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Improving prediction of pesticide drift deposition on water surfaces on the Colombian highlands

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Assessment of the environmental risk of new agricultural pesticides in Colombia may be highly underestimated. Control and registration of new pesticides is regulated by the Andean technical manual, which calculates the expected drift concentration expressed as the percentage of the applied dose. The calculations are based on tables with drift values depending on the crop type and the distance of the water surface from the field border based on the model proposed by Ganzelmeier et al. (1995). However, in the Andean region, the application techniques, agricultural practices and meteorological conditions usually significantly differ from those for which the model was designed. Therefore, the use of the tables based on Ganzelmeier et al. (1995) in the Andean manual might be producing an important disagreement between the actual and the expected pesticide concentration in water surfaces close to the treated field. The objectives of this study were i) to improve the understanding of the main factors influencing the mass fluxes (i.e. drift deposition), ii) to assess the suitability of the model proposed in the Andean technical manual for potato crops and other existing models under meteorological conditions and application practices of smallholding potato growers on the Colombian Andes, and iii) to propose a new model of drift deposition which performs better under such conditions.
The study was carried out among smallholder potato producers in the Department of Boyaca, Colombia. 12 trials were carried out with a local farmer using his knapsack sprayer. Spray relative drift deposition was measured using the tracer Uranine. The main factors influencing drift were distance from the field border, wind speed and vapour pressure deficit. The data obtained in this study demonstrated that drift calculated with the Andean technical manual's tables was highly underestimated (>200 %). A similar underestimation was observed also for other existing models. However, calibration of existing models significantly improved the prediction of drift deposition. Five new models were estimated, whose predictive capacity was compared with the calibrated existing models. Based on this comparison, the model with higher performance explained drift deposition as a function of distance from the field border, wind speed and vapour pressure deficit. Interestingly, acceptable prediction was also obtained with a model explaining drift deposition as a function of the distance from the field only, which might be of interest under scarce meteorological monitoring.
The proposed drift deposition models improve the understanding of the meteorological factors influencing drift deposition of agricultural pesticides on water sources under the conditions present on the Colombian highlands. Because of their high predictive capacity under such conditions, these models are a valuable support to decision makers, i.e. for the registration process of new pesticides and, more in general, for the assessment of environmental and health risks. Furthermore, some of the models are particularly suitable for adoption in developing countries and in other context where scarce meteorological monitoring is available.