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Soil macroinvertebrates diversity and glyphosate distribution in soybean plantations and surroundings at the Yucatan Peninsula, Mexico

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Introduction

- Glyphosate and its main metabolite (AMPA) are even after years of application present in soils (Silva et al. 2018)
- AMPA accumulates onsite, attached to clay particles (Bento et al. 2017)
- underlays the risk of offsite transport by water and wind erosion (Silva et al. 2017, Rendon-von Osten & Dzul-Caamal, 2017; Yang et al., 2015).

Introduction

- At Yucatan Peninsula, Mexico, genetically modified glyphosate-tolerant crops (Contardo-Jara, Klingelmann, & Wiegand, 2009) have led to the intensive use of glyphosate

- Previous investigations indicated the contamination of humans by this herbicide in Yucatan (Rendon-von Osten & Dzul-Caamal, 2017),

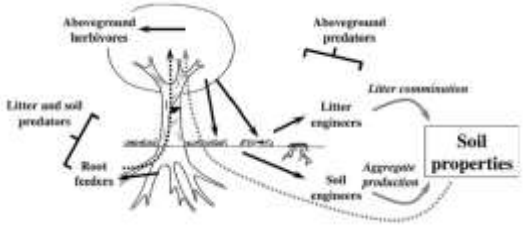
Introduction



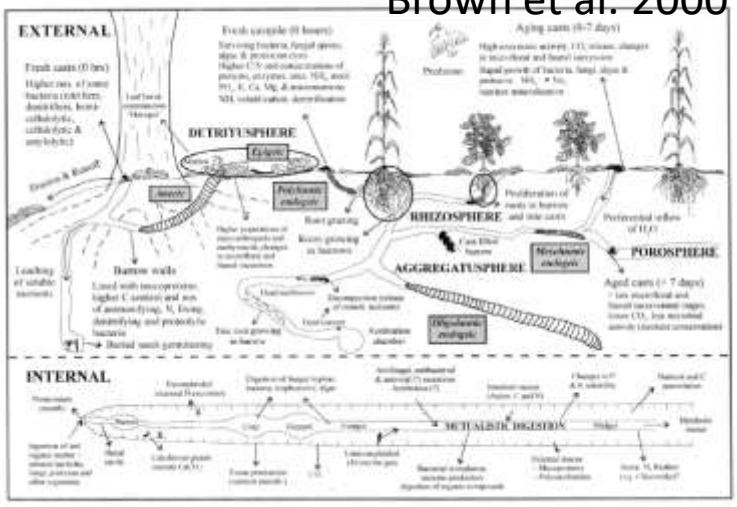



- Litter fragmenters
- Soil ecosystem engineers

Decaens et al. 2006



Brown et al. 2000



Introduction

Assessing:

- glyphosate and AMPA in soils from the soybean crops,
- soil macroinvertebrates diversity and abundance was also determined

