IMPACT OF PESTICIDES ON THE GROUNDWATER RESOURCES IN BUENOS AIRES PROVINCE, ARGENTINA

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Introduction

• Increased use of pesticides in Argentina

• Better crop yields ↔ Environmental impact

• Herbicides, insecticides, fungicides, etc.

high potential to affect water resources quality
Materials and Methods

• Selection of pesticides

• Parameter of selected pesticides, e.g.:
  Atrazine, Simazine, Aldicarb, Endosulfan

• Soil samples of the study area

• Simulations with model PESTAN (EPA)
Materials and Methods

Study Area

Rolling Pampas (Pampa Ondulada)

Escobar County

178,155 inhabitants

30,300 ha

Subtropical humid climate

900 mm/a

Aquifers: Pampeano (unconfined, 3-10 m)

Puelches (semiconfined, 30-50 m)

Negative water budget in summer

Irrigation (optimal production)
Materials and Methods

PESTAN (EPA)

• Estimation of vertical migration of dissolved organic solutes through vadose zone to groundwater

• Analytical solution of the advective-dispersive-reactive transport equation (Enfield et al. 1982)
Materials and Methods

PESTAN Model Parameters

Simulation Parameters
- Title: Study of Alachlor residues in Florida soil and water (Jeyes and Back, 1984)
- Recharge Rate: 0.0035 cm/h
- Minimum x value: 0 cm
- Maximum x value: 200 cm
- Minimum Time value: 0 days
- Maximum Time value: 50 days

Output Options
- Breakthrough Curve Dataset
- Location (cm): 100
- Soil Depth Profile
- Time (Days): 50

Pesticide Parameters
- Model Pesticide Values: Alachlor
  - Solid Phase Degradation Rate Constant: 0.0000222
  - Liquid Phase Degradation Rate Constant: 0.000222
  - Depression Coefficient: 2.0
  - Water Solubility: 8000 mg/L
  - Organic Carbon Partition Coefficient (Koc): 15.3 mg/L

Soil Type Parameters
- Model Soil Type: Leach Sand
  - Bulk Density: 1.62 g/cm³
  - Saturated Water Content: 0.41
  - Characteristic Curve Coefficient: 4.38
  - Saturated Hydraulic Conductivity: 0.059 cm/hr
  - Organic Carbon Content (Koc): 0.0001 g/kg

Waste Applications
- Rate (kg/ha): 2
- Start Time (day): 1
- Number of Waste Applications: 1

Introduction  Materials and Methods  Simulation Results  Conclusions
Simulation Results

Maschwitz - loamy sand

- Concentration [µg/l]
- Depth [cm]

- aldicarb
- atrazine
- endosulfan
- simazine

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Simulation Results

Loma Verde - clay

Concentration [µg/l] vs Depth [cm]

- Aldicarb
- Atrazine
- Endosulfan
- Simazine

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Conclusions

Simulation results

• High potential for contamination of groundwater resources by leaching of pesticides, especially atrazine

• Sorption (content of organic carbon in soil) and solubility have most influence

• Recharge rate has a direct impact on the advective transport

• Dispersion minor importance
Conclusions

• PESTAN is a simple model:
  - constant infiltration rate
  - persistence / no metabolites

• More precise analysis of the groundwater contamination risk by pesticides

  ← Complex model
Conclusions

• Show farmers in Argentina and other threshold and developing countries that there are potentials of the contamination of the water resources by pesticides, like atrazine

→ PESTAN is an appropriate model for a general risk analysis of groundwater contamination
Muchas gracias!

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