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Calculating pesticide emissions for chemical footprinting of kiwifruit

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AIM

Contributing to the development of a pesticide footprint for kiwifruit production in New Zealand, we aim to:

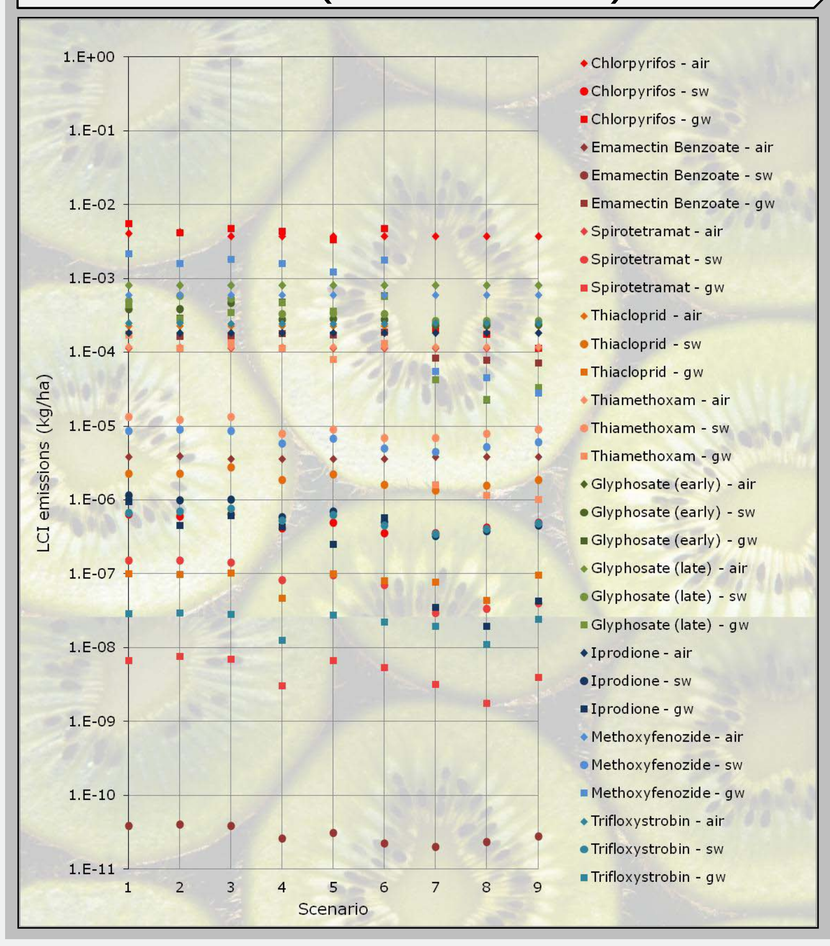
- Model pesticide emissions from kiwifruit orchards in the Bay of Plenty, using 2 LCI approaches
- Characterize human toxicity and freshwater ecotoxicity impacts of these emissions
- Determine the relevance of spatial variation in emissions and impact calculations

CONCLUSIONS

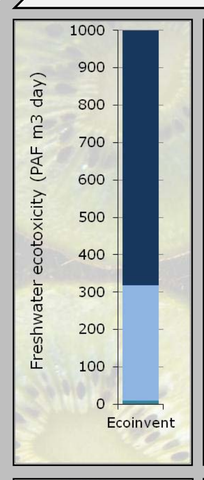
- Emissions of different pesticides, calculated with PestLCI 2.0, span several orders of magnitude
- Freshwater ecotoxicity impacts are dominated by fungicides, chlorpyrifos is the single main contributor to human toxicity impacts
- Compared to PestLCI 2.0, using Ecoinvent as LCI methodology results in considerably higher impacts
- The spatial variation of toxicity impacts is small

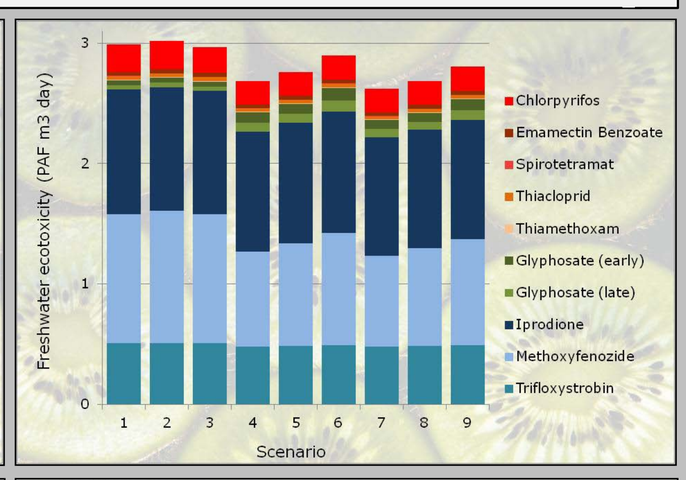
RESULTS

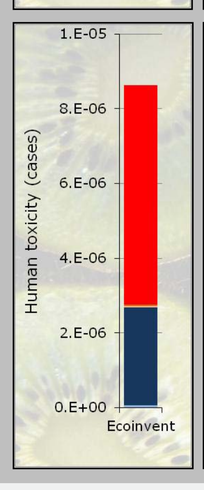
LCI (PestLCI 2.0)

