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FACULTAD DE CIENCIAS EXACTAS
UNIVERSIDAD NACIONAL DE LA PLATA
EMISA
ESPACIO MULTIDISCIPLINARIO DE INTERACCIÓN SOCIO AMBIENTAL

Environmental Impact of Glyphosate use in Argentina

Dr. Damián J. Marino

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

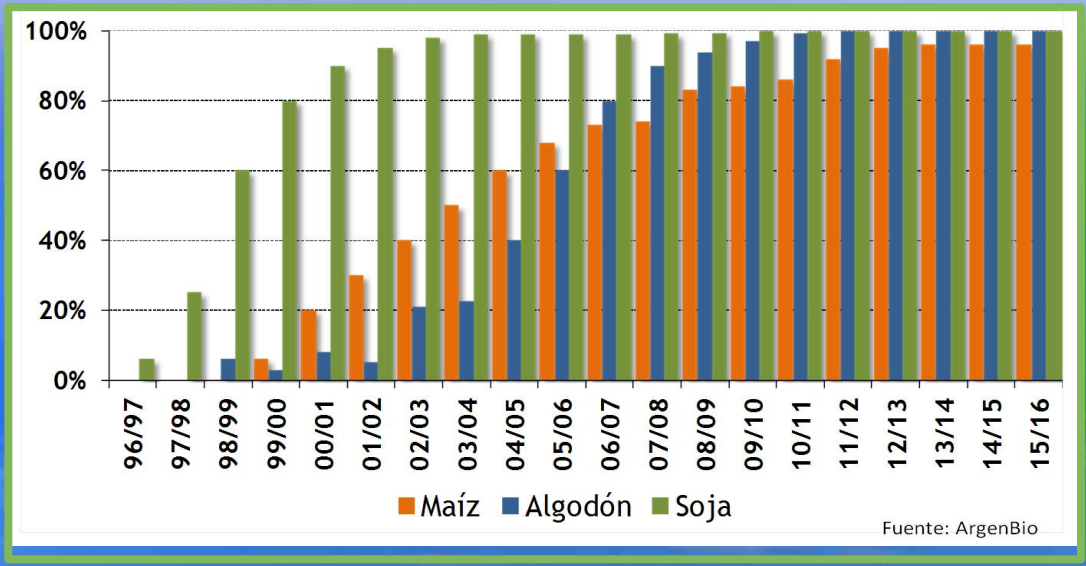
Thank you for all your work...


Welcome to the
Agroproductive Model
in Argentina

Agroproductive Model

Types of crops

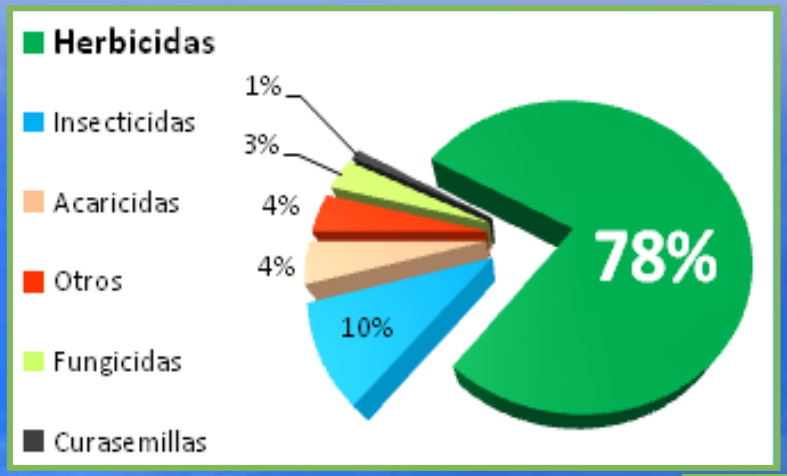
GMO (Soya RR, Corn BT)



