

Environmental Impact of Glyphosate use in Argentina

Dr. Damián J. Marino



Andrés Carrasco: 16 de Junio de 1946-10 de Mayo de 2014

Thank you for all your work...

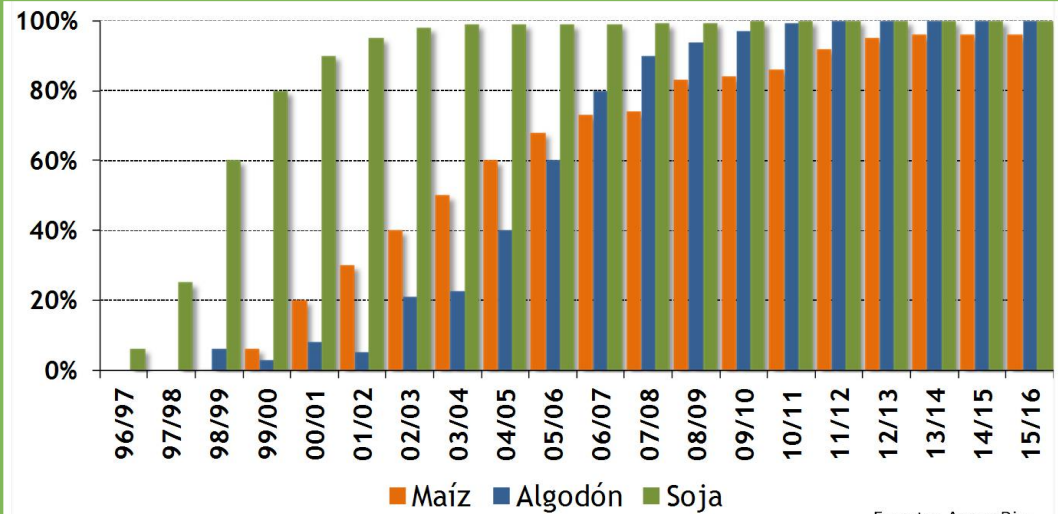
A photograph taken from inside a building, looking out through an open window. The window frame is dark wood. Outside, a large, leafy green tree dominates the center of the view. The tree has many small, light green leaves and some small, yellowish-green catkins hanging from its branches. The tree is situated in a grassy field. In the background, there is a line of trees and a field of tall, green crops, possibly corn. The sky is overcast and grey. The text "Welcome to the Agroproductive Model in Argentina" is overlaid on the bottom half of the image in a green, sans-serif font with a black outline.

Welcome to the
Agroproductive Model
in Argentina

Agroproductive Model

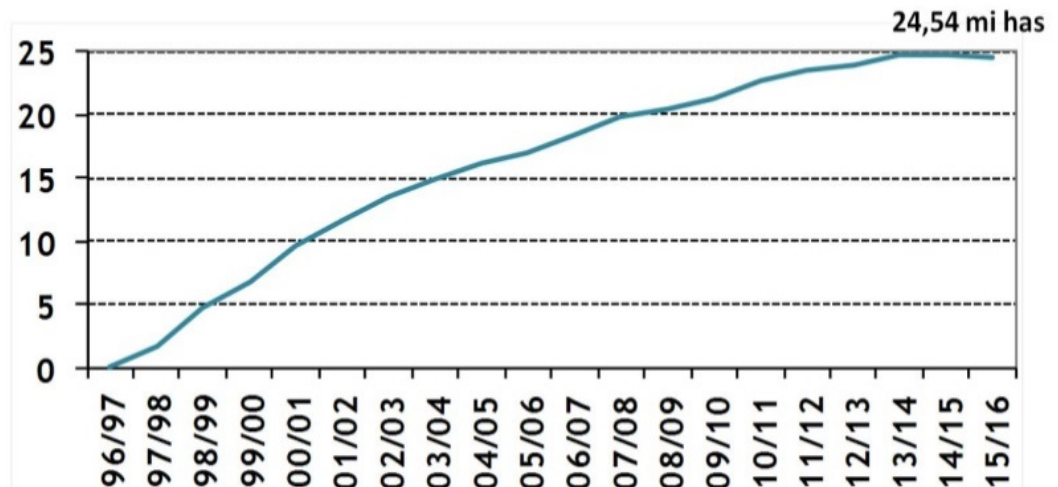
Types
of
crops

GMO
(Soya RR,
Corn BT)



Fuente: ArgenBio

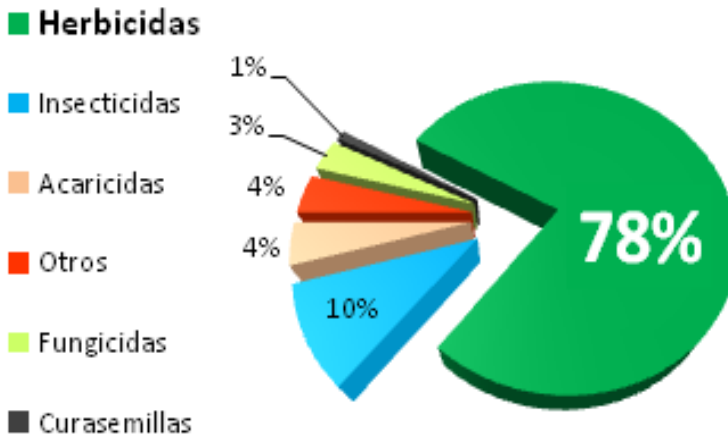
Direct
Seeding



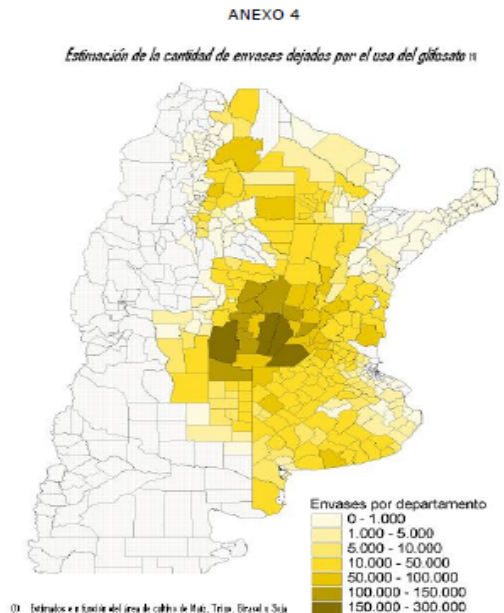
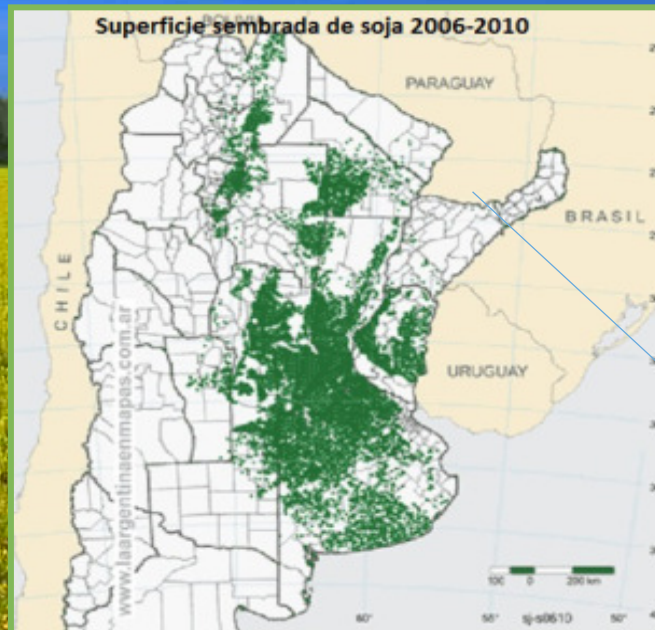
Agroproductive Model

