PESTICIDE ASSESSMENT IN THE BANANA SECTOR IN ECUADORIAN WATERSHEDS

UNIVERSITEIT GENT

ESPOL 1958 ESCUELA SUPERIOR POLITECNICA DEL LITORAL Guayaquil - Ecuador

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Introduction

The Ecuadorian banana sector represents more than 30% of total exportation from the country. In 1998, there were more than 135000 Ha of banana crops located in five provinces along the coastal region in Ecuador (El Oro, Guayas, Los Ríos, Esmeraldas and Manabi). Environmental issues are relatively new in the sector.

Project's Financial Support: VLIR (Vlaamse Interuniversitair Raad)

Project's developers: ESPOL (Ecuadorian University) and BIOMATH, at the Faculty of Agricultural and Applied Biological Sciences (Gent)

Objectives

The short-term objective is to determine the real impact caused by pesticides used in the Ecuadorian banana sector. This poster presents initial steps taken in the project.

Specific Objective in this poster is the preevaluation of the pesticide impact using screening models based on gathered data.

Methodology

- Literature and Data Review
- Field visits
- Evaluation of Screening Models (EQC and EXAMS)

Sources of Information

- ✓ Ecuadorian Ministry of Agriculture.
- ✓ Ecuadorian National Bank (Banco Central del Ecuador).
- ✓ Ecuadorian Commission for Development of the Guayas River Basin (CEDEGE)
- ✓ National Corporation of Banana Producers (CONABAN)
- ✓ ***THE FARMERS***.

Main problems getting the information:

- In Ecuador, it is difficult to get environmental records on a periodical basis.
- Most of the farmers are not willing to open their plantations to research studies.
- Some farmers are more interested in their product sales than in the environment.
- There is no specific environmental enforcement for the banana sector.

Getting into the Farms:

Seven (7) farms were visited based on the following criteria:

- Acceptance of farmers to visit their plantations.
- Fair distribution of visited farms among the three most productive provinces: Guayas (3), El Oro (3) and Los Ríos province (1).
- Two of the farms belong to a big national producer corporation (more than 6000 Ha.), which owns another 37 farms with the same pesticide management.
- A basic questionnaire was used to get data from the farmers

Figures below show visited sites as red spots (some spots represent two farms) and a summary of the results obtained with questionnaire.

Main Issues in the Survey

Farm information
Labor information
Crop Information
Pesticide Management
Packaging process
Soil information
Meteorological information
Irrigation Systems

Numbers of farms visited	7
Total cultivated area within visited sites	1407 Ha. (6770 Ha.) *
% Area relative to Banana Sector (135000 Ha.)	1.04 % (5.01 %)
% relative to total farms in Ecuador	0.14 % (0.89 %)
Average banana plant population	1478 plants per Ha.
Average production	30 boxes per week per Ha.
Average number of packaging facilities	1 per 100 Ha.
Average number of pesticides used in a farm	≈ 10
Average number of application cycles	≈ 15 per year
Pesticides most used in the farms	Imazalil (packaging), Thiabendazole (packaging) Tridemorph (aerial spray), Propiconazole (aerial spray), Glyphosate (manual spray)

* Number increases when considering other farms owned by the big corporation.

Screening Models Evaluation

The average distribution of the detected pesticides in an unitary environment were done using the following screening models:

- **E**nvironmental **Q**uality **C**riteria Model (EQS), version 1.01 (Mackay, DiGuardo, Paterson & Cowen, May 1997)
- **EX**posure **A**ssessment **M**odeling **S**ystem (EMACS) version 2.98.01 (Burns, September 2000)

Screening Models' Comparison Table

	EQC	EXAMS
Computer Environment	Windows interface	DOS
Type of Model	Deterministic (steady-state)	Deterministic (steady-state)
Compartment layout	Air, soil, water, sediment (Unique compartments)	Water, sediment (multiple linked compartments)
Compartment geometry	Constant	Can be changed
Chemical data	• All asked data is necessary to run the model • Only one chemical at a time	• The model can estimate some lacking data • Up to 5 chemicals + 6 ion species
Transport Processes	Advection	Advection + Dispersion
Environmental data	It is not site-specific at all	It is site-specific

Results

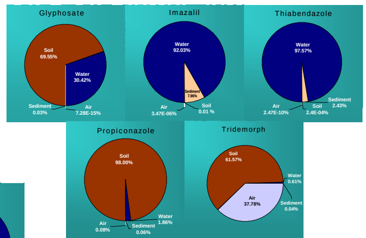
Conditions

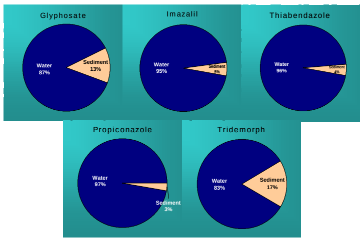
Hypothetical loading rate = 1000 kg / hour
Chemical data are averages of several data sources found in literature.
Same unitary world was evaluated.
Steady-State Analysis

EQC Running

Loading rate applied to:

- Soil (Glyphosate)
- Water (Imazalil, Thiabendazole)
- Air (Propiconazole, Tridemorph)





EXAMS Running

Loading rate applied to water compartment via:

- Runoff Load (Glyphosate)
- Stream Load (Imazalil, Thiabendazole)
- Drift Load (Propiconazole, Tridemorph)

Comparison between models

Due to different approaches considered in both models, the overall results cannot be compared. However, EXAMS results can be compared with the aquatic portion of EQC results, i.e. for **Tridemorph**

EQC's aquatic (sediment – water) distribution = 0.643 kg / 100 kg

Considering EXAMS results:	Sediment = 0.643 x 17 % = **0.11 kg / 100 kg**
	Water = 0.643 x 83 % = **0.533 kg / 100 kg**
Compare to EQC results:	Sediment = **0.033 kg / 100 kg**
	Water = **0.607 kg / 100 kg**

CONCLUSIONS

- Soil and water compartments are the most affected by pesticides used in the Ecuadorian Banana Sector. However, the air compartment receives a significative input when ***Tridemorph*** is used.
- In this case study, water compartment predictions with EXAMS are between 0.87 and 1.03 times the prediction for the same compartment using EQC.
- There is not enough data for every pesticide to get conclusive results.

NEXT STEPS IN THE PROJECT

- Apply the EXAMS model in a specific river on the Ecuadorian banana sector to see the impact of different discharges along the river. The river will be divided in the maximum allowable number of segments (50 compartments)
- Evaluate other models to get integration with a Geographical Information System.

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BIOMATH

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