Direct Seeding

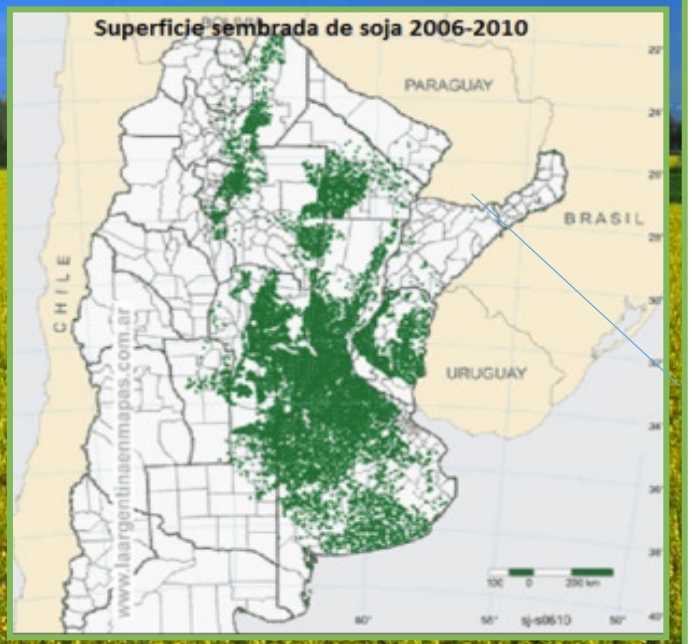
Agroproductive Model

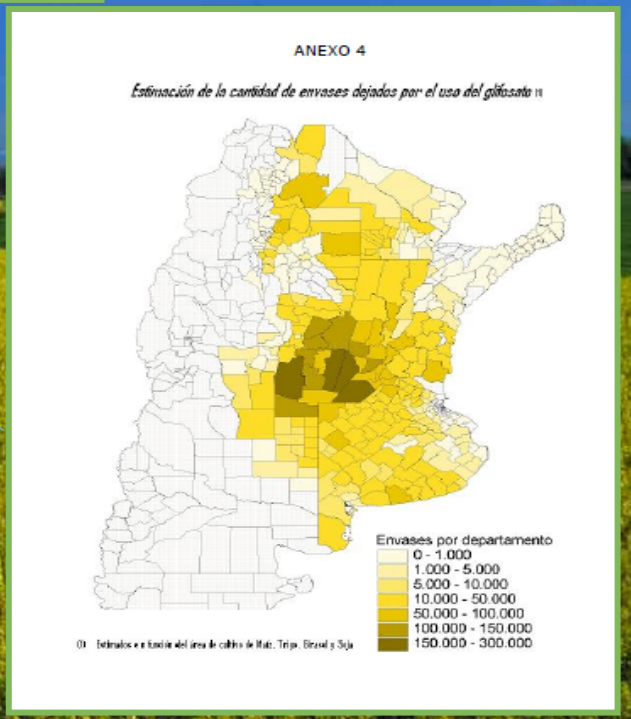
Pesticides



- 3 L/Ha (’90)
- 10 L/Ha (2000-10)
- 317 millons L/Kg pesticides formulations

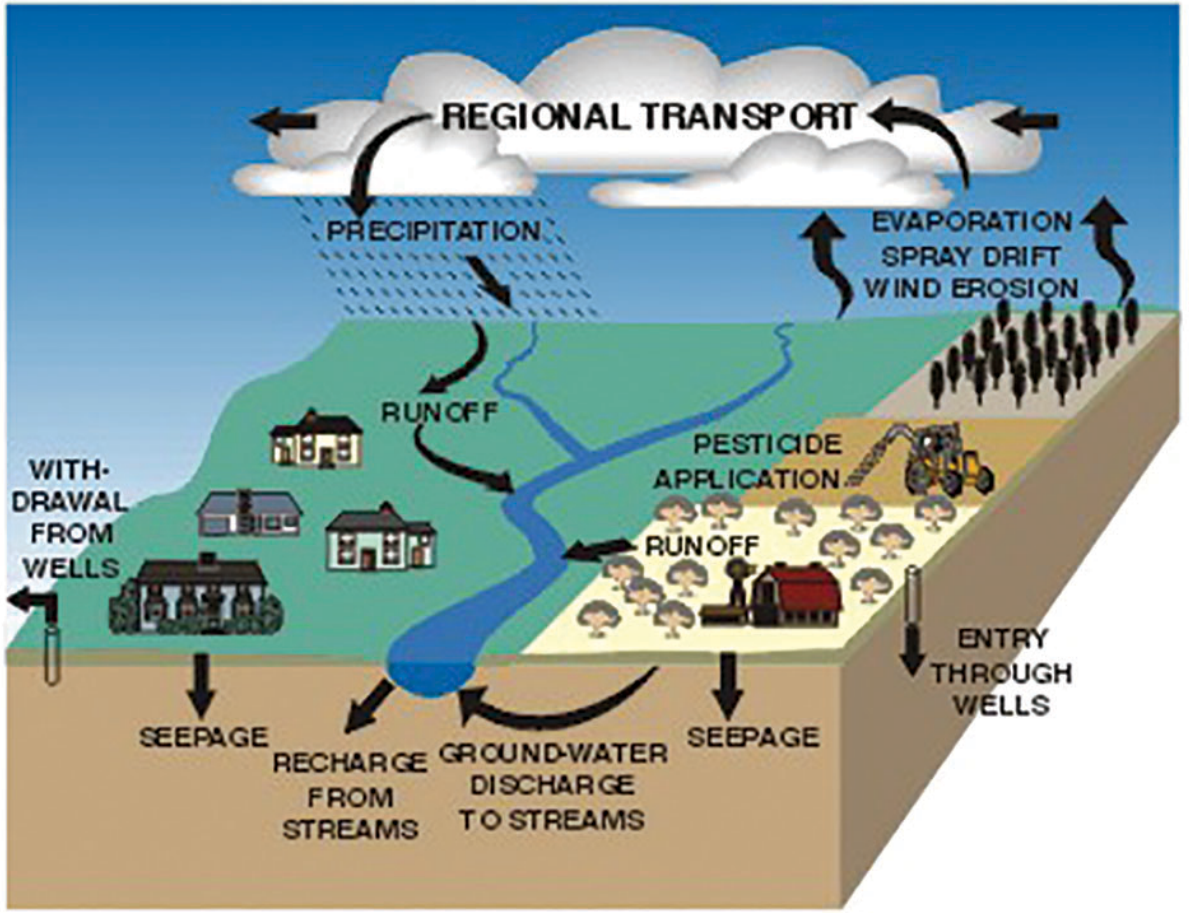
Environmental Impact



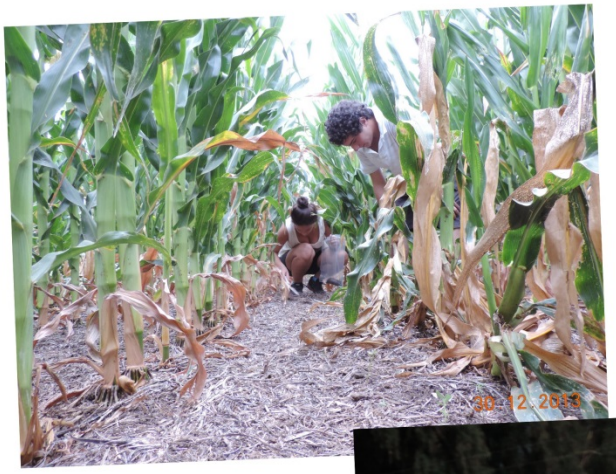


Environmental Dynamic of Pesticides

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



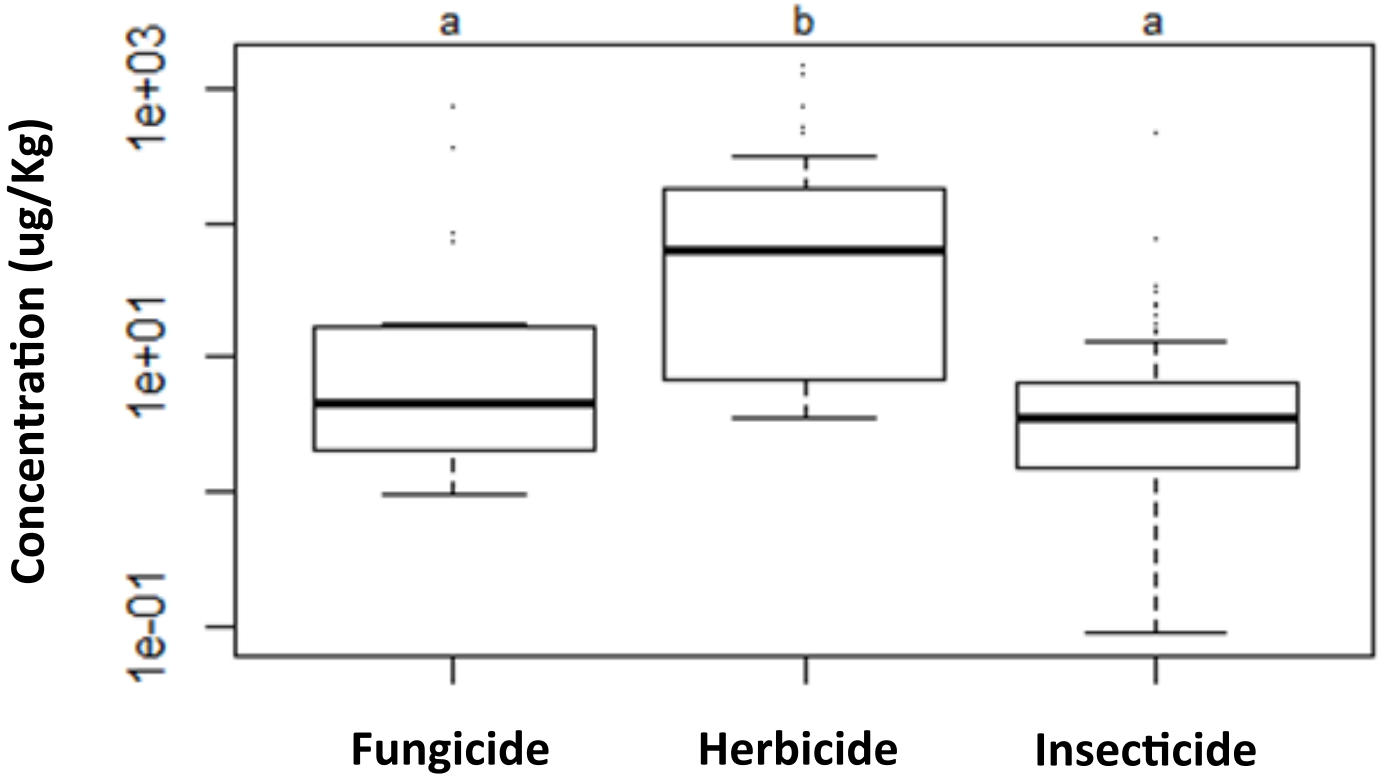
Case Study 1: Soil samples

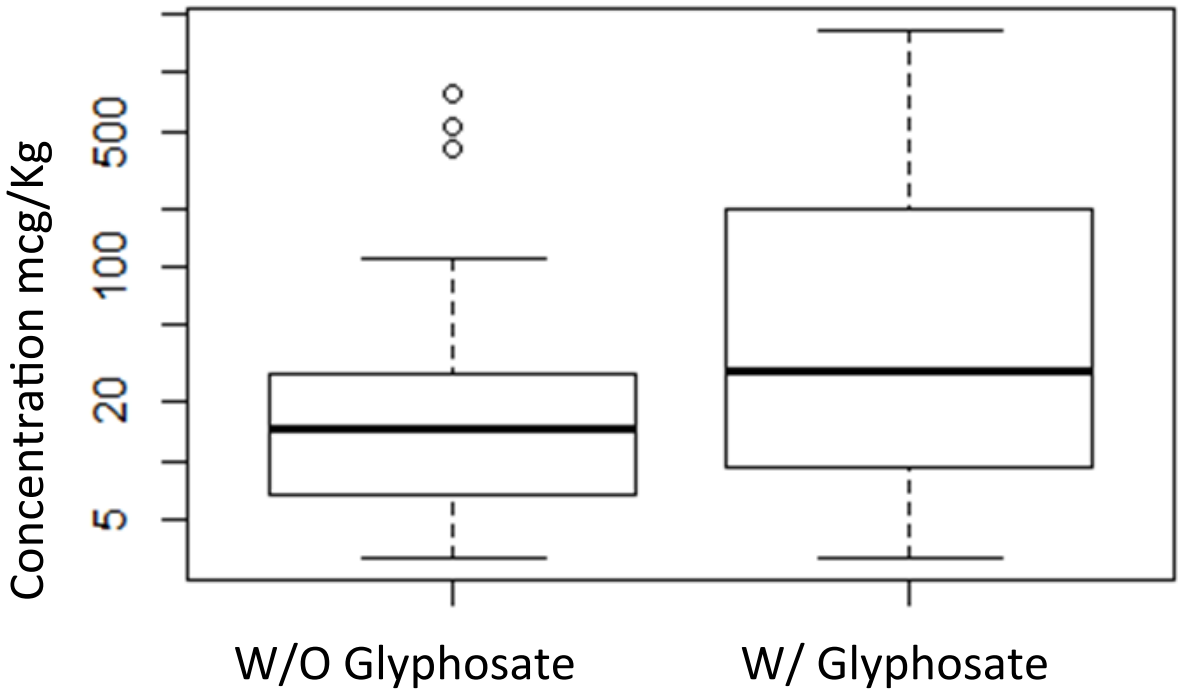


Samples:
1. Sub-superficials
2. Integrated

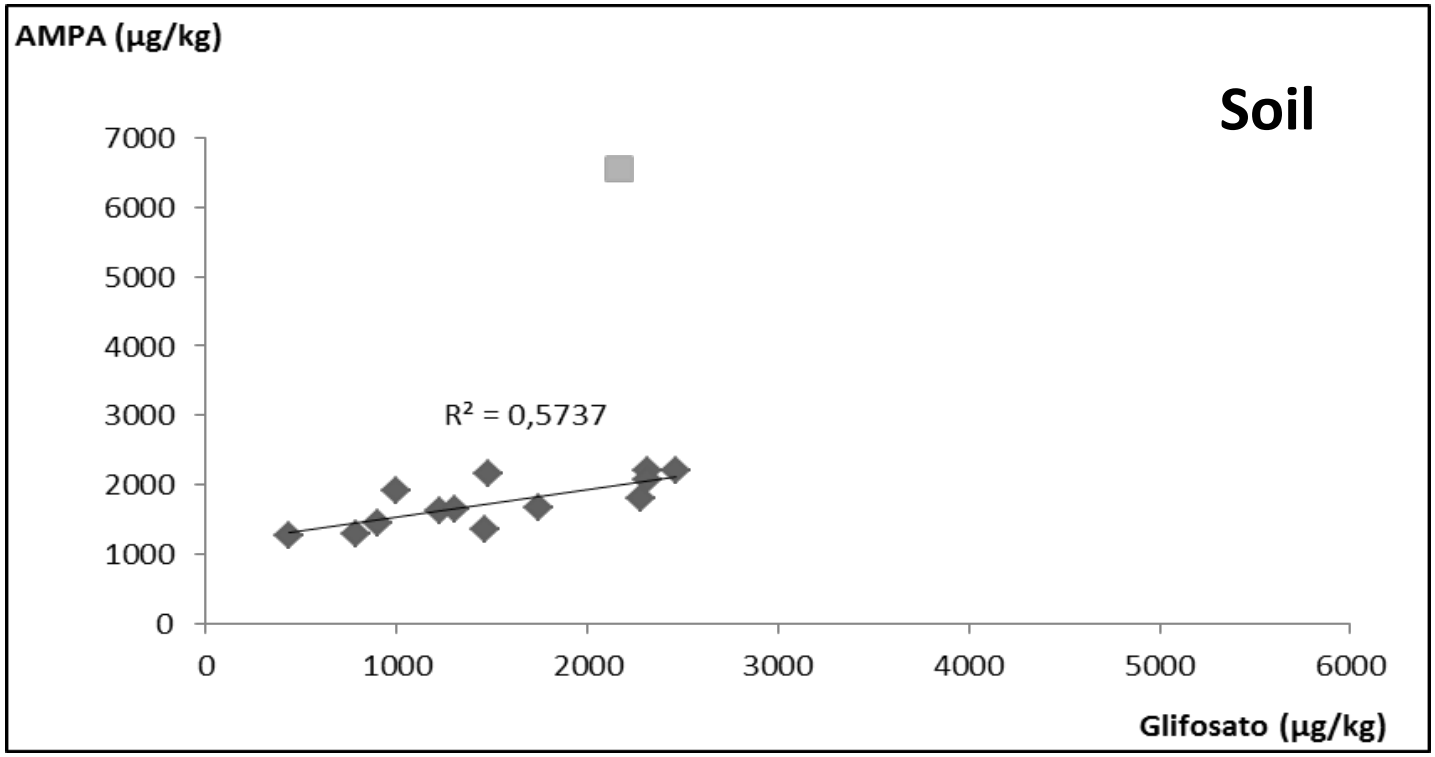

N =
N = 3
N = 7
N = 3
N = 5
N = 12
N = 19
N = 10
63
Corrientes
Hersilia
Santa Fe
Brinkman
La Rioja
Ituzaingo
Malvinas Argentinas
San Salvador
Córdoba
