

Environmental risk of pesticides used in soilless horticulture crops under optimal water management

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Background

Greenhouse horticulture is an important agricultural sector in the Netherlands. The currently used approach for the exposure assessment of pesticides, i.e. 0.1% of the applied mass (similar to drift), underestimates probably the emission from greenhouses to surface water. Therefore, new realistic worst case exposure scenarios are being developed for The Netherlands.

Growers individual water management practices determine, to a large extent, the emission of pesticides to surface water. Growers aim to decrease their water discharge e.g. by using low-sodium water sources and re-use of drainwater. The question raises if this will lead to sufficient reduction of the environmental risks posed by pesticides.



Figure 1 Storage of water and nutrients in a greenhouse

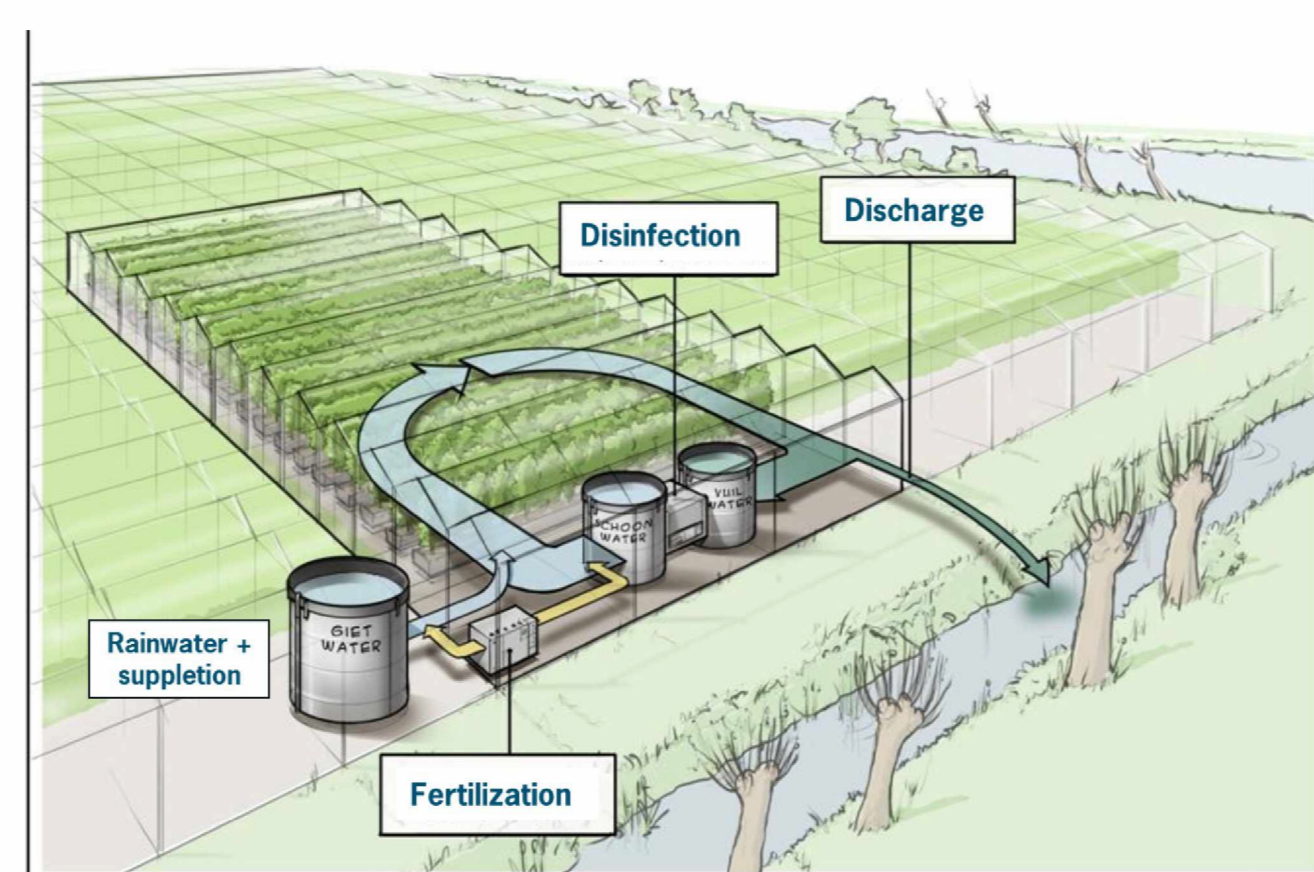


Figure 2. Schematization of water and nutrient re-use

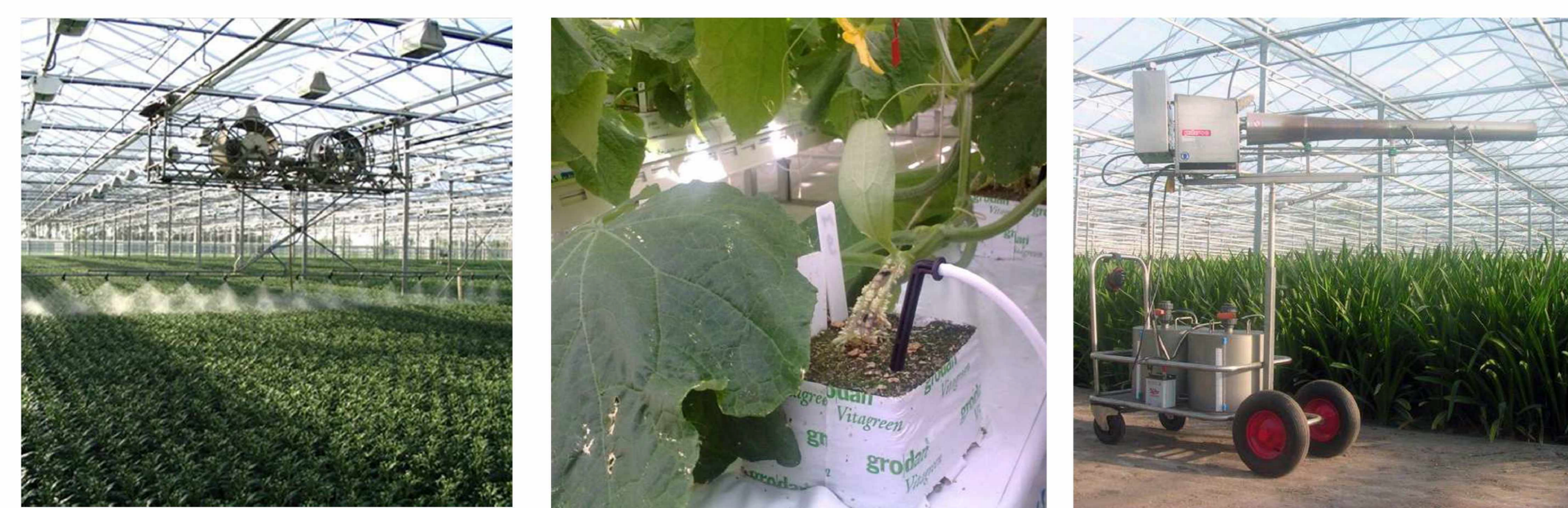




Figure 3. PPP spray application (left), drip application (middle) and fogging (right)