Pestici-
des

Environ-
mental
Impact

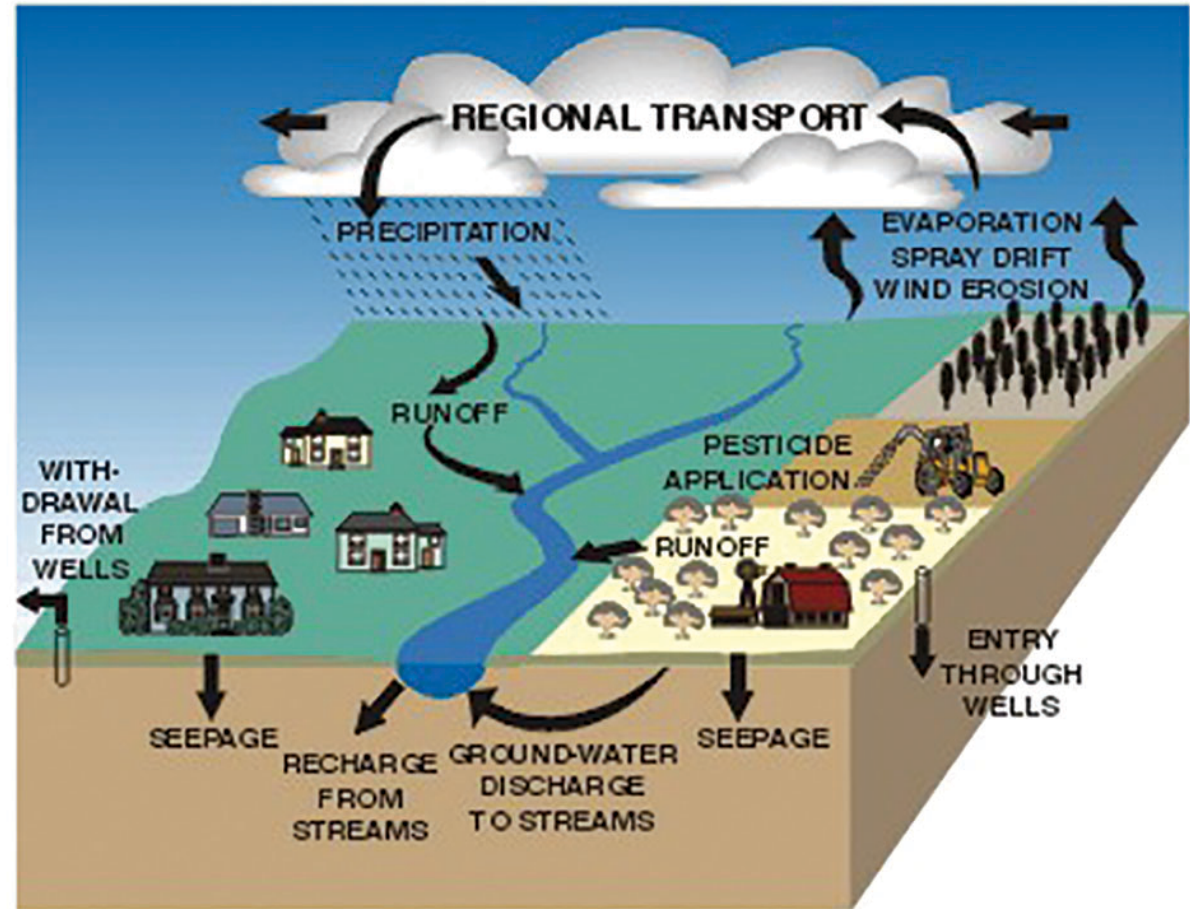


- ❖ 3 L/Ha ('90)
- ❖ 10 L/Ha (2000-10)
- ❖ 317 millones L/Kg pesticides formulations



Environmental Dynamic of Pesticides

- Physicochemical properties.
- Climate: wind, rain, temperature...
- Pesticide application procedure and equipment.



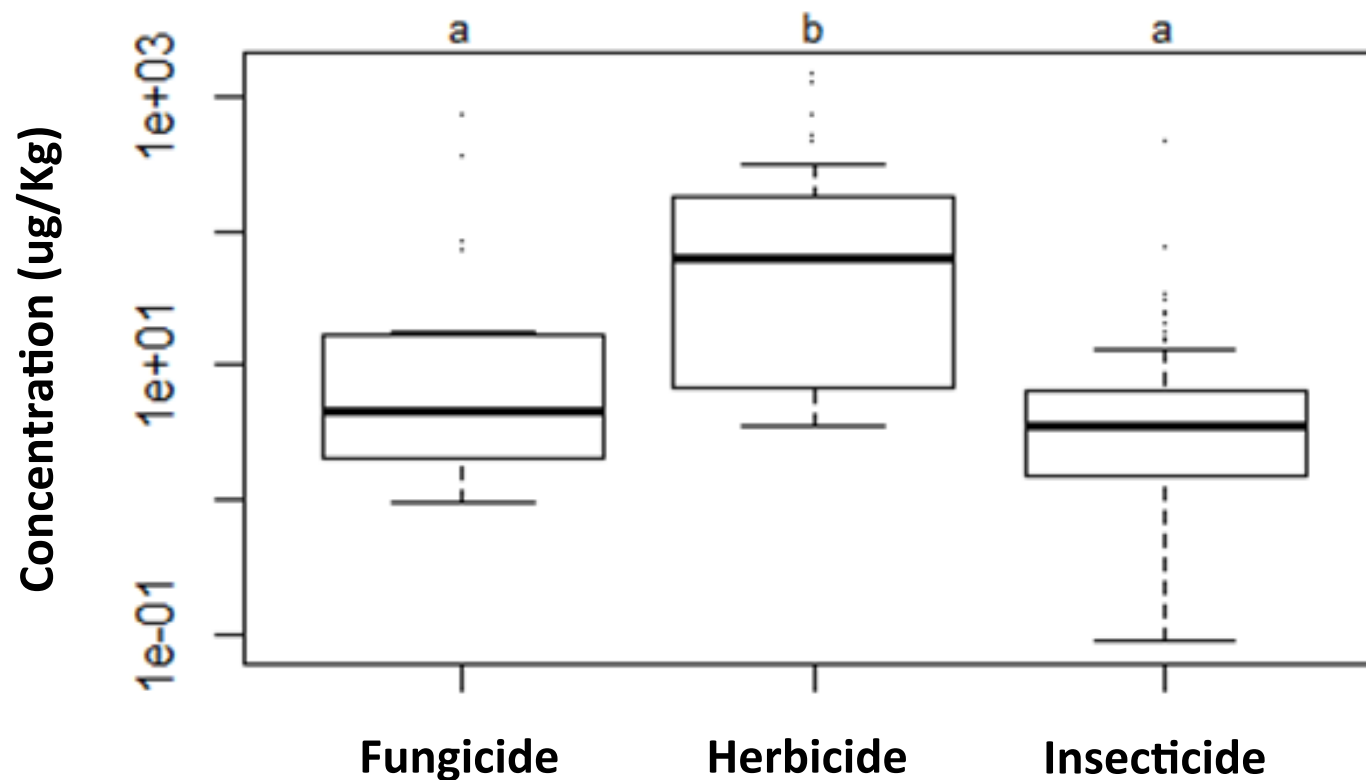
Case Study 1: Soil samples

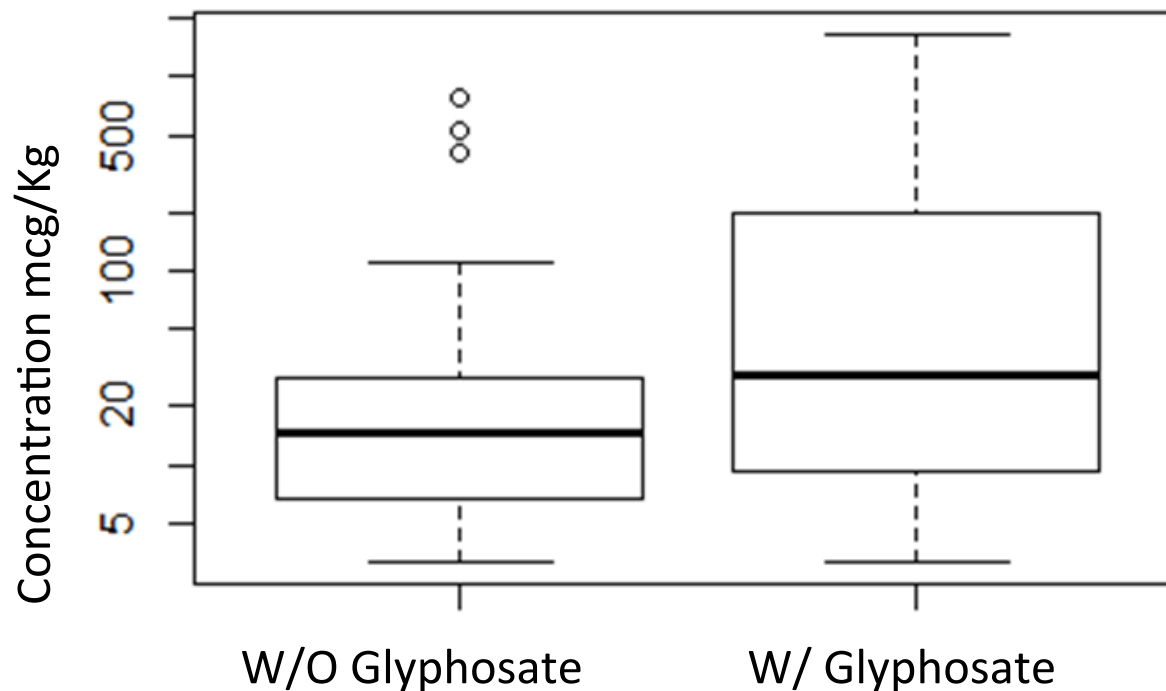


Samples:
1. Sub-superficials
2. Integrated

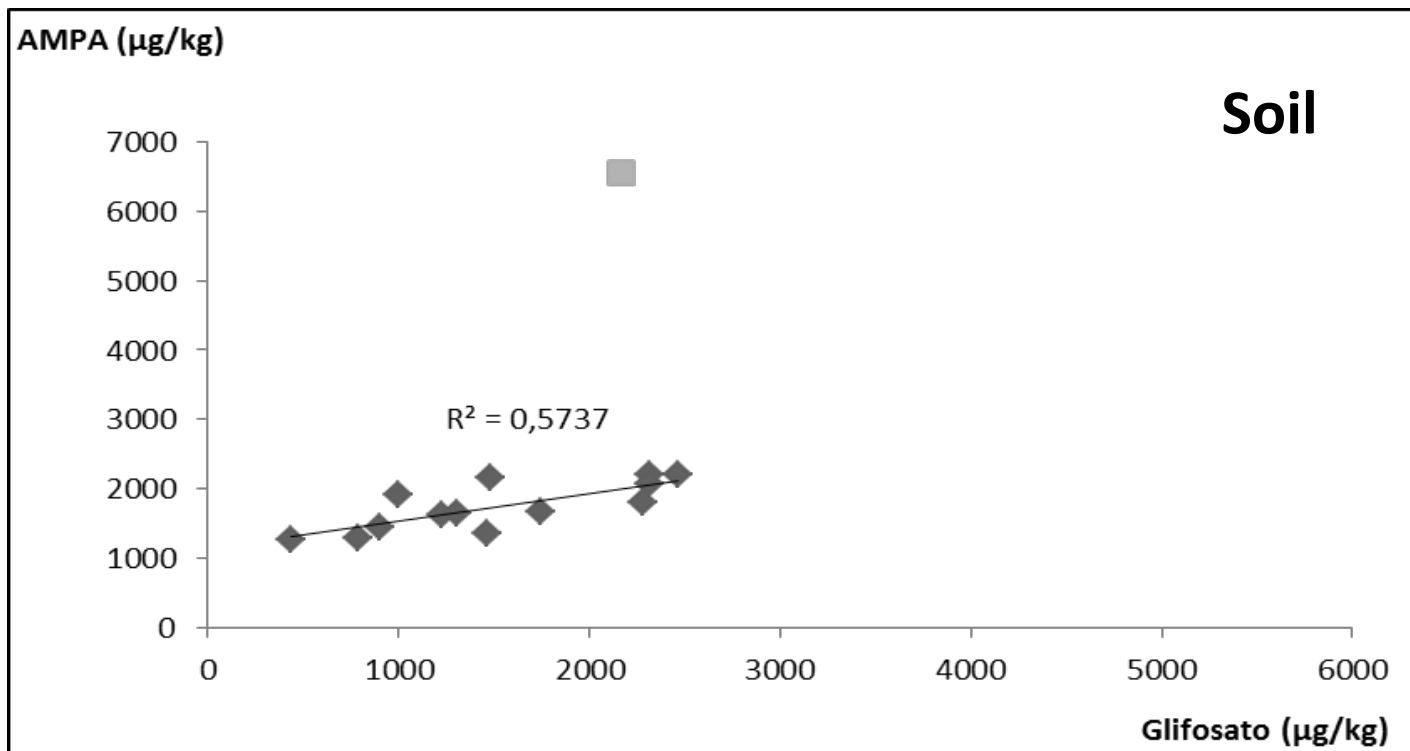


Concentration of pesticide by target action.