Entre Rios
Uruguay
San Luis
La Plata
9 de Julio
Argentina
Buenos Aires
Coronel Suarez
La Pampa

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. → $r^2 = 0,0831$

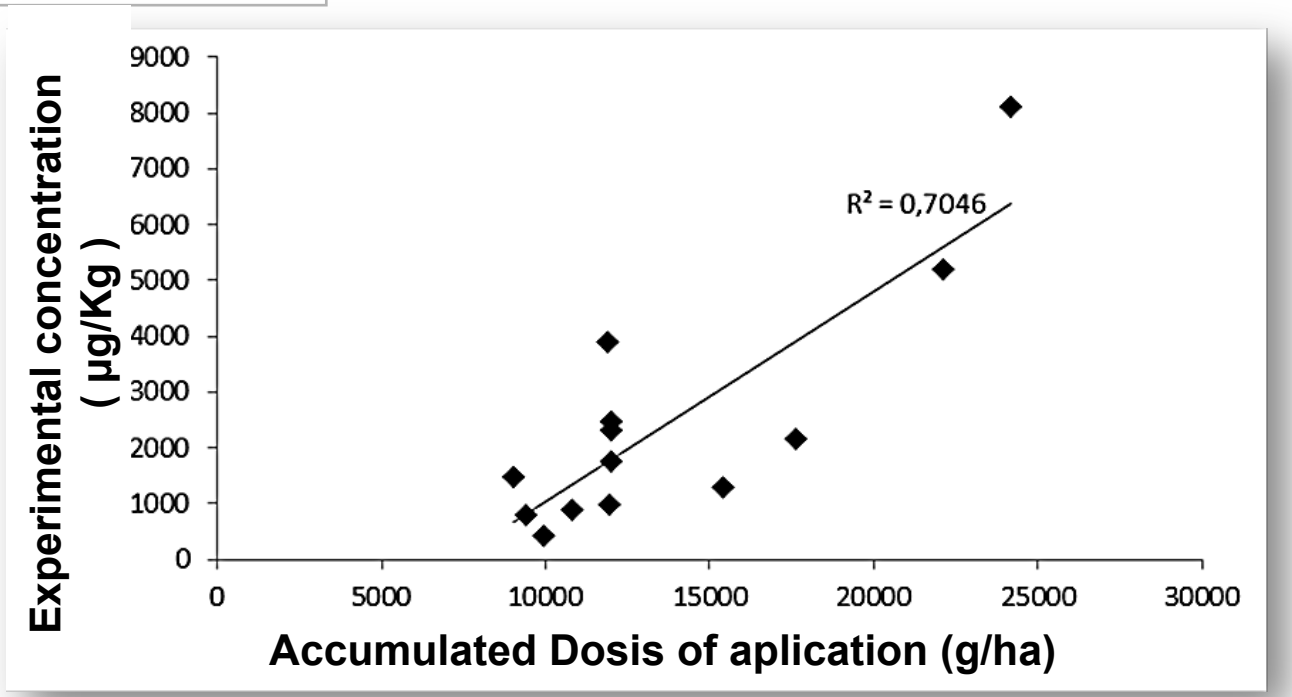
ii) Total applied dose in each cultivated area, during last campaign. → $r^2 = 0,4856$

iii) Total applied dose in each cultivated area, during the last 6 years. → $r^2 = 0,7046$

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

CrossMark

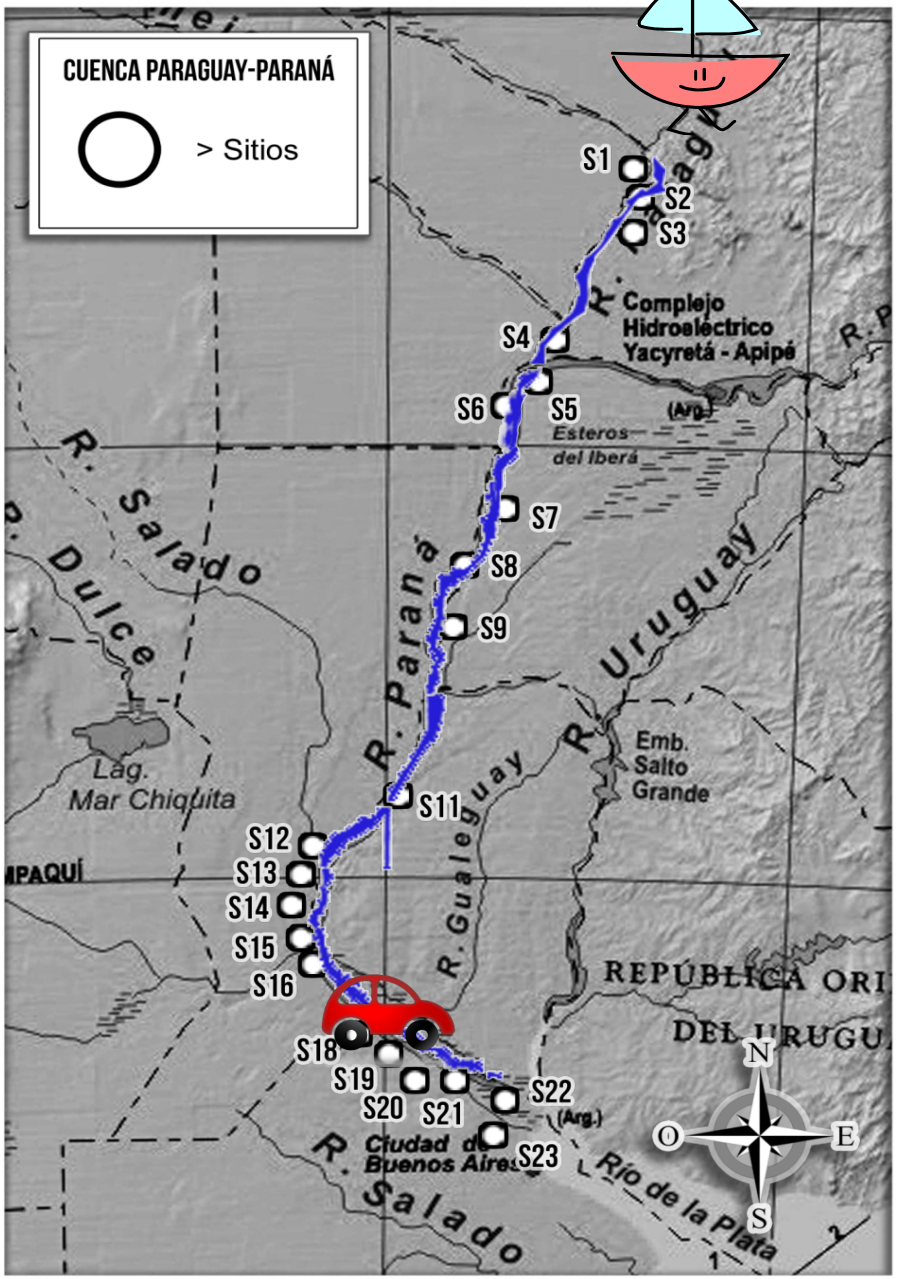
Water quality of the main tributaries of the Paraná Basin: glyphosate and AMPA in surface water and bottom sediments

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 trasport potential for Glyphosate and AMPA in the environment.
- ✓ Gubernamental interest.