Objective

In this study, the environmental risk posed by pesticides is assessed, in case of optimal water management for soilless horticulture crops.

Materials and methods

For the example crops rose and sweet pepper, optimal water strategies were determined and 10 frequently used pesticides were selected. These pesticides are accepted for use in The Netherlands. We calculated, the pesticide fate in the greenhouse, i.e. recirculation, application, degradation, emission and the 90th percentile overall concentration (PEC) in the receiving water course. The calculated results are preliminary.

	authorization criterion (µg/L)	Application			
		type	timing	Rate*	
	imidacloprid	0.06	drip	April	2 · 0.84 kg
	boscalid	12.5	spraying	Jul-Aug	5 · 0.3 kg
	kresoxim-methyl	2.0	spraying	Jun-Jul	6 · 0.15 kg
	dodemorph	8.0	spraying	Jun-Jul	7 · 2.5 kg
	indoxacarb	2.6	spraying	Jul-Sept	6 · 0.1 kg
	chlorantraniprole	0.071	spraying	Jul-Aug	6 · 0.0525 kg
	abamectine	1.0	spraying	Dec-Jan	4 · 0.0135 kg
	bifenazate	0.51	fogging	Jul	2 · 0.144 kg
	pirimicarb	0.09	spraying	Jul	3 · 0.625 kg
	pymetrozine	2.5	drip	Jun	3 · 0.115 kg