- Between 89% and 100% of the total pesticide mass, corresponded to glyphosate and AMPA.



- Quantitative relationship between soil levels of Glyphosate and AMPA.
- AMPA is an indicator of the evolution of glyphosate in the environment.

INFORMATION FROM THE LAST 6 YEARS

- i) Final applied dose in each cultivated area.
- ii) Total applied dose in each cultivated area, during last campaign.
- iii) Total applied dose in each cultivated area, during the last 6 years.

→ $r^2 = 0,0831$

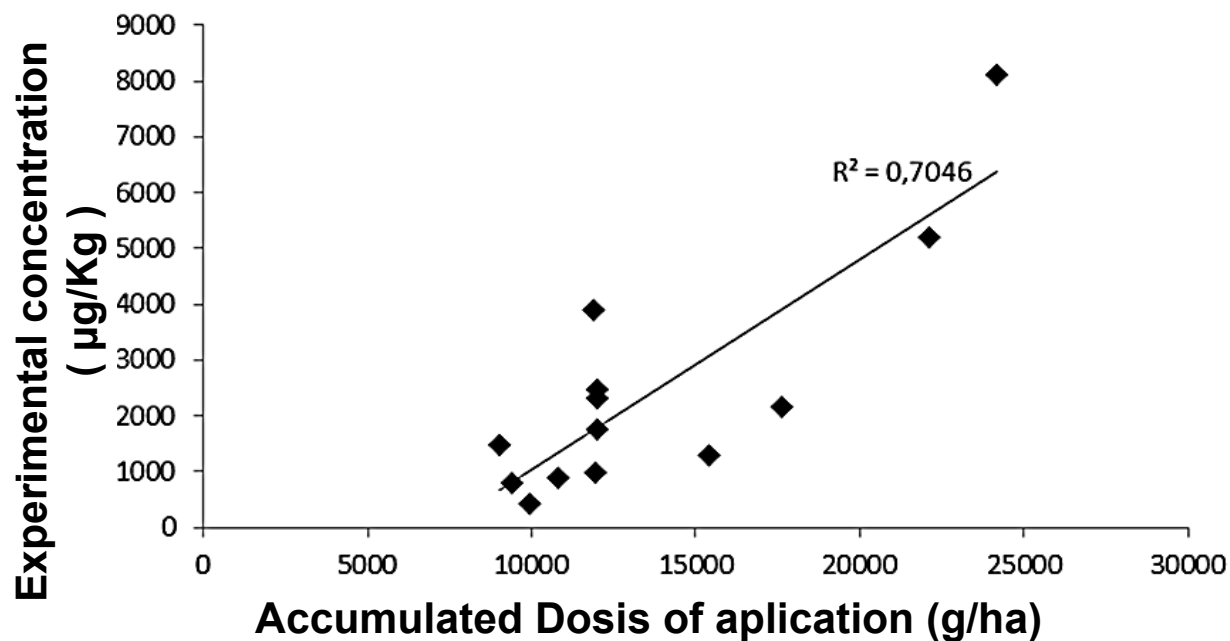
→ $r^2 = 0,4856$

→ $r^2 = 0,7046$

Vs.

*Soil level of glyphosate in
each cultivated area*

Accumulation
in the
environment



Environ Monit Assess (2016) 188:458
DOI 10.1007/s10661-016-5467-0



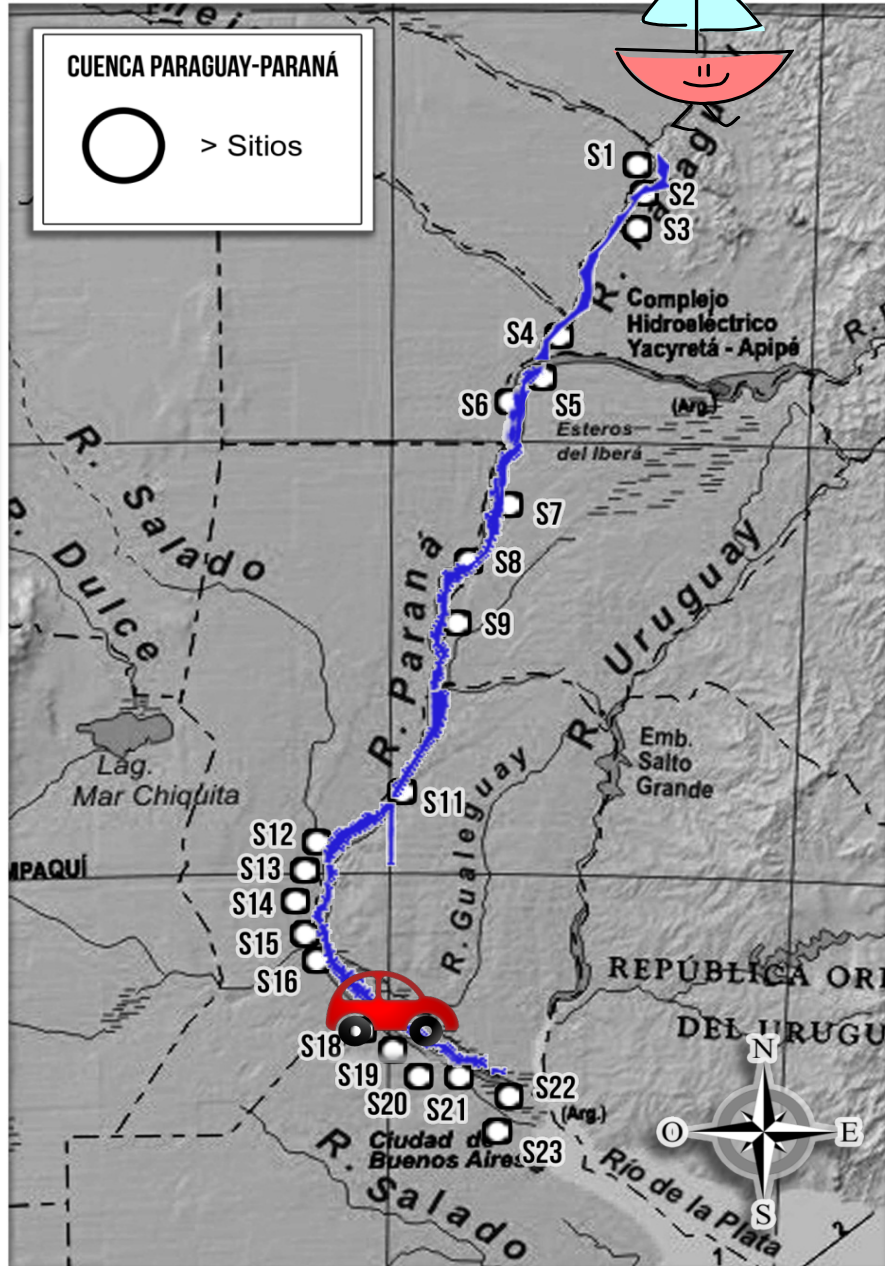
Water quality of the main tributaries of the Paraná Basin: glyphosate and AMPA in surface water and bottom sediments

A. E. Ronco • D. J. G. Marino • M. Abelando •
P. Almada • C. D. Apartin

- ✓ High social impact in Argentina.
- ✓ Showed evidence of the long-range transport potential for Glyphosate and AMPA in the environment.
- ✓ Gubernamental interest.