Case Study 2: Paraná-Paraguay-SEDIMENTS

PREFECTURA NAVAL ARGENTINA

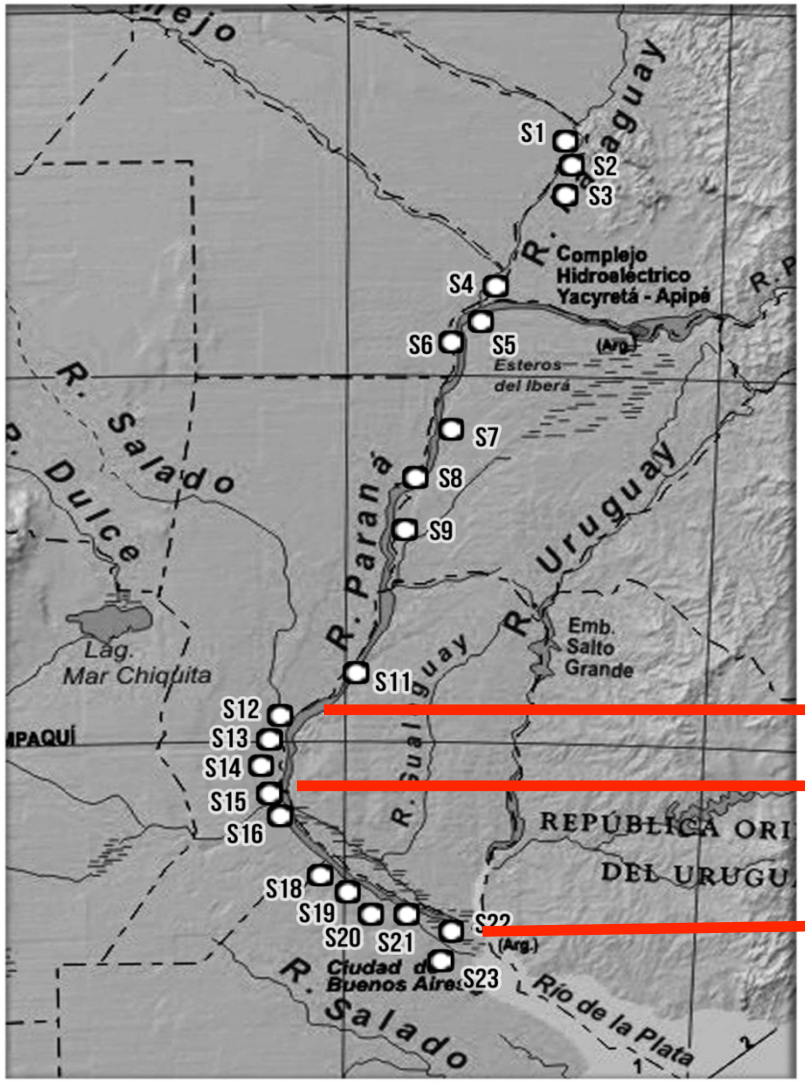


23 Site Samples

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 concentratios in bottom sediments (> 1000 times more than water).



