# Fate of pesticides in paddy rice farming systems in NW-Vietnam

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During the past decades, paddy rice production in Vietnam has undergone a major intensification due to population growth and increasing export-market orientation. As a consequence, the amount of applied pesticides has been tripled during the last decade [FAO 2011]. Recent studies from major rice cultivating regions in Europe and Japan indicate that considerable fractions of applied pesticides are lost from the target area to surface water compartments, such as lakes or rivers (e.g. NUMABE and NAGAHORA, 2006). Other studies indicate that a considerable fraction of applied pesticides is prone to infiltrate into deeper soil layers and potentially pollute groundwater aquifers (e.g. PAPADOPOULOU-MOURKIDOU, E. et al, 2003). LAMERS et al. (2011) recently showed for the watershed under study that both surface- and groundwater pollution by pesticides poses a serious environmental problem. In remote areas of NW-Vietnam, surface- and groundwater is multiply re-used for domestic purposes, thus strengthening the need for quantifying and forecasting pesticide losses to groundwater and surface water from paddy rice fields. However, for south-east Asia in general and Vietnam in particular, studies focusing on the fate of pesticides in paddy rice regions are limited.

The aim of the present study is to quantify and analyse the fate of pesticides in paddy rice farming systems in the Chieng Khoi watershed, NW-Vietnam. In 2010, we installed gauging stations at an upstream, midstream and downstream position of the watershed. At each station we measured discharge and we automatically sampled water for pesticide analyses in four consecutive rice cropping seasons in 2010 and 2011. Furthermore, we conducted field surveys among up to 145 rice farmers to gain knowledge on the application practices in each season. To assess the occurrence of groundwater pollution by pesticides, 16 representative wells and one natural spring have been sampled once per week during two consecutive rice cropping seasons in 2010. All water samples were immediately transported to the field laboratory in Yen Chau and stored at 4 °C until further transport to Hanoi. In Hanoi, the samples have been analysed in certified laboratories for the most commonly applied pesticides according to the field surveys among farmer households (Imidacloprid, Fenitrothion, Fenobucarb, Trichlorfon and Cypermethrin). Key results indicate that according to their physico-chemical properties significant fractions of the applied mass of pesticides were lost from the paddy fields to the receiving stream and to groundwater aquifers, respectively. High concentrations of pesticides were found in both surface and groundwater during all seasons. Peak concentrations for imidacloprid of up to 0.69 µg/l for surface water

and up to 4.0 µg/l for groundwater, respectively. The field surveys revealed a high and quickly changing variety of applied pesticides. While imidacloprid was one of the most commonly applied pesticides in both years, the importance of other applied pesticides varied from year to year.

In our presentation we will focus on the experimental setup and key results indicating that under the current management practice pesticide use in paddy fields poses a serious environmental problem in northern Vietnam.

## References


Numabe, A. and Nagahora, S. 2006. Estimation of pesticide runoff from paddy fields to rural rivers. Water Science & Technology Volume 53 (No. 2): 139-146

Papadopoulou-Mourkidou, E., Karpouzas, D.G., Patsias, J., Kotopoulou, A., Milothridou, A., Kintzikoglou, K., Vlachou, P. 2004. The Potential of Pesticides to contaminate the froundwater resources of the Axios river basin. Part II. Monitoring study in the south part of the basin. Science of the Total Environment 321: 147-164

Lamers, M., Anyusheva, M., La, N., Vien, N.V., Streck, T. 2011. Pesticide Pollution in Surface- and Groundwater by Paddy Rice Cultivation: A Case Study from Northern Vietnam. Clean – Soil, Air, Water 39 (4): 356-361.