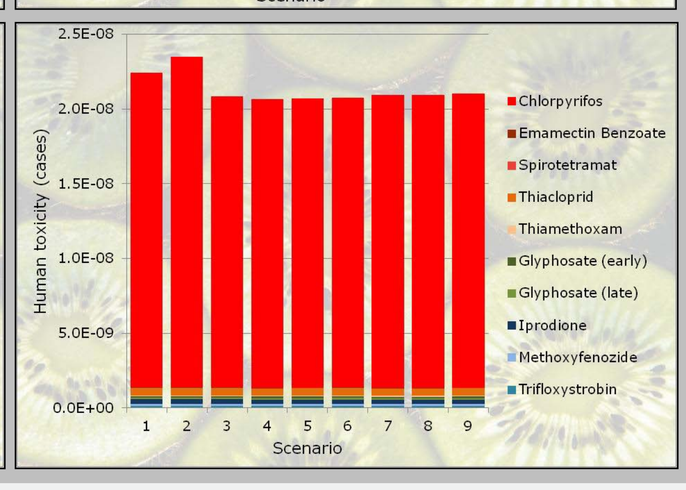


LCIA









Scenarios

Scenario	Climate	Soil
1	Waihi	Katikati sandy loam
2	Katikati	Katikati sandy loam
3	Tauranga	Katikati sandy loam
4	Tauranga	Paenearoa sandy loam
5	Tauranga	Ohinapanea loamy sand
6	Tauranga	Oropi coarse sandy loam
7	Te Puke	Paenearoa sandy loam
8	Te Puke	Ohinapanea loamy sand
9	Te Puke	Oropi coarse sandy loam
Ecoinvent	N/A	N/A

Pesticides applied

Pesticide active ingredient	Function	Application dose (kg/ha)
Chlorpyrifos	Insecticide	0.5
Emamectin Benzoate	Insecticide	0.002
Glyphosate (early application)	Herbicide	0.66
Glyphosate (late application)	Herbicide	0.66
Iprodione	Fungicide	0.75
Methoxyfenozide	Fungicide	0.1
Spirotetramat	Insecticide	0.096
Thiacloprid	Insecticide	0.19
Thiamethoxam	Insecticide	0.1
Trifloxystrobin	Fungicide	0.15

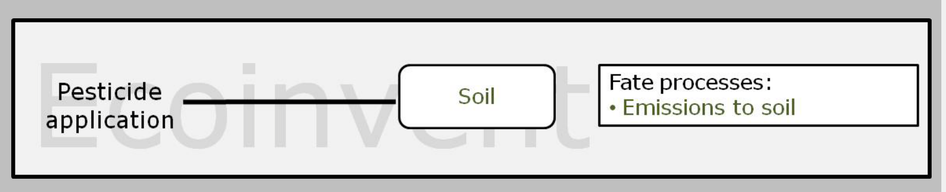
METHOD

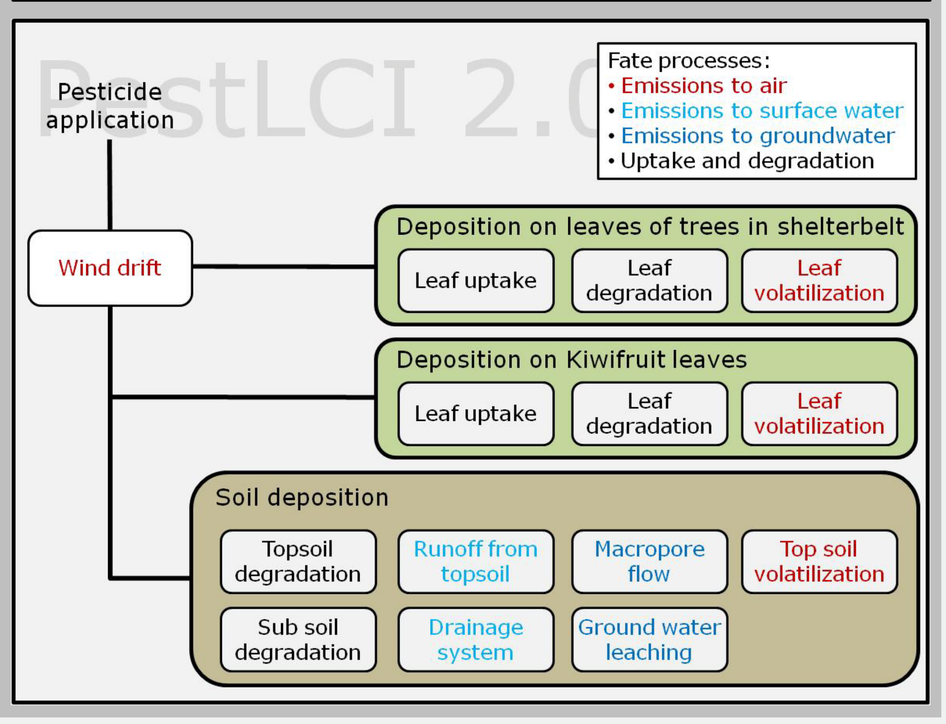
Life Cycle Inventory - 2 modelling approaches

1. Ecoinvent
   Assumes that all pesticides are emitted to soil
2. PestLCI 2.0
   Calculates emissions to air, surface water and groundwater
   Model adaptations
   - Inclusion of kiwifruit, modelling of shelterbelts
   - Updated macropore leaching calculation
   Model inputs
   - 9 pesticides identified from kiwifruit growers' spray diaries
   - 9 spatial scenarios: 4 climatic zones in the Bay of Plenty, each with up to 4 different representative soils

Life Cycle Impact Assessment

Characterization using characterization factors obtained with USEtox





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