LD/LD µg/kg

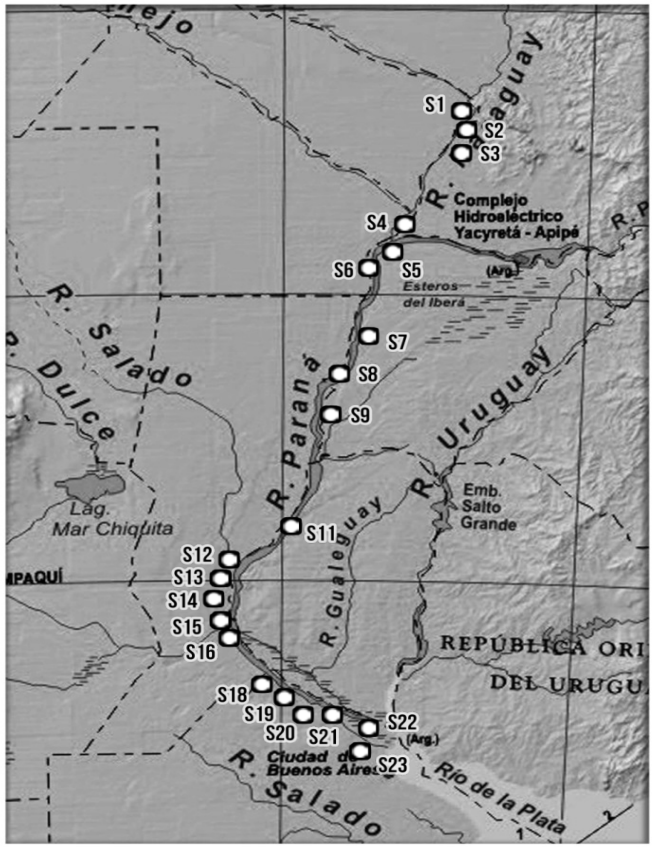
GLY/AMPA µg/kg

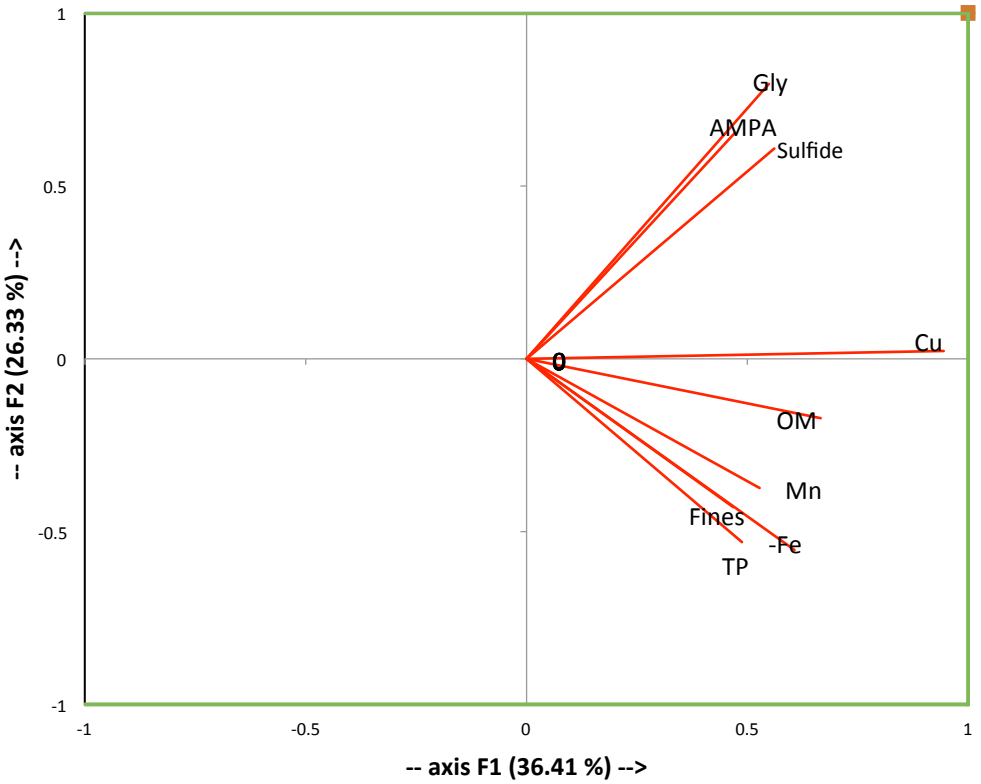
500/200 µg/kg

1800/470 µg/kg

3000/5300 µg/kg

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





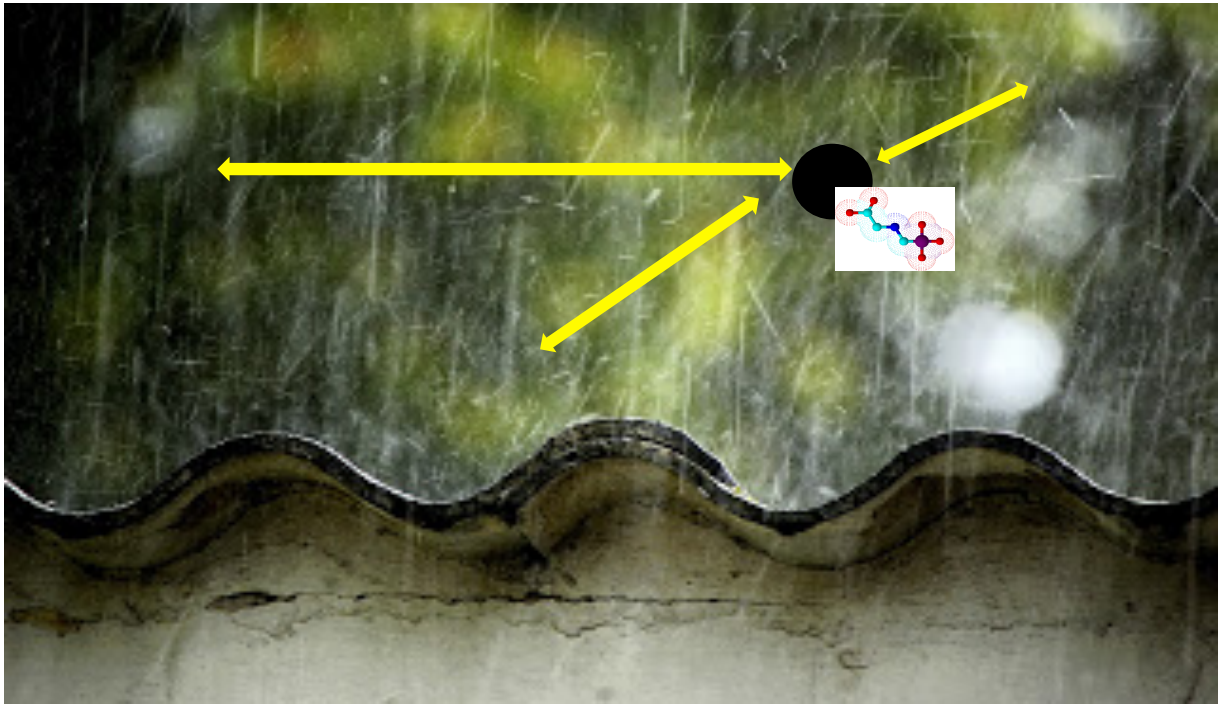
SULFIDE? COPPER? ….


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.**

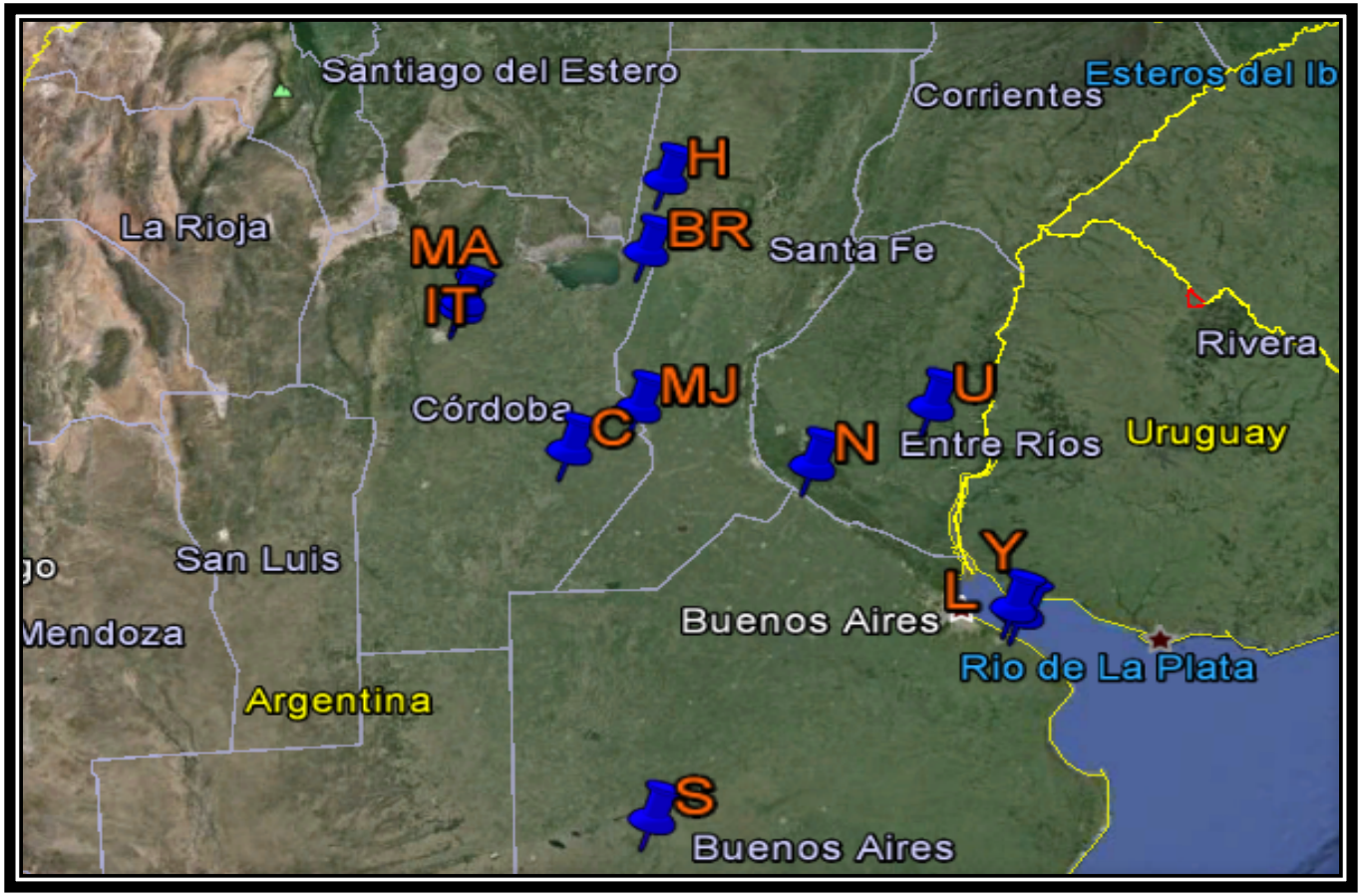
- **Atrazine**: 110.000 Kg/year in the Mississippi watershed (USGS) fron rainfall.

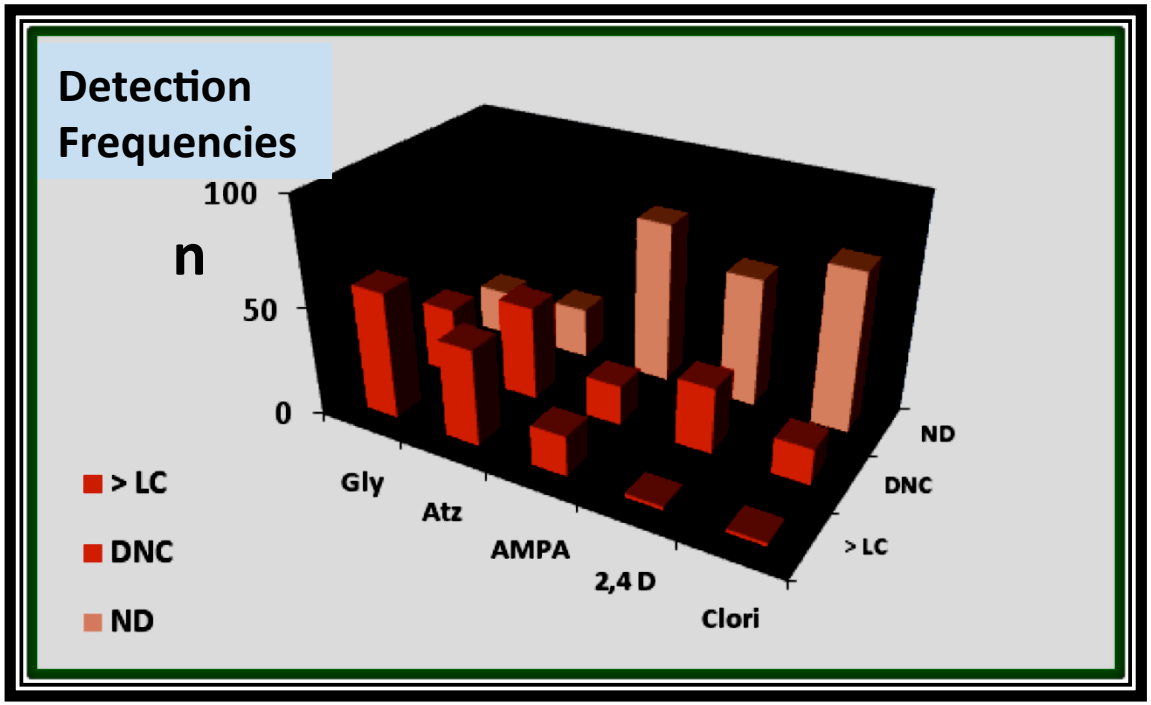
PSEUDO-PERSISTENT (EPA)

