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Water-Mediated Discharge of Pesticides from a Sloped Lychee Orchard, N-Thailand

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Abstract

Fruit cropping is considered to be a sustainable alternative to annual field crops in the mountainous regions of northern Thailand because permanent cultures are less prone to erosion, but little is known about pesticide discharge from Thai fruit orchards. The objective of our study was to investigate water-mediated transport of agrochemicals from a sloped lychee plantation into ground and surface water. Therefore, we installed suction lysimeters, wick lysimeters (both in 55 cm soil depth) and surface runoff collectors in a 10-year-old orchard with grass-covered soil. Water and pesticide fluxes were monitored for 50 days after repeated manual applications of organochlorine and organophosphorous insecticides typically used in lychee production (simultaneous applications of 6 different compounds every 10 days). Despite an inclination of ca. 15°, surface runoff and its pesticide load were negligible (runoff <0.05 % of precipitation; pesticide discharge max. 1 10⁻⁴ % of the applied amount; malathion). Wick lysimeters delivered water only under saturated conditions (6 of 25 sampling events; 7.2 % of precipitation), maximal pesticide discharge amounted to 6 10⁻⁴ % of the applied amount (endosulfan). The suction lysimeters delivered about 70 % of the amount of precipitation. This high proportion indicates that preferential flow is a relevant process of water transport on our research site. Nevertheless, pesticide concentrations in samples from the suction lysimeters were below the limit of detection throughout the experiment. Thus, under the given weather conditions, the pathways investigated in our study do not contribute significantly to pesticide inputs into ground and surface waters. Even an extreme storm event observed in a previous experiment on the same plot translocated only small amounts of pesticides (<2 % of applied). We conclude that pesticides detected in the rivers of our research area will, at least partially, enter them either from land-use systems other than lychee orchards (i.e. crop or flower cultivation) and/or on pathways other than surface runoff and leaching (i.e. volatilisation and re-precipitation and/or spray drift).

Keywords: Fruit orchard, leaching, pesticide contamination, preferential flow, Southeast Asia, surface runoff, sustainability