* Active ingredient

Results

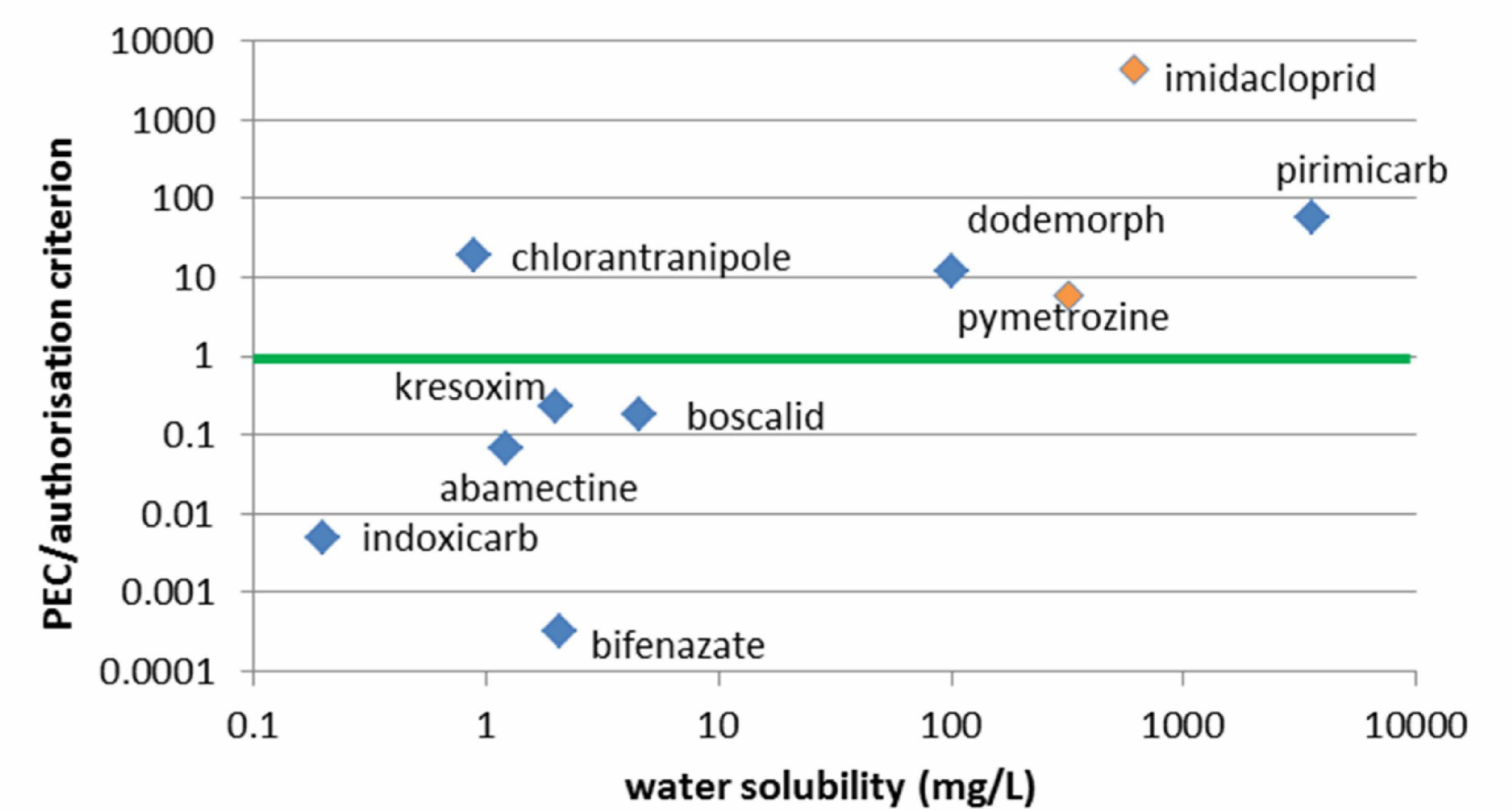


Figure 4. Ratio between Predicted Environmental Concentration (PEC) and authorization criterion for the selected pesticides. The orange markers indicate drip application and the blue markers indicate application via spraying or fogging.

- Average annual discharges to surface water were 90 m³ha⁻¹ and 30 m³ha⁻¹ for rose and sweet pepper, respectively;
- For 5 of the selected pesticides the PEC was above the authorization criterion;
- Despite the difference in discharge to surface water, PECs calculated for rose and sweet pepper are in the same order of magnitude;
- Drip application probably leads to higher emissions and PECs than spraying or fogging;
- The higher the pesticide solubility, the higher the chance of criterion exceedance;
- For the pesticides exceeding the criterion, end-of-pipe treatment may be considered, e.g. UV-treatment.

Conclusion

For frequently used pesticides imidacloprid, pirimicarb, chlorantraniprole, dodemorph and pymetrozine, the Predicted Environmental Concentrations exceed the authorisation criterion, even under optimal water management.

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