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



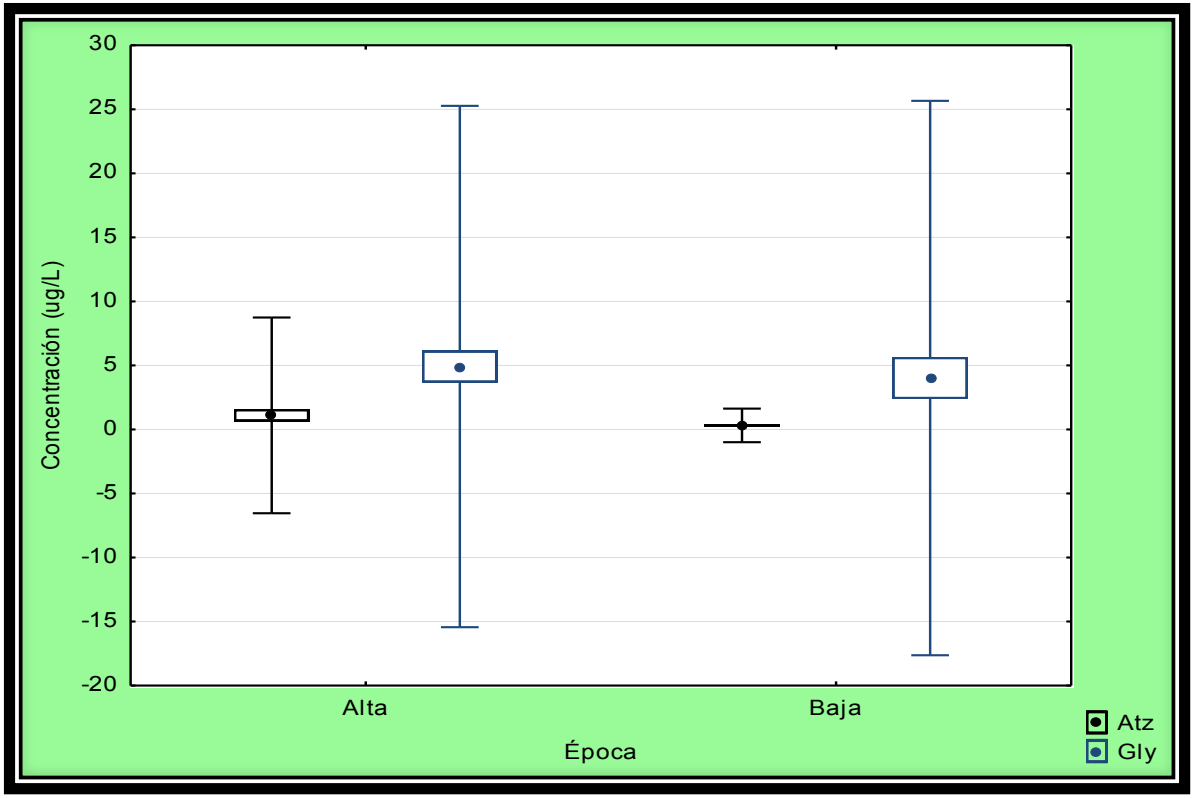


Glyphosate and Atrazine: Most detected.

Glyphosate: concentration significatively higher than other herbicides

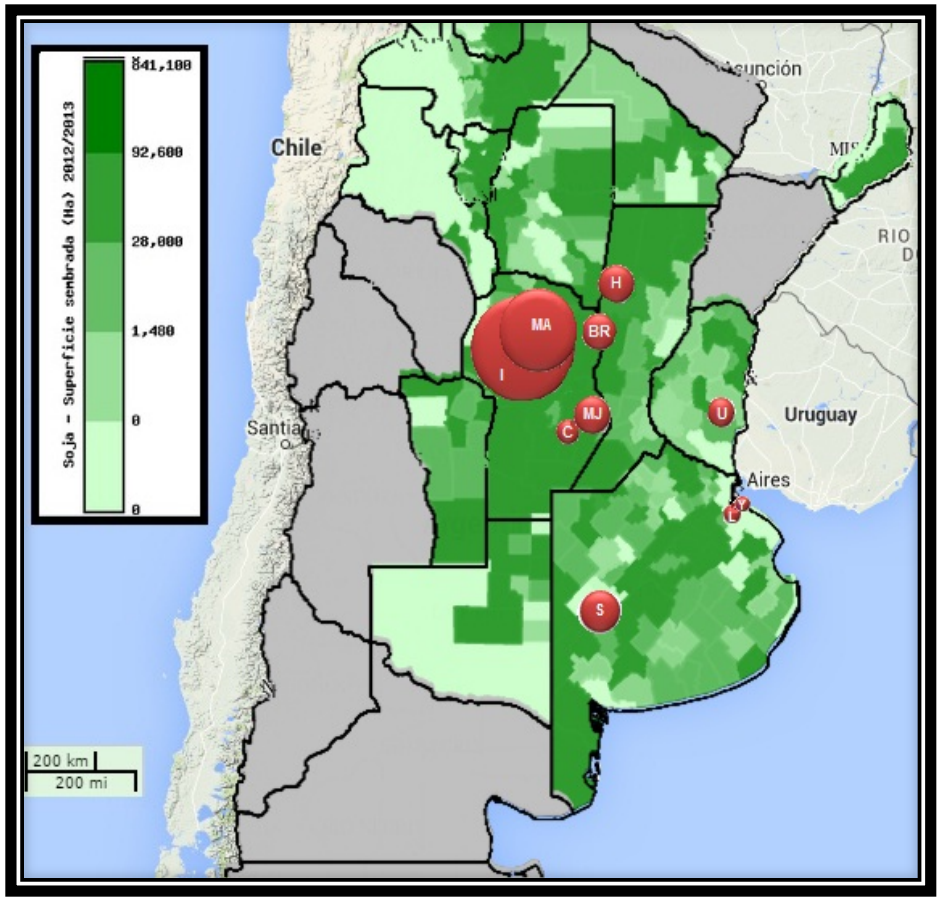
Concentration in rain (µg/L)	GLY	AMPA	Atz
Average ± DE (*n*)	4.5 ± 10.4 (112)	<LC ± 1.2 (112)	0.8 ± 3.0 (112)
Concentration Intervals	(LD-67.3)	(LD-7.9)	(LD-26.9)

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



No significative diferences between sampling campaigns

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

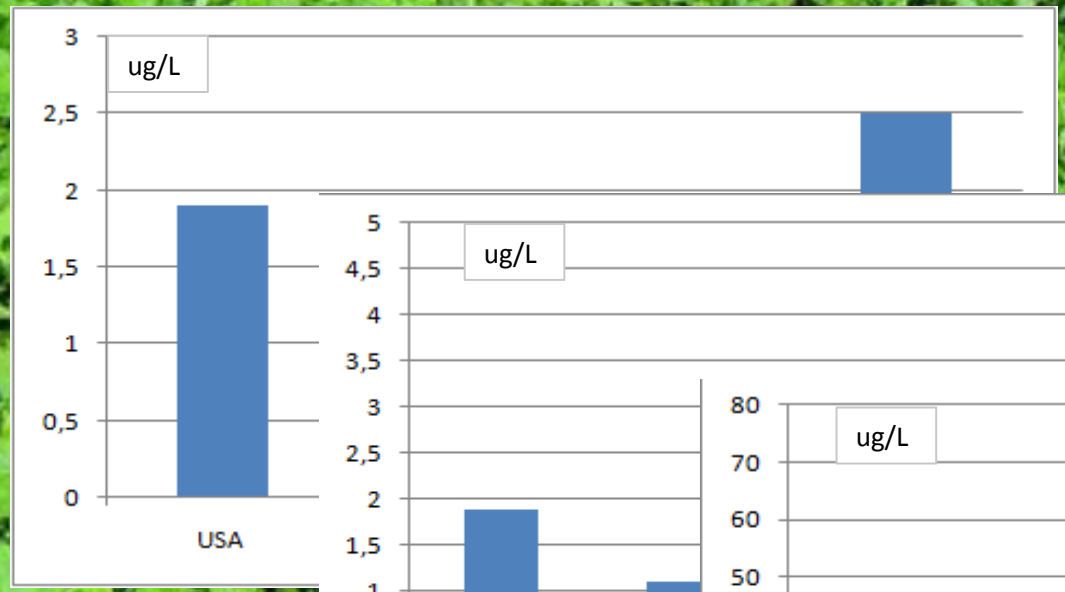


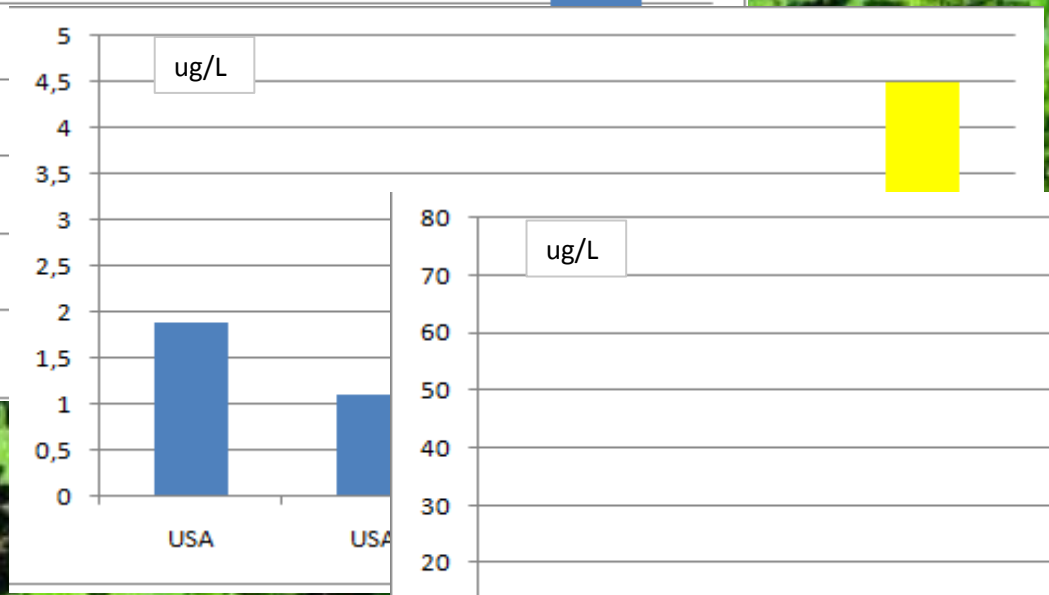
- Maximum concentration increases from EAST to WEST ($p<0,05$).
- No influence in NORTH-SOUTH direction.
- Influence of the continental input to the atmosphere.