Case Study 2: Paraná-Paraguay- SEDIMENTS

 **PREFECTURA
NAVAL ARGENTINA**

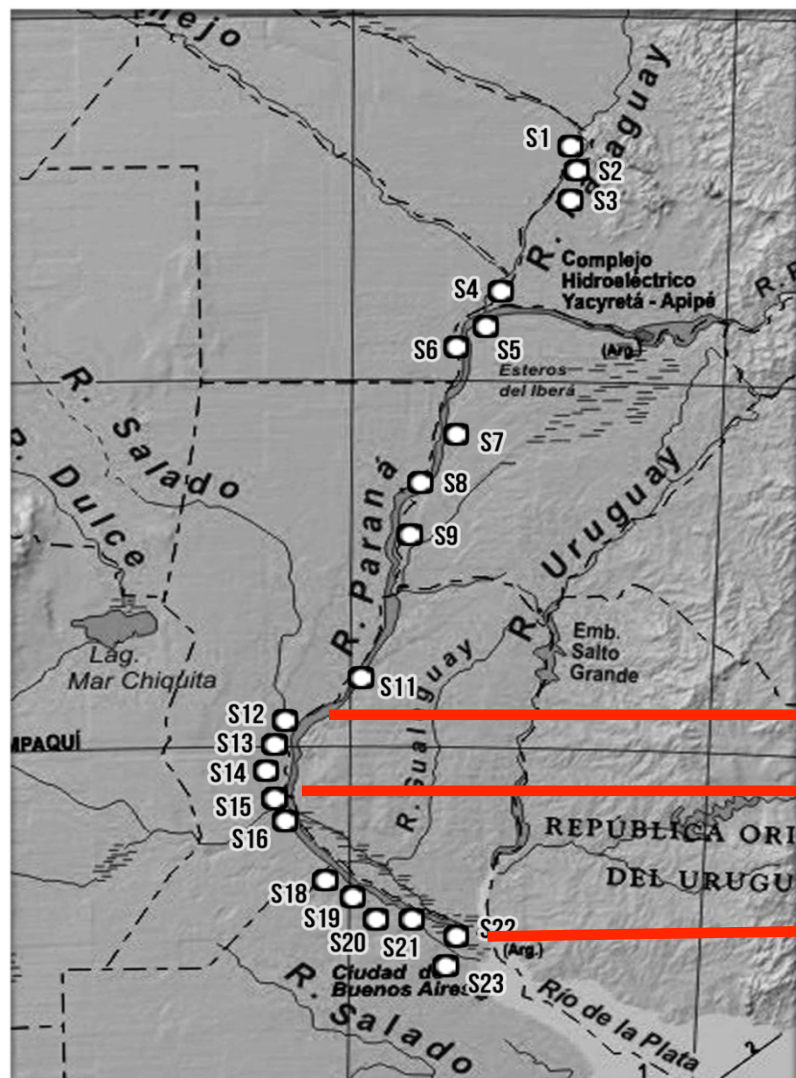


23 Site Samples

- I. Water
- II. Sediments
- III. Suspended particulate matter

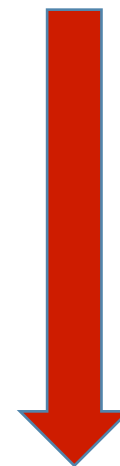
Relevant results

- Low detection frequencies and concentration levels in water (whole water and soluble fraction).
- Was detected in suspended particulated matter.
- High concentrations in bottom sediments (> 1000 times more than water).



LD/LD $\mu\text{g/kg}$

GLY/AMPA $\mu\text{g/kg}$

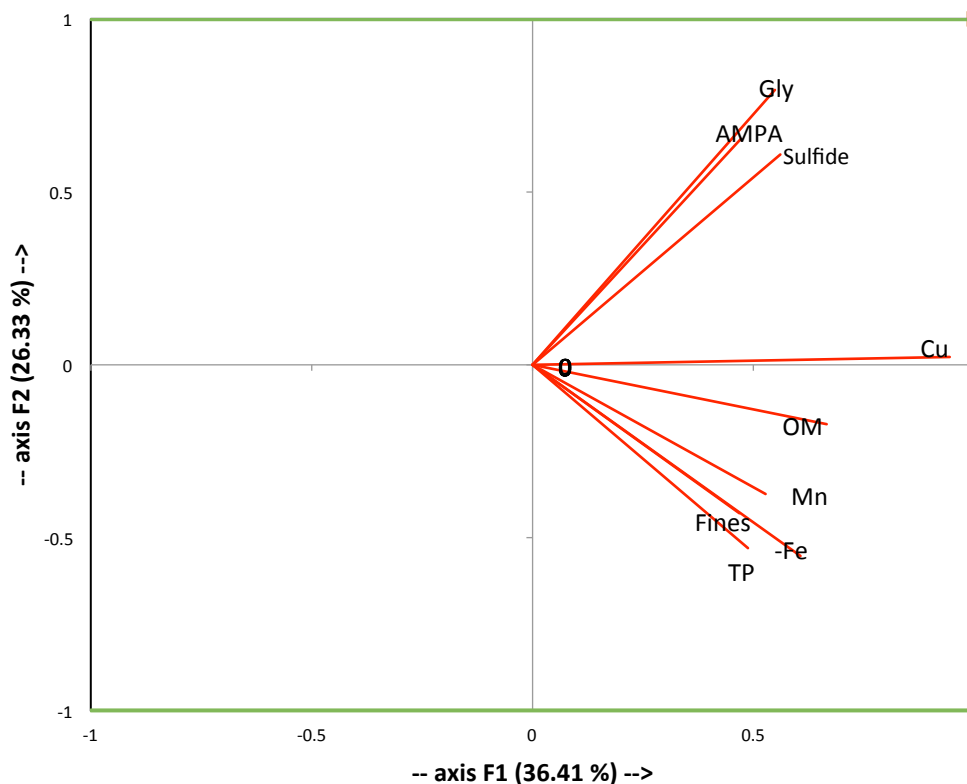
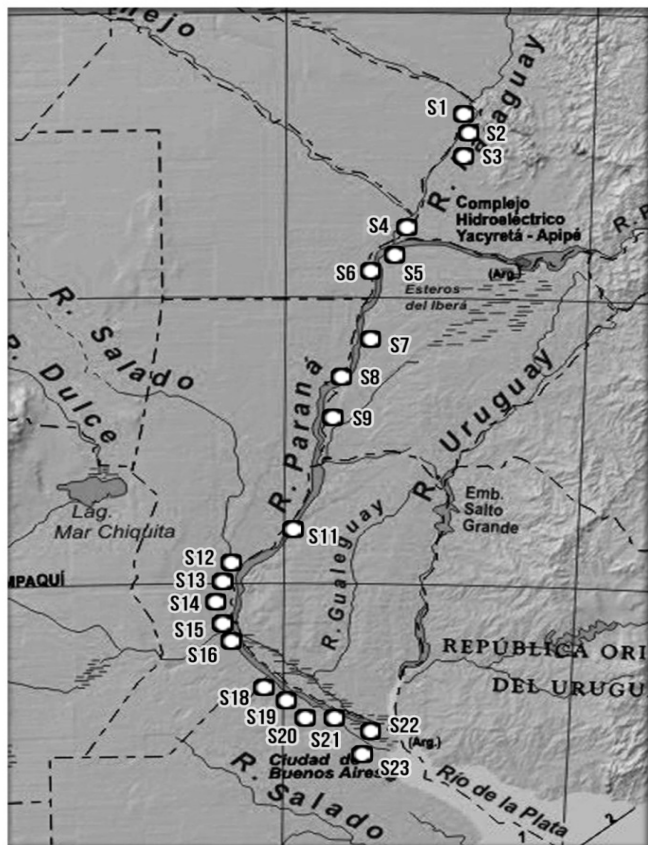


500/200 $\mu\text{g/kg}$

1800/470 $\mu\text{g/kg}$

3000/5300 $\mu\text{g/kg}$

Principal Components Analysis (PCA) of general parameters in sediments and glyphosate/AMPA.



SULFIDE? COPPER?

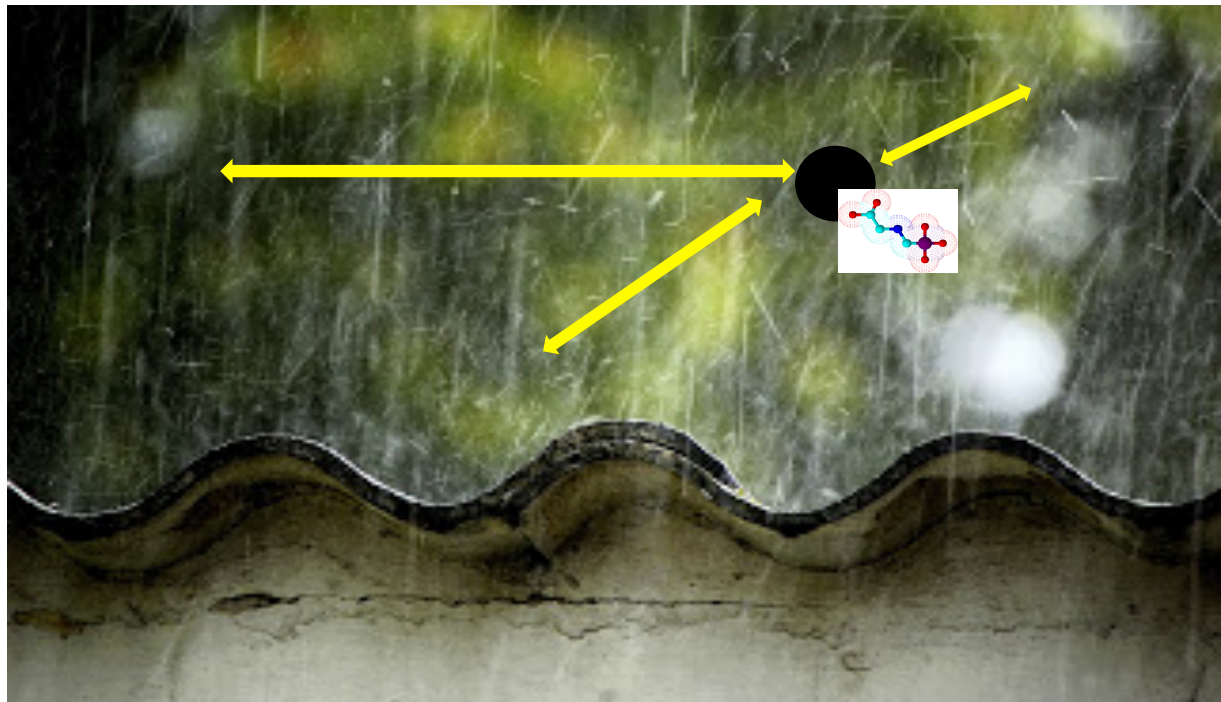
RAIN...

