The Uplands Program

Short-term Variation of Pesticide Loads in Mae Sa River, Northern Thailand

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Introduction

Land use changes in mountainous areas of Northern Thailand have been accompanied by increased input of agrochemicals, which might be lost to streams and contaminate water in the lowlands. Previous studies showed that vertical and lateral preferential transport are important pathways for agrochemicals (Ciglasch et al., 2005; Kahl et al., 2007). Investigations showed that agrochemicals are lost to the river mainly by surface runoff and interflow (Kahl et al., 2008).

Objectives

The objectives of this research are

- to quantify the load of selected pesticides in the subtropical Mae Sa river from the watershed.
- to explore the short-term dynamics of the pesticide loads after heavy rain events

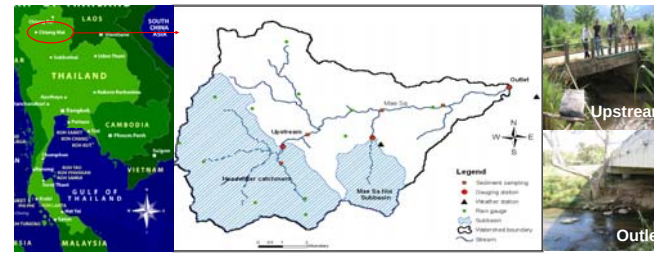

Figure 1: Location of the study site of important installations within the Mae Sa watershed

Methods

Study area and sampling

The Mae Sa catchment (77 km²) is located in Northern Thailand, 15 km northwest of Chiang Mai in the subtropical climate (Figure 1). For collecting river water, automatic gauging stations (ISCO 6217) were installed in head-catchment, at mid stream and at the outlet. In this study, we will present only the results from the upstream gauge. At the beginning of rainy season 2008, water samples were collected every hour from 3rd to 6th May 2008.

Pesticide extraction and analysis

300 ml of water samples were poured through a glass filter (GF/F 0.45µm). Subsequently, samples were extracted by solid phase extraction (graphitized carbon black, 500 mg). The cartridge was rinsed by 8 ml CH_2Cl_2:MeOH 9:1, 3 ml MeOH and 25 ml ascorbic acid (pH 2). 10 ml of acetone, 15 ml CH_2Cl_2:MeOH 9:1 and 30 ml of TBME were rinsed through the cartridge. Finally, sample was concentrated to a final volume of 1 ml with an evaporator. Samples were analyzed for the pesticides by gas chromatography µ-electron capture detector (GC-µ-ECD) and/or nitrogen-phosphorus detector (GC-NPD).

Pesticides

Seven pesticides frequently used in the Mae Sa watershed (Schreinemachers, and Sirijinda, 2008) were selected for analysis (Table 1).

Table 1 Major crops and usage of commonly detected pesticides in this study area

Crop	Herbicide	Insecticide				Fungicide
	Atrazine	Dichlorvos	Dimethoate	Chlorpyrifos	Endosulfan	Cypermethrin	Chlorthalonil
Bell pepper		x		x		x	x
Chrysanthemum		x		x		x	x
White cabbage		x		x	x	x	
Bush bean		x					x
Chinese cabbage		x		x		x	
Litchi		x		x		x	x
Chayote		x					x
Paddy rice				x		x	

Results and Discussion

Rainfall and Discharge data

Figure 2 shows discharge and rainfall during some rain events. Average rain fall during the events was 51 mm. Baseflow, which was measured at the end of the dry season 2008, was 0.4 m³/s. Total runoff volume during the event was 121.4 x 10³ m³.

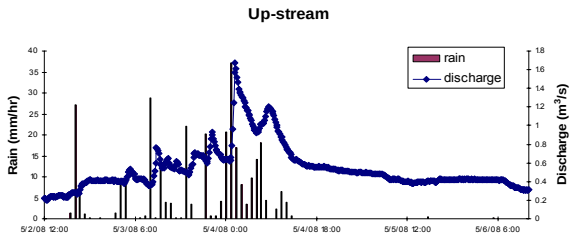

Figure 2: Rainfall and stream discharge during the rainfall event 3-6 May 2008

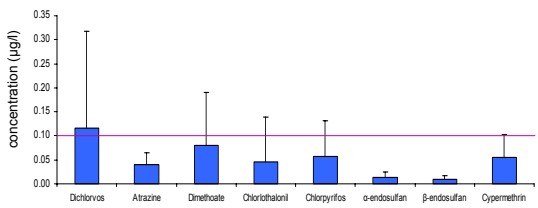

Figure 3: Mean concentration of pesticides in the upstream position of the Mae Sa river (N=61) ——— EU drinking water threshold

Pesticide concentrations and loads

Concentrations of pesticides detected in the water samples are shown in Figure 3. Some pesticides appeared together with the discharge peaks while others were mainly detected during the falling limbs of the peaks. In general, Dichlorvos showed up first while Chlorthalonil appeared last (Figure 4).

Appearance of pesticides with the peaks can be interpreted as transport with runoff water. That some pesticides show up with the falling limbs of the discharge peak indicates preferential transport with lateral interflow water (Kahl et al., 2007, 2008).

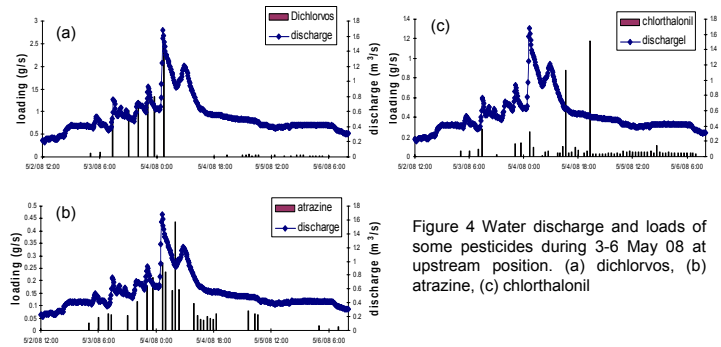

Figure 4 Water discharge and loads of some pesticides during 3-6 May 08 at upstream position. (a) dichlorvos, (b) atrazine, (c) chlorthalonil

Outlook

Comparison of pesticide concentration and load of sampling sites will be evaluated. More monitoring data in the mid and end of wet season will be collected to explore the dynamic of pesticides. The study is a part of the long-run data which will be used to calibrate and test the SWAT (Soil and Water Assessment Tool) model to asses the effect of land use changes in the uplands on the pesticide load of the Mae Sa river.

Acknowledgements

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