Risk assessment with the indicator model SYNOPS based on sugar beet specific pesticide use

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Even with the appropriate use of pesticides, environmental risks can occur under unfavorable conditions that cannot be estimated within the scope of the approval process.

The research approach of the present project was on the one hand to record the status quo of pesticide use in sugar beet cultivation in Germany and associated environmental risks and the development of crop protection strategies optimized with regard to the environmental risk.

The data on chemical plant protection in sugar beet cultivation in Germany were collected in the years 2010-2015. A number of 2314 randomly chosen farmers were surveyed via questionnaire about the chemical plant protection on their largest sugar beet field, whereby the interviewees changed annually. The farms were distributed over all regions of Germany according to the regional distribution of the sugar beet growing area.

The model SYNOPS-GIS was used for the calculation of possible environmental risks caused by sugar beet specific application of pesticides. The model assesses risks based on agricultural fields derived from spatial land use datasets. Each reported application pattern was combined with a multitude of fields. The environmentally relevant concentrations of active ingredients in the non-target compartments soil, neighboring surface waters and field margins were estimated. The acute and chronic risk indices of the considered application are given as the quotient of the environmental concentration and the toxicity (LC_{50}/10, NOEC) for different terrestrial and aquatic reference organisms (exposition-toxicity-ratio, ETR).

The calculated application-specific results were mainly in the (very) low risk category (ETR = 1). In general, the aquatic risk was slightly higher than the terrestrial risk. The aquatic risk was evaluated separately for herbicides, fungicides and insecticides. Medium and high risks were mainly caused by herbicides or insecticides. Herbicides, which are applied on nearly 100% of fields, provide a higher risk reduction potential than insecticides which are used on about 15%.

The identified risks are not founded in the use of specific active ingredients or application patterns. The ETR is not directly determined by the amount of active ingredient applied. The combination of application pattern with field-specific environmental conditions determines the risk.

These risks might be avoidable by implementation of field-specific risk mitigation measures like creation of vegetated filter strips.