Case Study 3 : Glyphosate and AMPA in rainfall

- input
- degradation
- distribution



- Persistence
- Environmental Fate



- **Glyphosate** in Indiana , USA, application dose up to **2,8 L/Kg-Ha** with maximum level detection in rainfall of **2,5 µg/L**.
- **Atrazine**: 110.000 Kg/year in the Mississippi watershed (USGS) from rainfall.

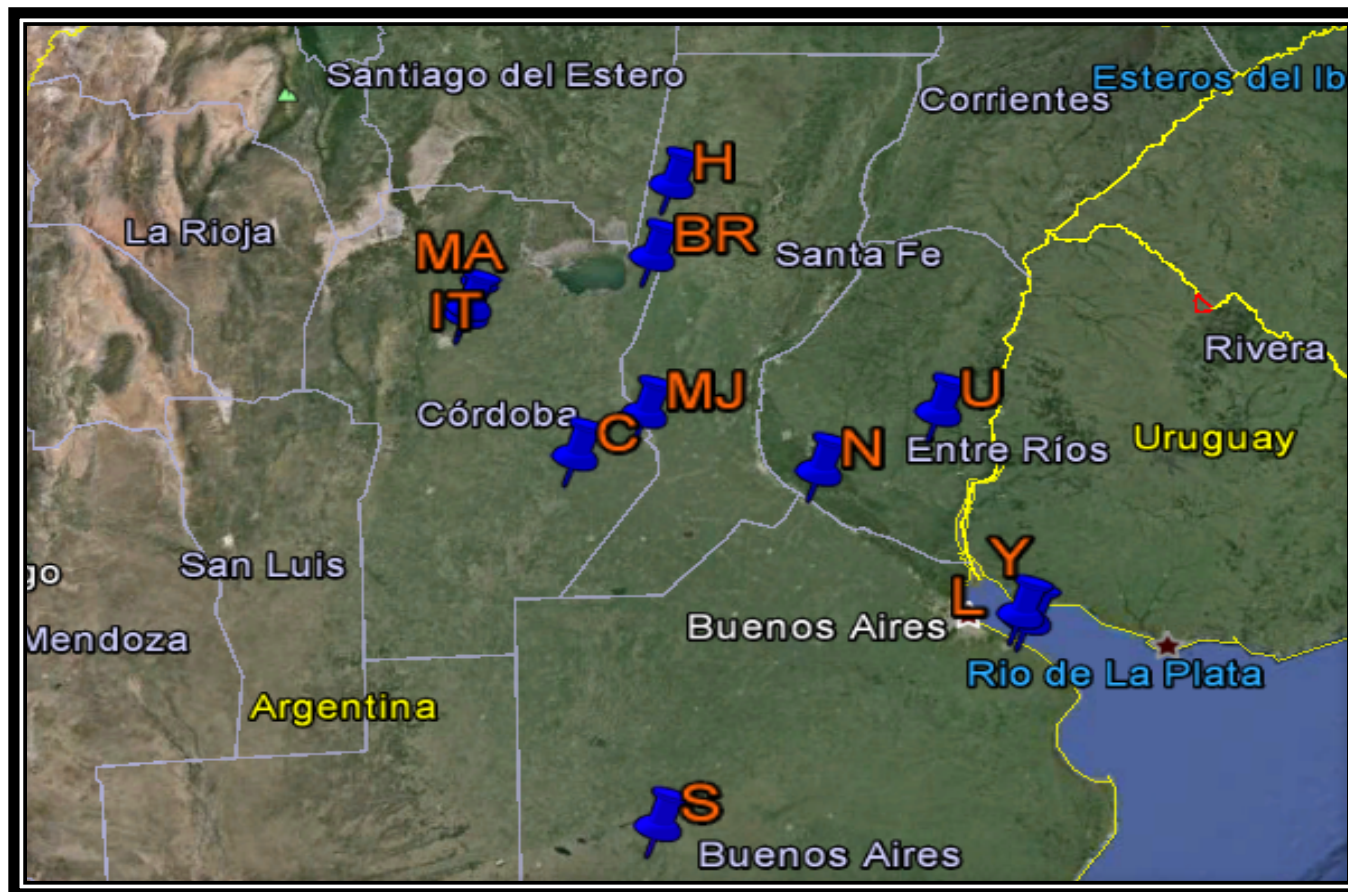
PSEUDO-PERSISTENT (EPA)

ARGENTINA? (10-15 l/Kg-Ha)...

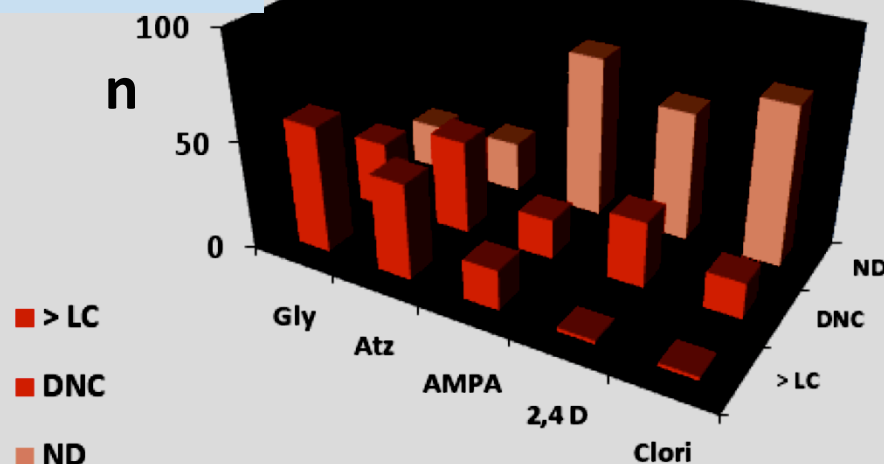
***Can we stand
under the
rain like
Homer and
Bart?***



9 sampling sites / 2 campaigns / n=112 rainfall samples



Detection Frequencies

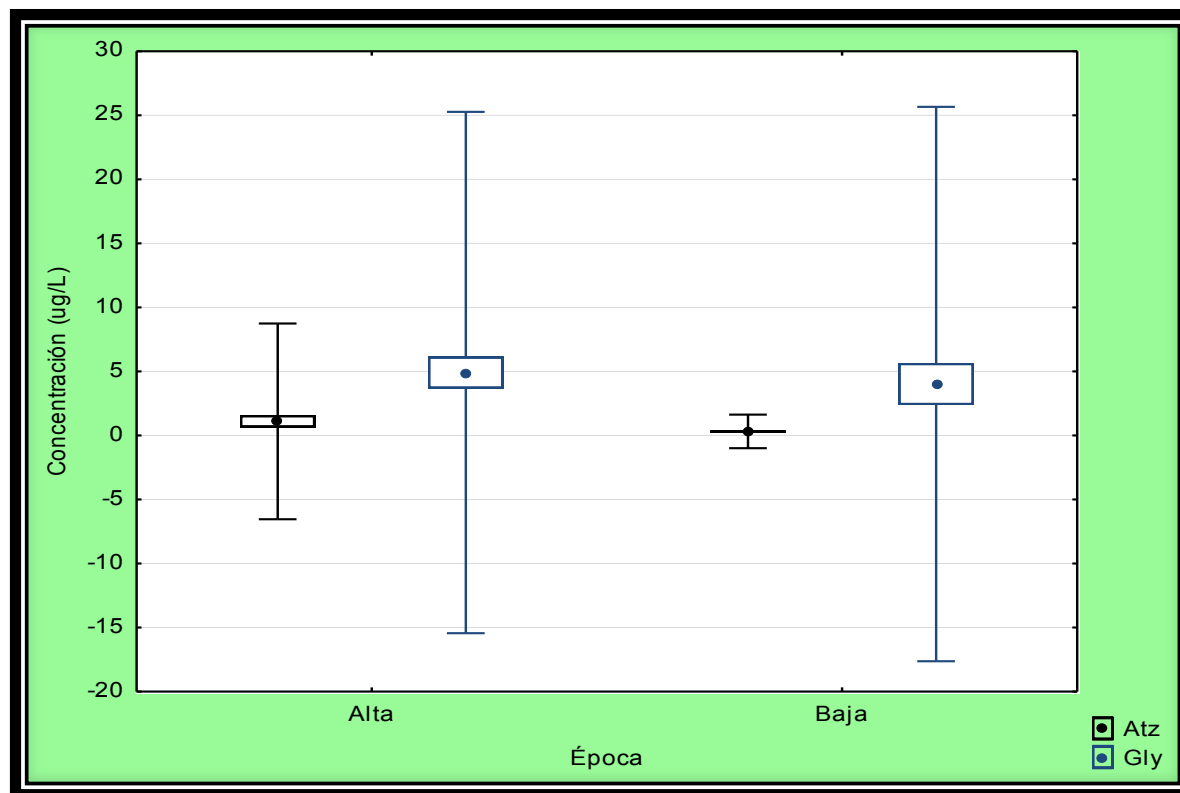


Glyphosate and Atrazine:
Most detected.

