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Quantification of pesticides used in agriculture in the EU-27

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Pesticides have become relatively ubiquitous pollutants. They may affect non-targeted organisms and can be found as contaminants in agricultural soils, groundwater, rivers, lakes and in the food chain (Margni et al., 2002; Hamilton & Crossley, 2004; Arias-Estévez et al., 2008).
As "it has been common knowledge that many pesticides cause harm to the environment and to human health" (Pretty & Waibel, 2005), it is essential to account for a quantitative assessment of impacts of current agricultural practice at the European scale. Therefore, inventory data sets of applications and related emissions of the most relevant active substances are necessary.

A review of publicly available data sets evidenced that data on consumption of active substances and releases into the environment for EU member states are of low quality or lacking entirely. Either only few substances are covered (e.g. EPER, E-PRTR) or data are highly aggregated in terms of total amount of active substances. Sales or consumption data are differentiated by target organisms and crop types (Eurostat) or by chemical classes (FAOSTAT, OECD.StatExtracts). In Germany, sales data categorised into target organisms and chemical classes are available. To our knowledge, Denmark and the United Kingdom are the only European countries providing application rates for specific active substances and crops.
As a basis for analysing the relation between source, environmental fate and sink of pesticides and for considering the importance of crop-specific properties on the fate of pesticides (Trapp and Kulhanek, 2006), crop-specific emission inventories for individual active substances are required.
Thus, the aim of our work was to develop a crop-specific inventory for active substances currently used in agriculture in the EU-27.

Based on Eurostat (2007), the five most important active substances applied to the crop categories of cereals, maize, oilseeds, potatoes, sugar-beets, grapes and vine, fruit trees and vegetables were identified for each EU member state. The focus was on herbicides and insecticides. Also, the average dosage (i.e. application rate [kg active substance/ha]) for chemical classes per crop category and country was provided. Each active substance was then related to the average dosage of its chemical class for each crop category and country. The amount of active substance applied on a specific crop type in a country was calculated by multiplying the country specific crop production area with the respective dosage. Based on the loss fraction of applied substance to air, the emission into air can be calculated.

With this approach we identified 89 active substances of relevance (63 herbicides, 26 insecticides) in the EU-27. The analysis showed a high variation of active substances between the member states, i.e. each country uses particular herbicides and insecticides for particular commodities according to specific climate conditions. For the majority of the member states, our approach covers more than 70 % of total use compared to the aggregated consumption of active substances per country as published in Eurostat.
For some specific countries with substance-specific application data available, our results can be compared to real application rates. Discrepancies can be considered as an indicator for the variation of our estimates.
By relating the emission inventory data sets to land use maps, they can be spatially disaggregated and thus may serve as input for a subsequent exposure and impact assessment modelling of individual pesticides.

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