

Experimental determination of a foliar wash-off coefficient – development of a laboratory procedure

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In order to estimate environmental concentrations of plant protection products (PPP) in soil, surface- and ground water different models under FOCUS are applied. One part of the exposure assessment is the assessment of the portion of a PPP which might be washed off from freshly treated plant surfaces to the soil by unexpected rain events. However, for this wash-off coefficient currently a default is used since valid procedures for an experimental determination are missing.

In our project it was intended to develop a laboratory procedure for the experimental determination of the wash-off coefficient. A major challenge for such study is the supply of artificial rain simulating a natural rain event, which is a prerequisite for a reliable experimental procedure. The traditional methods used for determination of rain parameters like droplet size, velocity and rainfall intensity are quite time consuming and none of the methods deliver all the required parameters at one time. An online determination of the rainfall characteristics during the experiment is impossible with the traditional methods.

During the project it was found that for the characterization of rain the Laser Precipitation Monitor (LPM) from ThiesClima enables an easy and online characterisation of the quality of the artificial rain. The monitor is capable of detecting raindrop diameters as well as velocities and rainfall intensities. With these easy to measure characteristics as a new parameter the kinetic energy of the rain is proposed which allows a comparison between natural and simulated rain. So far labs who want to perform those studies were supposed to have a “rain tower” since it is accepted that this is the only way to simulate natural rain. The new parameter would allow proving that other techniques might produce proper artificial rain as well.

Based on that parameter a lab experiment was conducted. The lack of drop speed, which would require a drop height of at least 5 meters, was compensated for by the larger number of drops per time and drop size to achieve comparable kinetic energy transfer to the system. The experimental set-up simulated moderate and heavy rain.

With this setup a wash-off experiment was conducted using a ¹⁴C-labelled pesticide and wheat as a representative crop. The wash-off experiment was performed with different rain amounts applied 24 h after pesticide spray application to simulate a worst case scenario. The samples were analysed before and after the rain events for the applied pesticide. The collected data were used for calculation of a wash-off coefficient. It could be shown that the applied test method is suitable to determine the proportion of pesticides washed off by rain after application to plant surfaces in a lab approach. Next step is the comparison of the wash-off with different kinetic energies to verify the suitability of the new parameter.