Glyphosate: concentration
significantly higher than
other herbicides

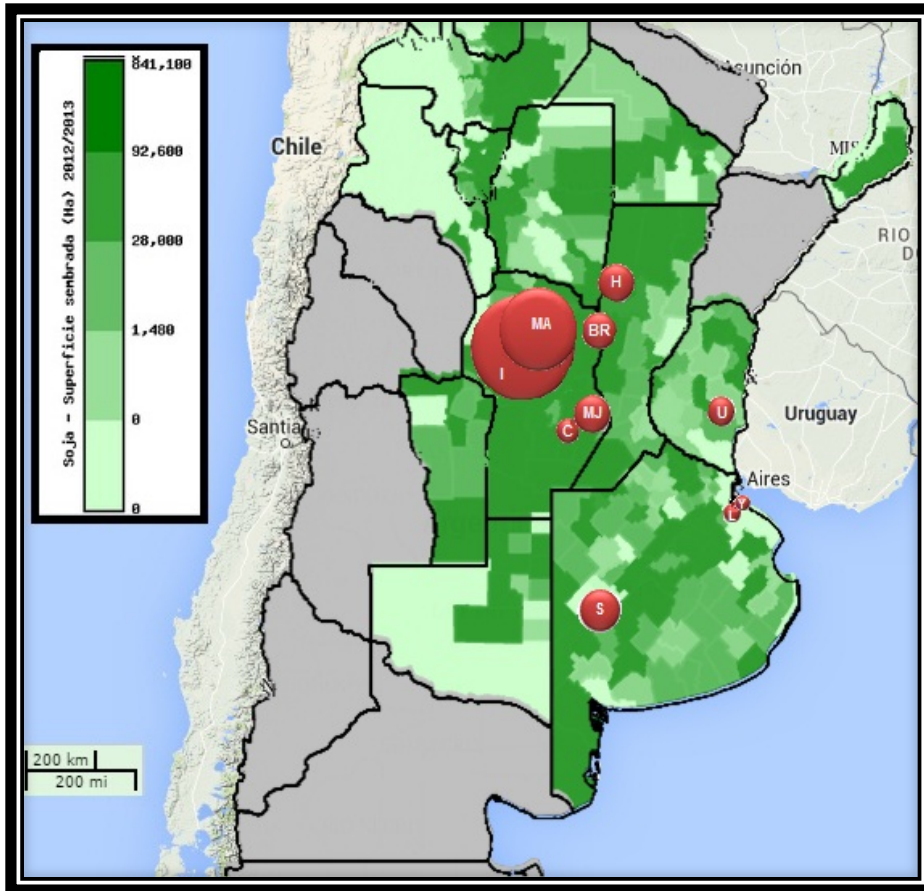
Concentration in rain (µg/L)	GLY	AMPA	Atz
Average ± DE (n)	4.5 ± 10.4 (112)	<LC ± 1.2 (112)	0.8 ± 3.0 (112)
Concentration Intervals	(LD-67.3)	(LD-7.9)	(LD-26.9)

➤ Frequencies and amount of
rainfall could be conditioning
the level of glyphosate and
AMPA.



No significative
differences between
sampling campaigns

- Glyphosate → year-round applications
- Wind erosion occurs independently of the season and the time of pesticide application.

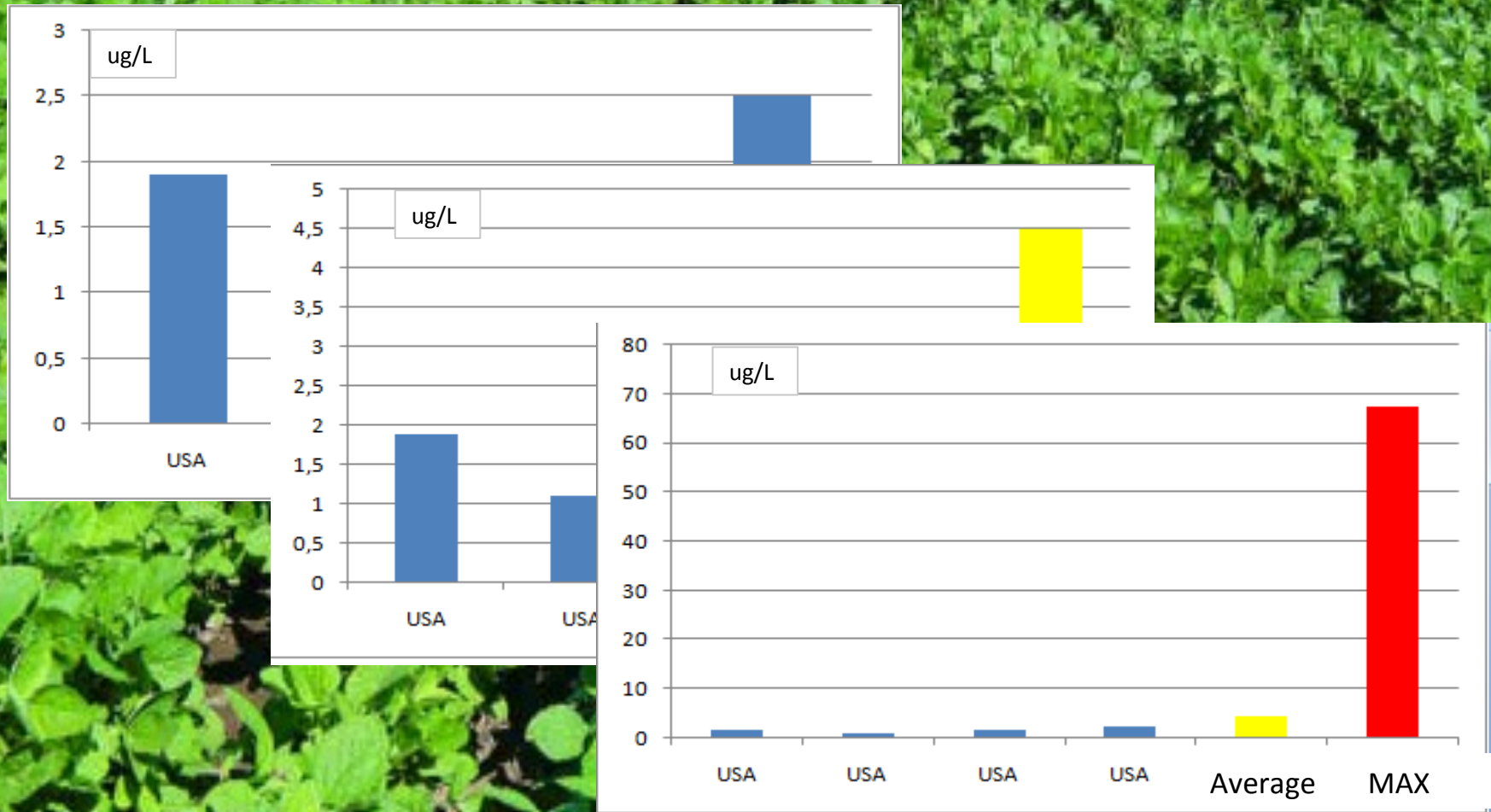


- Maximum concentration increases from EAST to WEST ($p < 0,05$).
- No influence in NORTH-SOUTH direction.
- Influence of the continental input to the atmosphere.

International context

Glyphosate:

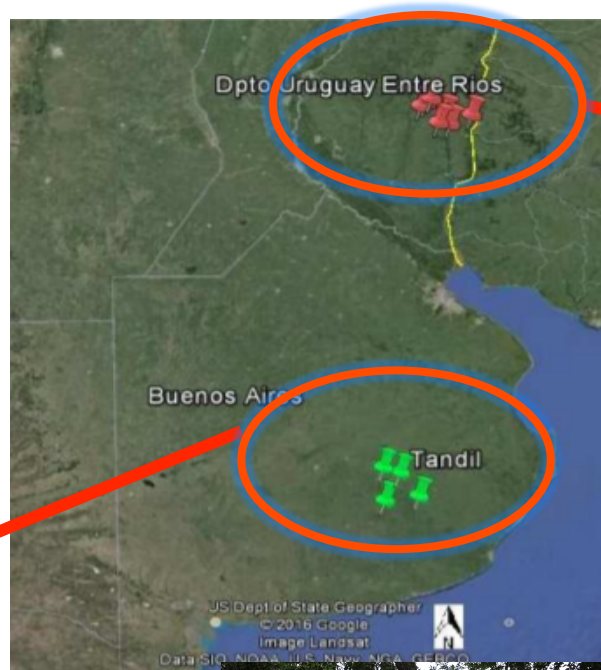
Remember: 2,8 L/Kg-Ha USA vs 10-15 L/Kg-Ha Argentina



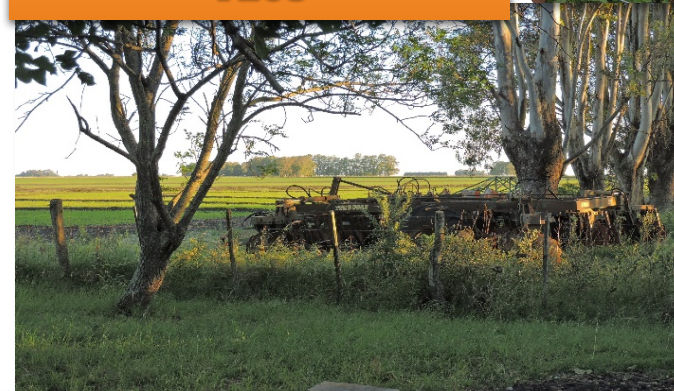
Case Study 4: Glyphosate and AMPA in rural schools