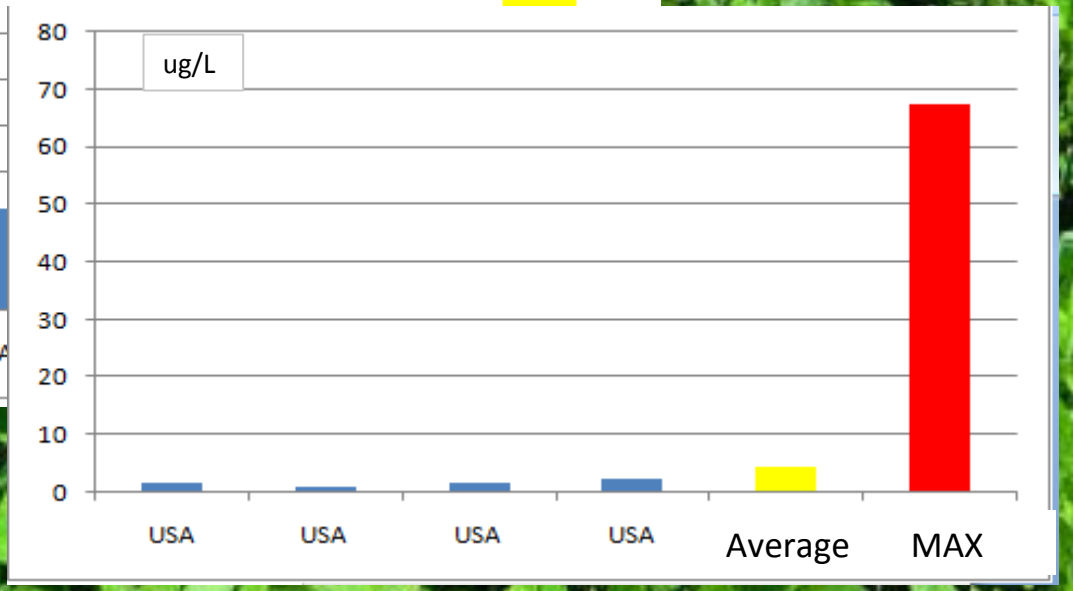
International context

Glyphosate:

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







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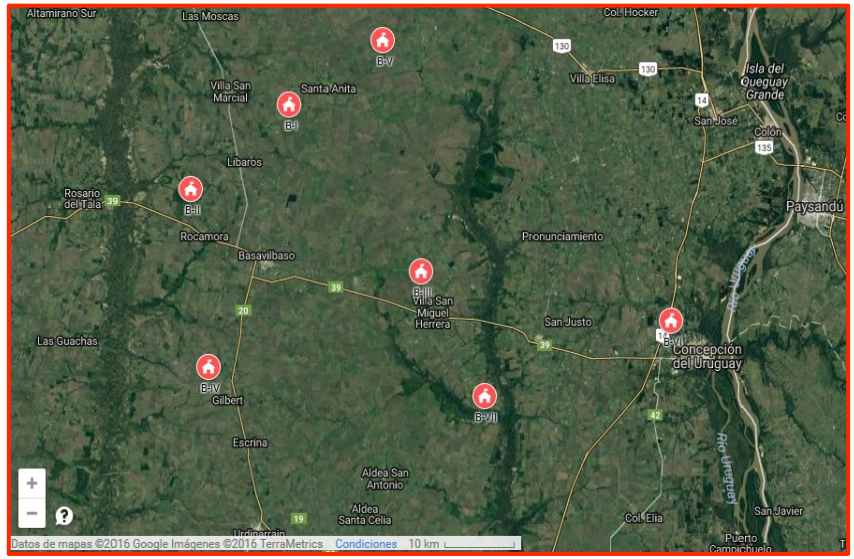
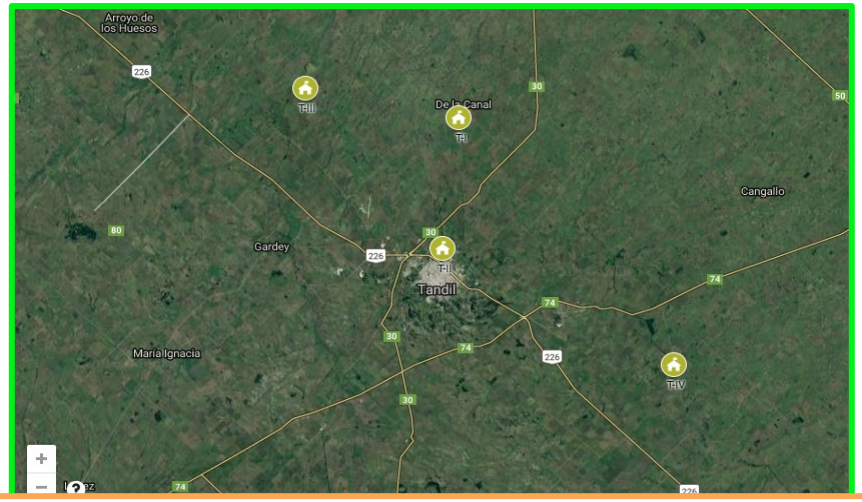
Case Study 4: Glyphosate and AMPA in rural schools

