinds of soils of a vineyard before (April) and after (July) treatments.

Owing to these preliminary results, a larger field campaign was set up from February to September 2013 to screen pesticides in soils, ground water and air from the vineyard by active but also passive sampling. The results of this pesticide monitoring in the different environmental compartments will be presented here.

**Conclusion**

This study will permit to have a global view of the impact of pesticide use in the 3 environmental compartments of a vineyard. This is quite innovating, as vineyards are little studied or analyses generally focused on one compartment. Direct impacts of treatments may be shown by soil analysis, especially for samples collected just after spraying. Indeed, some fungicides such as folpel degrades within a few days (Bermúdez-Couso et al., 2007). Moreover, air passive sampling is largely used for organochlorine pesticide (Tuduri et al., 2011) but not for “recent use” pesticides such as cyprodonil, although they can be detected in air with active techniques (Coscollà et al., 2010).

**References**


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