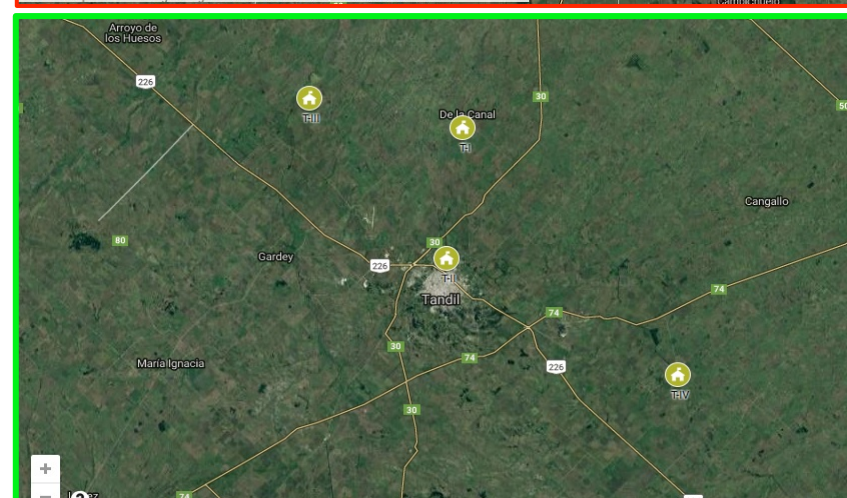
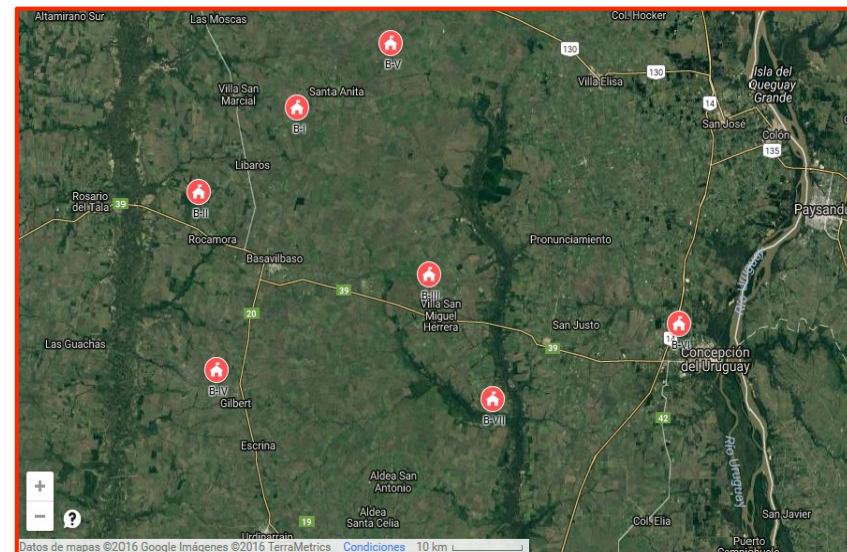
Tandil, Buenos Aires



Dpto. Uruguay, Entre
Ríos



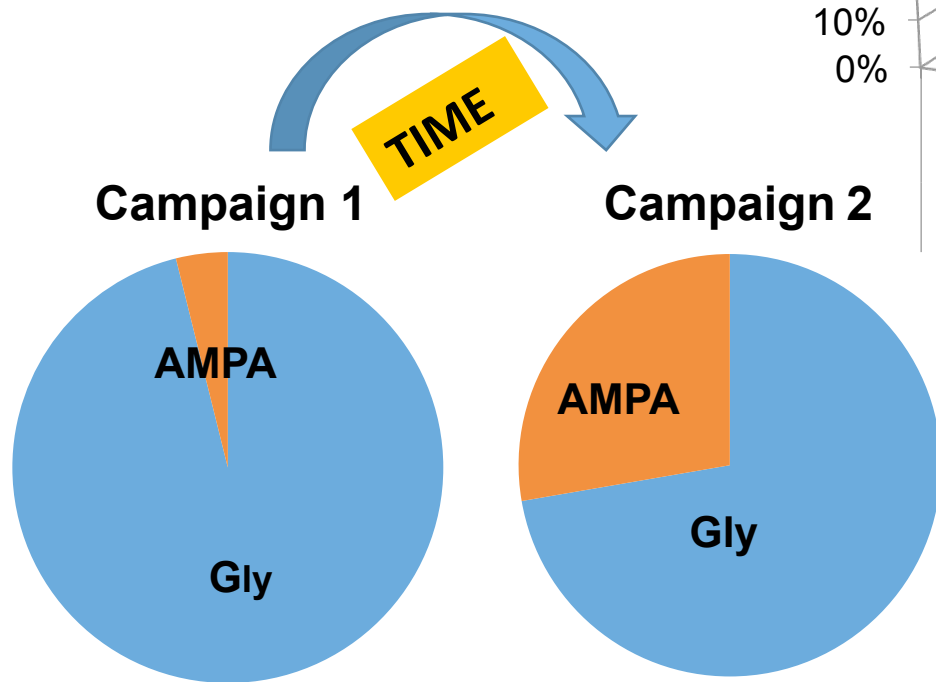
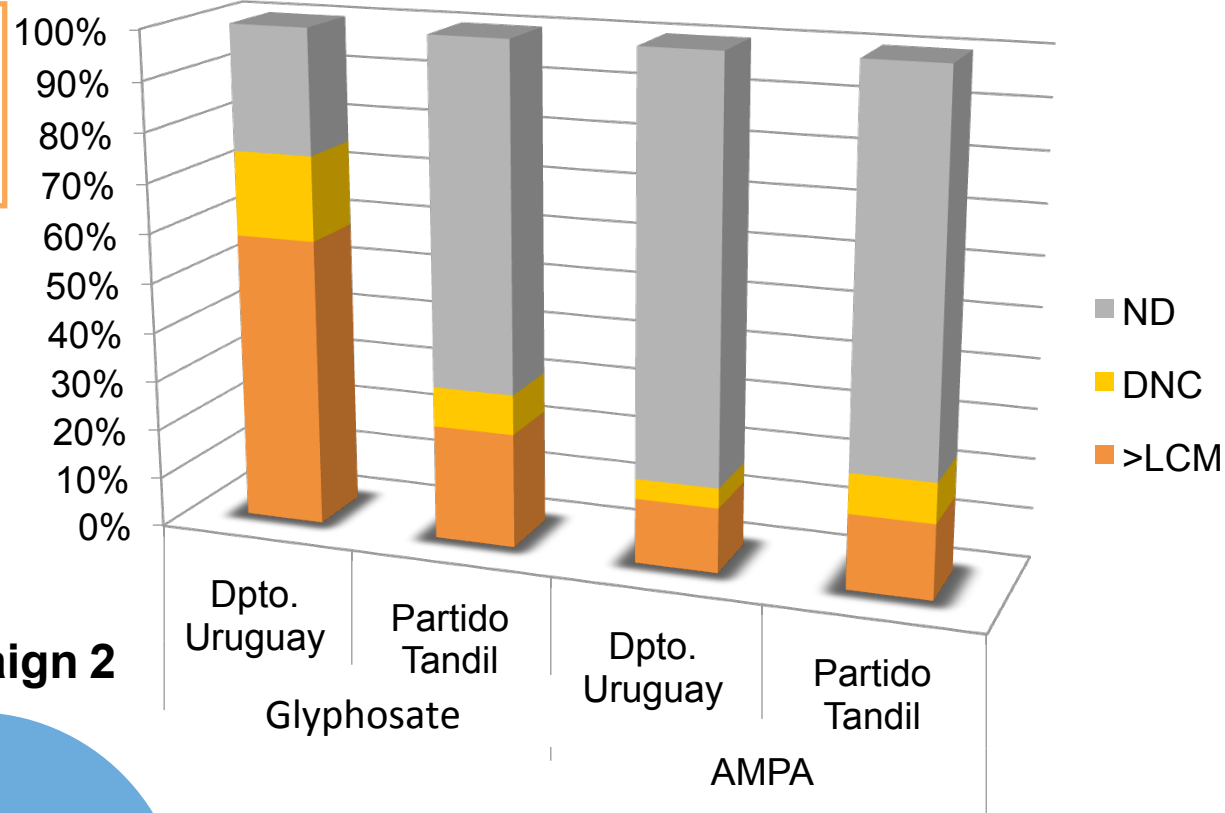
School	Campaign 1	Campaign 2	N° samples/ campaigns
B-I	26/11/15 - 21/12/15	19/05/16 - 04/06/16	28
B-II			
B-III			
B-IV			
B-V			
B-VI			
B-VII			
T-I	07/12/15 - 31/12/15	11/03/16 - 04/04/16	16
T-II			
T-III			
T-IV			



Samples by study regio and campaigns / Passive Methods

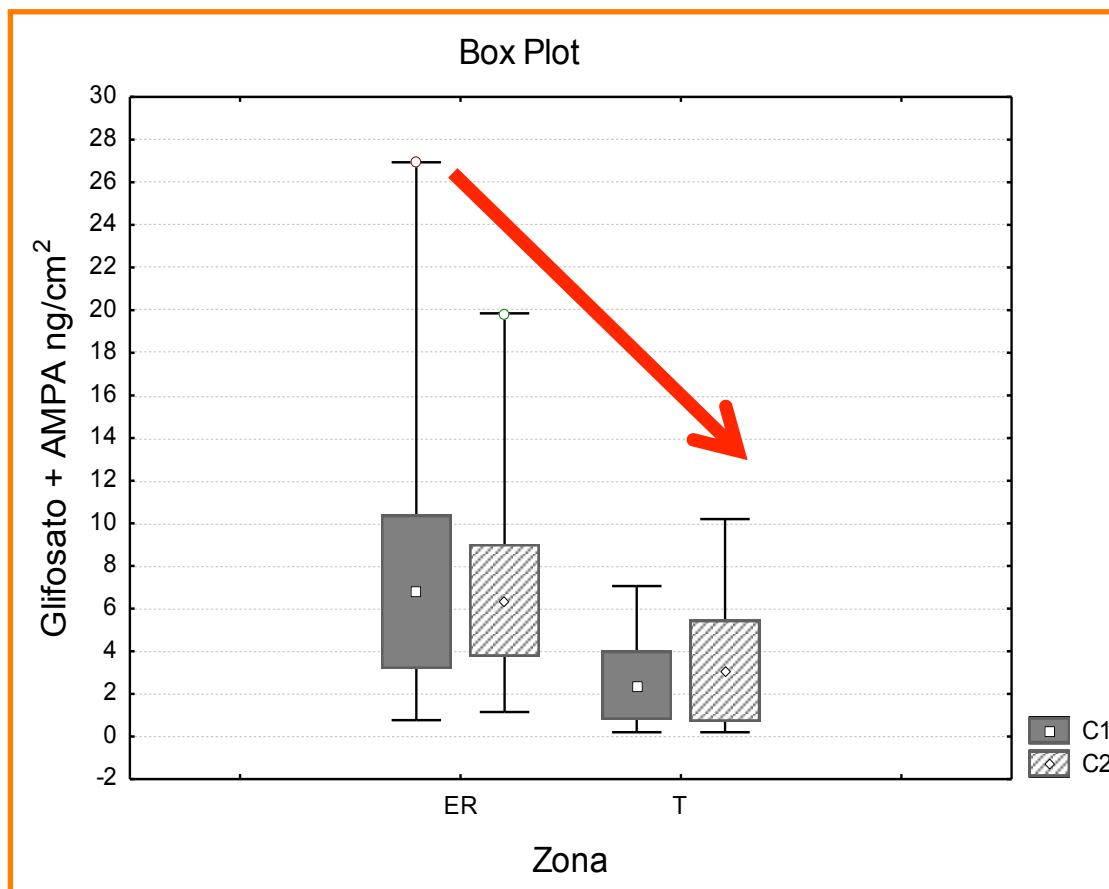
Detection frequencies: Glyphosate and AMPA