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			

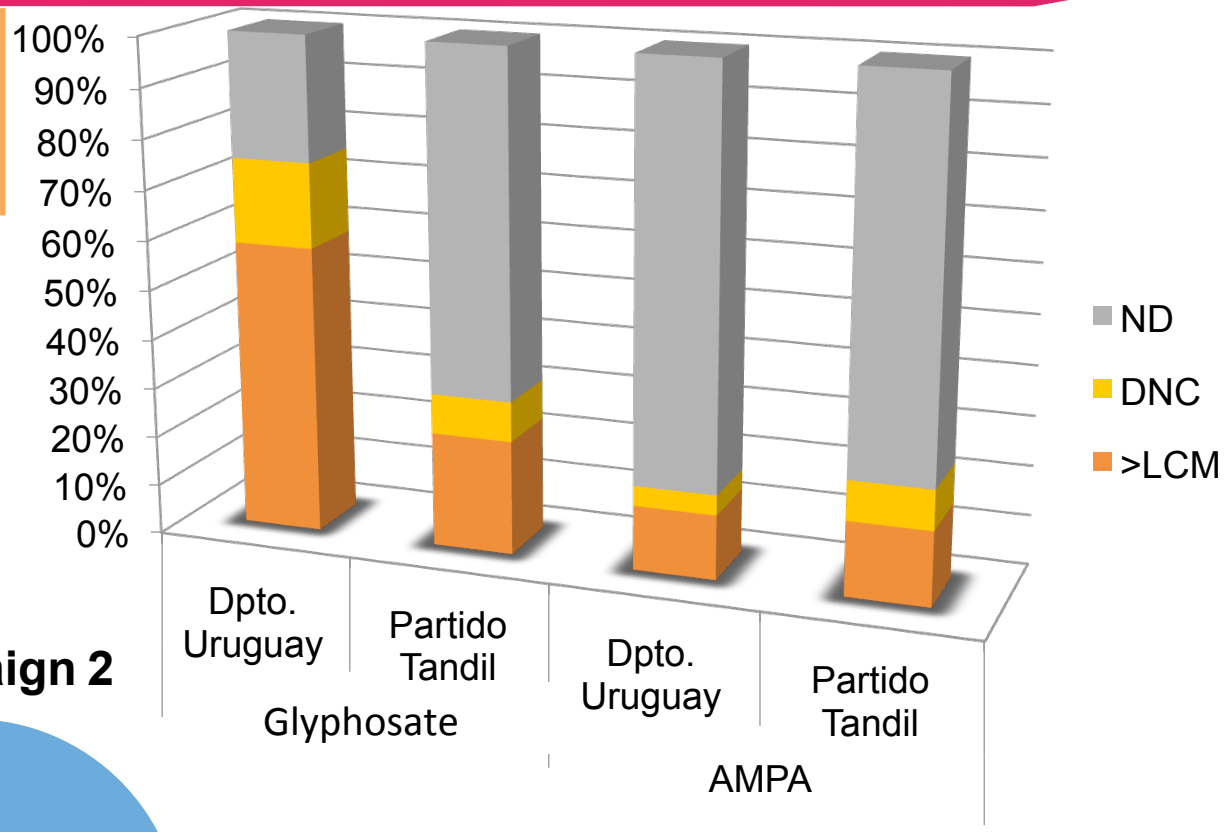


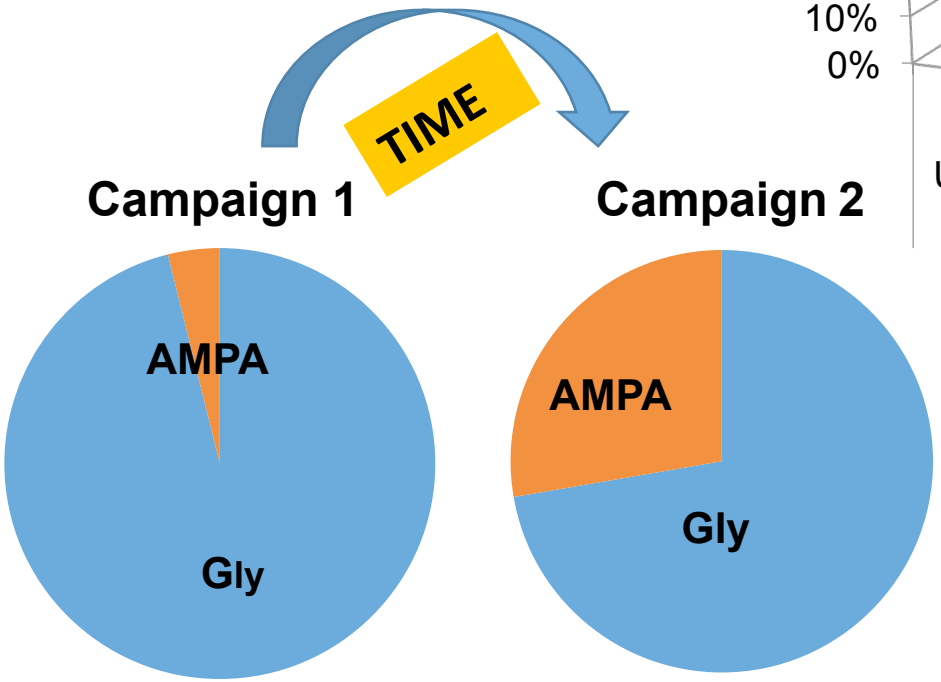


Samples by study regio and campaigns / Passive Methods

Detection frequencies: Glyphosate and AMPA

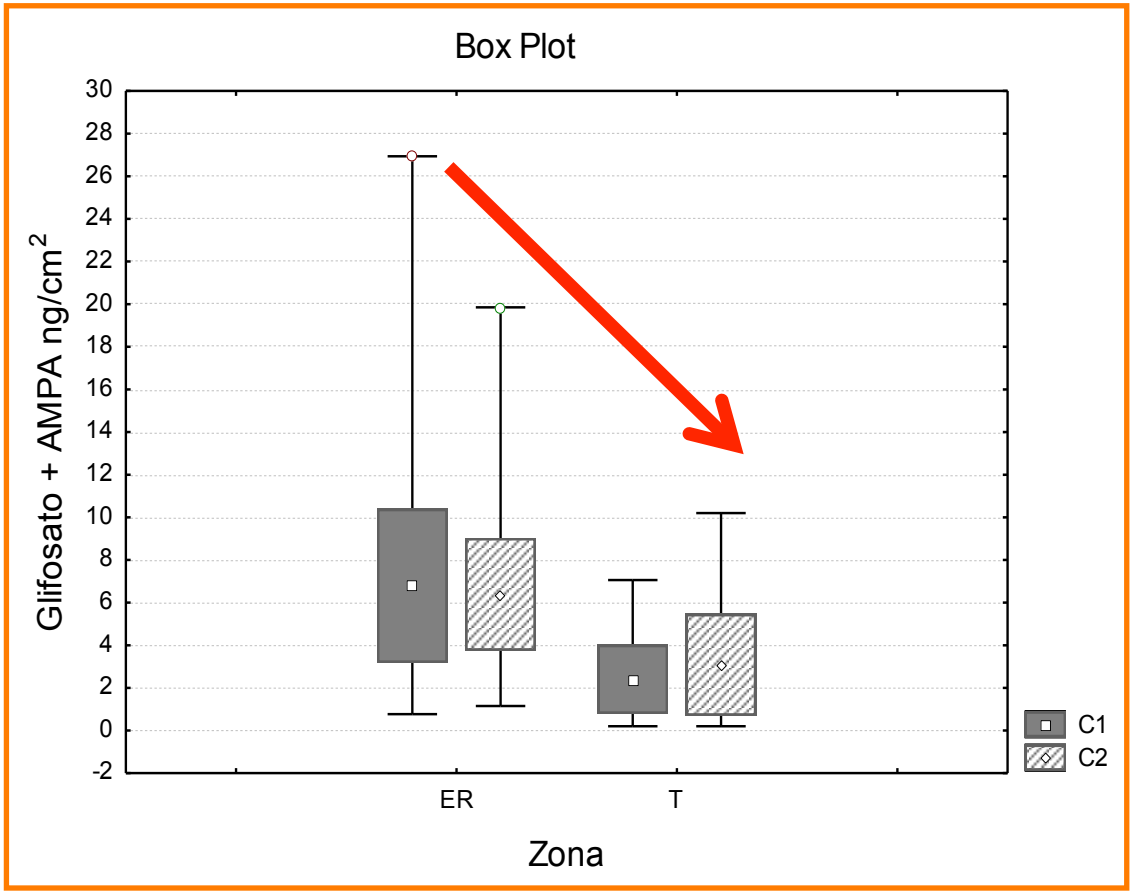
By study region





By compound

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



Campaign 1			
School	Cardinal Point	**Glyphosate** ng/cm^2	Territorial observation
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

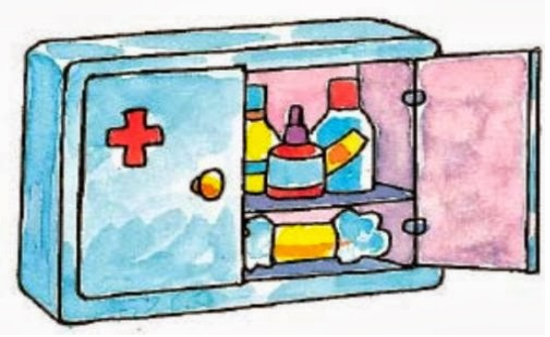
GRANULOS SOLUBLES

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



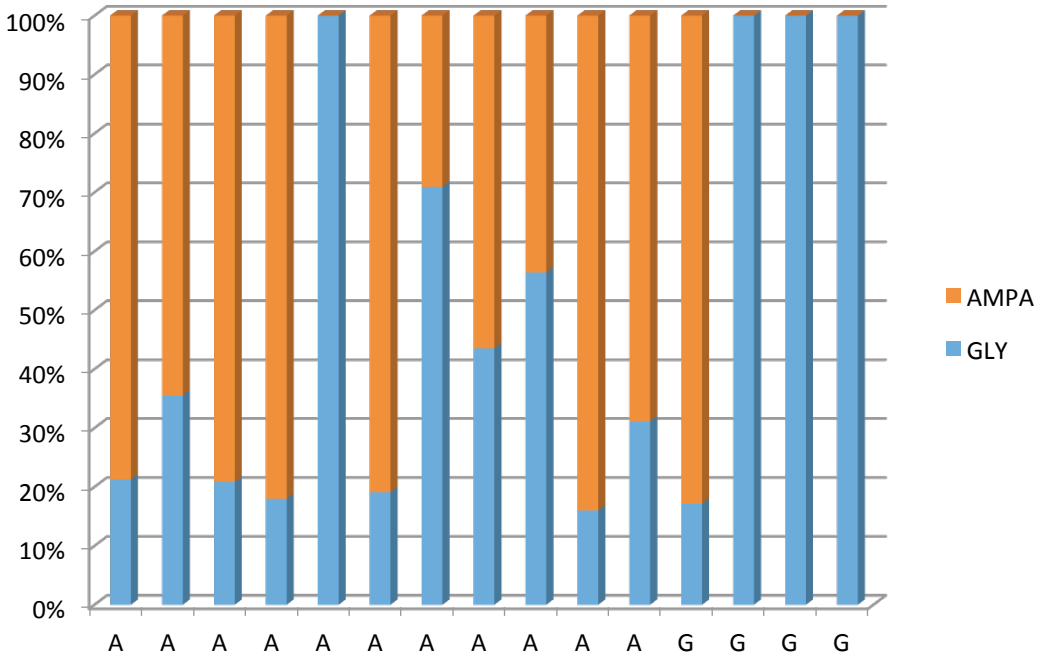
RESULTS




85 % GLY

100 %

62 % AMPA



In cotton gauze, AMPA was not detected …..esterilization?

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.

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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!!!!!!