Predicting pesticide loads more accurately

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Rapeseed fields are protected from pests by plant protection products. New software from Fraunhofer IME can calculate how high the concentration in the adjacent body of water is. Credit: panthermedia/Katja Beetz

The EU wants to further improve the authorization process for plant protection products. The different national procedures for this are supposed to be further harmonized. Fraunhofer researchers have developed a software for estimating the transfer of pesticides into surface water initially in Germany.

Researchers of the Fraunhofer Institute for Molecular Biology and Applied Ecology IME have developed software for Germany that calculates the concentration of pesticides/plant protection products in surface waters like ditches or streams. The new process can be employed as a component of pesticide authorization procedures. The software developed by the scientists at the Schmallenberg location works more accurately and delivers faster results than current procedures in Germany and the EU. The concentrations of pesticides are used to assess the risk for the populations of aquatic organisms – these include fish, aquatic

plants, and insects. The research partners are the Institute of Landscape Ecology and Resources Management of the Justus Liebig University Giessen, the RLP AgroScience - Institute of Agroecology, the RWTH Aachen University, and the French IT company FOOTWAYS S.A.S. The German Federal Environment Agency (Umweltbundesamt, UBA) sponsored the research.

A blueprint for other EU member states?

The software builds on existing computer models for authorizing active substances in pesticides within the EU. It might therefore serve as a blueprint for other EU member states to further harmonize the assessment procedures between EU countries for plant protection products. The prototype, named GERDA – short for "German Run-off, Erosion, and Drainage Risk Assessment" – has already been tested successfully by the researchers. "We are hopeful that the software will be introduced before the beginning of next year," says Dr. Michael Klein from the Department of Ecological Chemistry in Schmallenberg, "but the final decision on that will be made by the German approval authorities."

The researchers have optimized GERDA at many points in comparison to existing EU methods. The method now incorporates a comprehensive data base of scenarios for environmental conditions specific to Germany. These are based upon weather data over the last 30 years and detailed soil maps of Germany. The researchers have relied here on data from the Germany's National Meteorological Service (Deutscher Wetter-dienst/DWD) and the German Federal Institute for Geosciences and Natural Resources (BGR). The software processes information about the active substances in the pesticides, their application area and their usage according to quantity and point in time. From the pool of data, GERDA calculates the particular pesticide concentration that represents a realistic worst case for the waters under conditions of good agricultural practice.

"The final objective is that the populations are not impaired," explains Klein.

Users of the program can set various environmental conditions to observe how the alterations affect the calculated environmental concentrations, such as how the concentrations in the waters decline if larger distances to surface waters are maintained for the particular agricultural area where the plant protection products are applied. "This information is then placed on the product packaging of the pesticide and represents a condition of authorization and use of the pesticide," says Klein. The models the researchers use to calculate the pesticide concentrations are complex. Nevertheless, they work faster than existing procedures. "We wrote simpler code for several of the calculations," Klein explains.

The scientists developed a convenient user interface so that the software can also be operated by those who have a different technical background. "For users, it is as easy as filling out an input screen for a normal PC spreadsheet application program," according to Klein.

In order for the software to be able to process all the necessary data the researchers first transferred the heterogeneous pool of information comprising meteorological, geographical, and chemical data into a format that the predictive model can process. Klein's colleague Udo Hommen from the Department of Ecotoxicology contributed knowledge of when an ecosystem becomes damaged. "There is a difference, for example, between short-term and long-term exposure. If organisms are harmed by even very brief exposure, then it does not make sense to implement daily average values as relevant for the aquatic concentrations. In contrast, for other substances short-term exposure may have no effect," Hommen explains. The predictive model facilitates this differentiation.

The function of plant protection products is to protect crops against plant or animal pests or against fungi. To avoid negative effects of these chemicals on humans and on the environment, there is a two-level authorization system in the EU. First, the active substances in the pesticide are checked at the EU level. Then the pesticides are evaluated and authorized at a national level. In Germany, the Federal Office of Consumer Protection and Food Safety (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit/BVL), the Julius Kühn Institute (JKI), the Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung/BfR) and the Federal Environment Agency (Umweltbundesamt/UBA) are responsible for this.

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