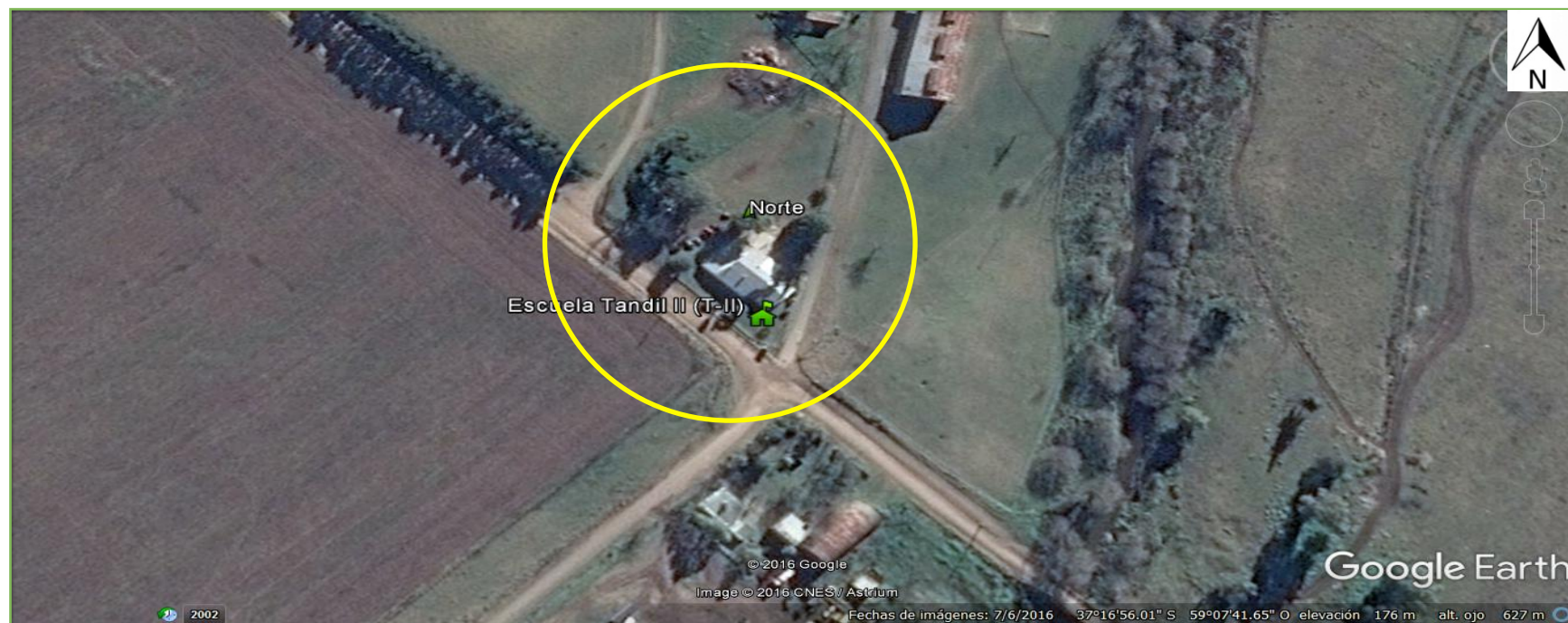
By study region



By compound

Range of concentration of glyphosate+AMPA by study region and campaign.





Campaign 1

School	Cardinal Point	Glyphosate	Territorial observation
		ng/cm ²	
T-II	N	<LD	W/O Cultive
	S	<LD	Edification
	E	<LD	W/O Cultive
	W	4.53	Soya (20 meters)

Case Study 5: Glyphosate and AMPA in Cotton – First study in the world

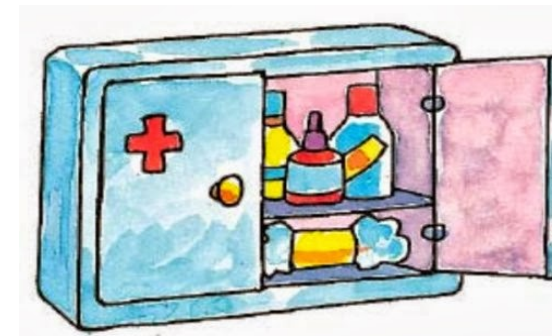
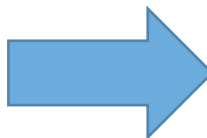
- ✓ First planting 1894/95
- ✓ Actual production 745,395 ton

GRANULOS SOLUBLES
Para el control post-emergente de malezas gramíneas,
ciperáceas y de hoja ancha en pre-siembra de cultivos con
Labranza Convencional y con Siembra Directa y en
post-emergencia de variedades de Soja RR, Maíz RR y Algodón
RR genéticamente modificadas, tolerantes al principio activo.

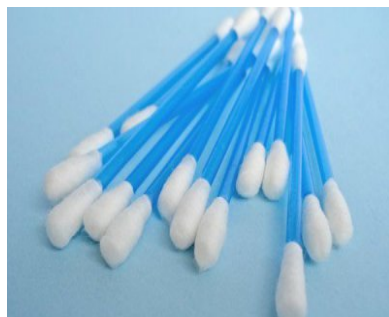
COMPOSICION

glifosato (sal monoamónica de la N-fosfonometil glicina)	74,7 g.*
inertes y coadyuvantes c.s.p.	100 g.

*equivalente a glifosato ácido 67.9 % p/p



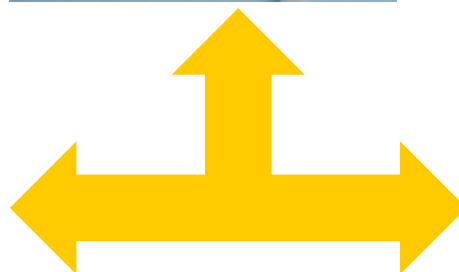
RESULTS



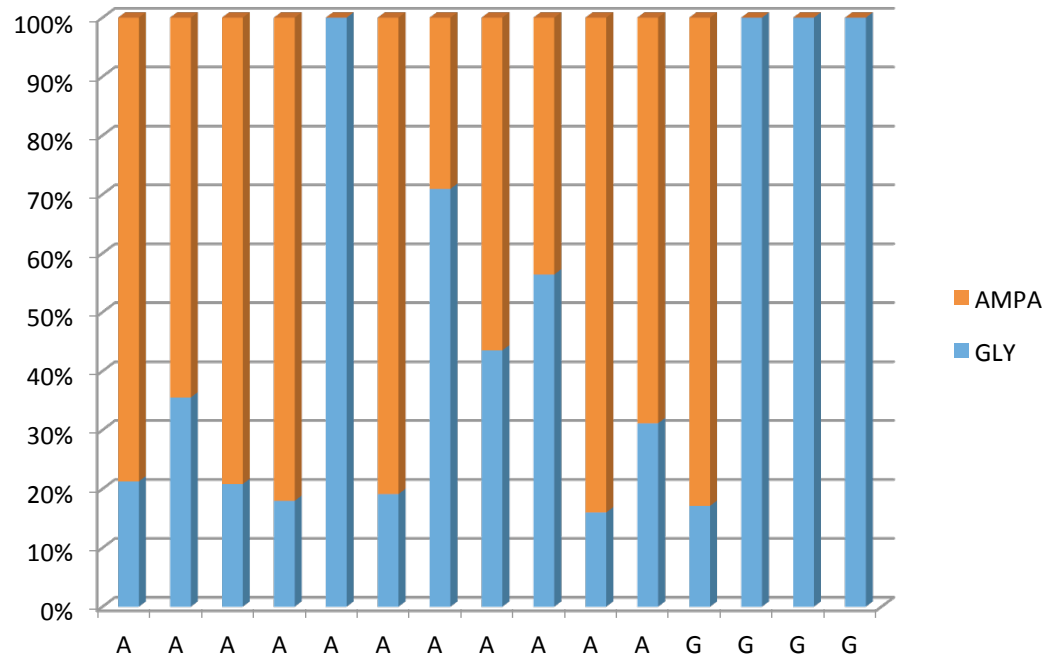
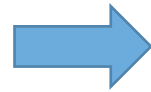
85 % GLY



100 %



62 % AMPA



In cotton gauze, AMPA was not detectedesterilization?

FINAL REMARKS

- Glyphosate and AMPA are present in all environmental matrices.
- The bottom sediments are the most important environmental fate for glyphosate and AMPA.
- This herbicide is an ubiquitous compound and potentially a pseudo-persistent contaminant.
- Its presence in the environment is a consequence of the actual agroproductive model.
- It can be found far away from the application site.

Dedicated to Dra. Alicia Ronco (14 Oct 1945-28 Nov 2016)

- Creator of the Licenciatura en Química y Tecnología Ambiental in the La Plata University
- Director of the Centro de Investigaciones del Medio Ambiente-CIMA-UNLP
- “Scientific mother” of Ecotoxicology in Argentina.
- More de 20 Thesis of PhD.
- Professor in the Facultad de Ciencias Exactas-UNLP



Las construcciones exitosas son siempre colectivas.

GRACIAS!!!!!!

