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Dermal and Inhalation Exposure Assessment of Pesticide Management in Greenhouse Flower Crops in Colombia

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Abstract

Pesticides are chemicals of public health concern because epidemiological studies have evidenced the association between agricultural occupation activities and related health problems. Floriculture is an agricultural activity in developing countries in which the greenhouse environment conditions are designed to optimise the plant growing rather than to protect the worker's health. Colombia is the second world flower exporter with a cultivated area of 6800 hectares with an average of 15 workers per hectare. Numerous studies worldwide have assessed the exposure to pesticides in greenhouses; however, there are no available studies in the floriculture system in Colombia in which large number of workers might be at risk of exposure. In our research, we assess the dermal and inhalation exposure applying the Material Flow Analysis methodology to study the dispersion of the pesticides in the human body during pesticide management. The study area was a flower farm located in Sabaná de Bogotá, Colombia. The Whole Body Dosimetry was applied to obtain the pesticide distribution on the human body parts using the tracer uranine as pesticide surrogate and tyvek garments as sampling media. The Button Personal Inhalable Aerosol Sampler was used to measure inhalation exposure. The results show high levels of potential dermal exposure in upper body parts like abdomen, chest and back; however, the level of protection given by the personal protective equipment was higher than 98.6%. Actual dermal exposure represented 0,48 % of the total amount of tracer applied. From the total human exposure (*i.e.* actual dermal exposure and inhalation), actual dermal exposure represented 95 % and inhalation exposure 5 %. Even though exposure values were very low, there is still a high health risk depending on pesticide toxicity, type of pesticide mixtures and total time of exposure. Therefore, further research is required to determine the level of human exposure and how the exposure dynamics change with the time when there is a cumulative exposure to pesticide mixtures affected by a determined degradation rate. This research was funded by the Swiss National Science Foundation and performed by a cooperation between LMU München, ETH Zürich, UniZürich, UniBoyacá and Universidad Nacional de Colombia.

Keywords: Colombia, dermal exposure assessment, developing countries, flowers, greenhouses, inhalation exposure assessment, material flow analysis, pesticides