Ilsa Phillips 2018

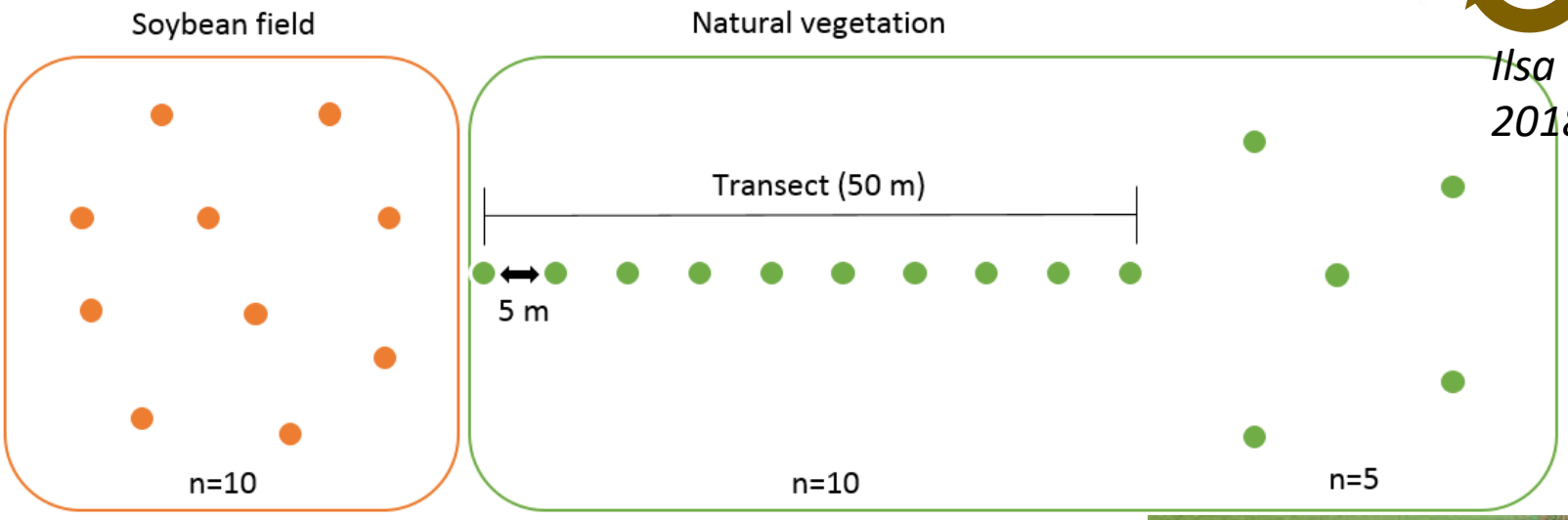
Material and Methods

- The study was developed at Campeche, Mexico

Material and Methods

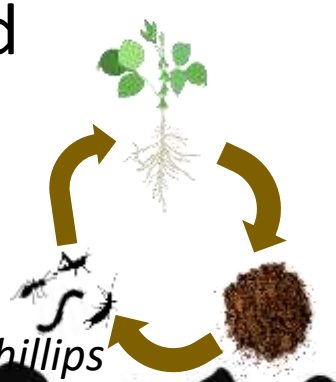
Ilsa Phillips 2018

Experimental design



Material and Methods

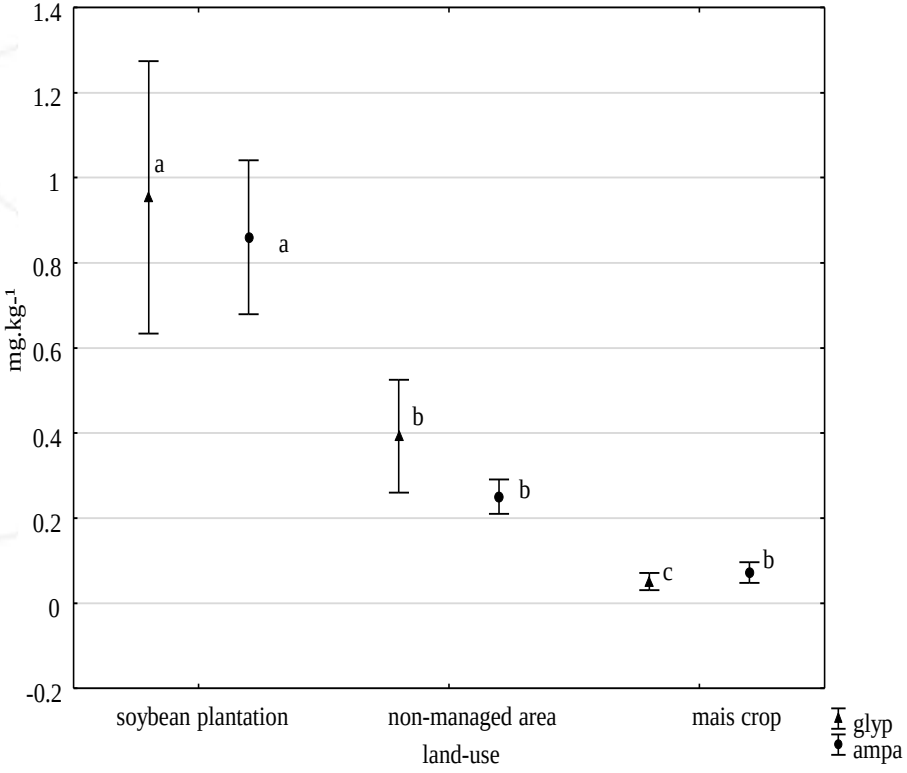
- Total of 200 top-soil samples (0-2cm) were taken for glyphosate and AMPA determination (Bento et al. (2017), LC-MS/MS
- 200 25x25x25 cm monoliths for soil macrofauna (TSBF, Anderson & Ingram 1993)
- Organic matter and clay was also determined
- Ratio glyphosate/invetebrates



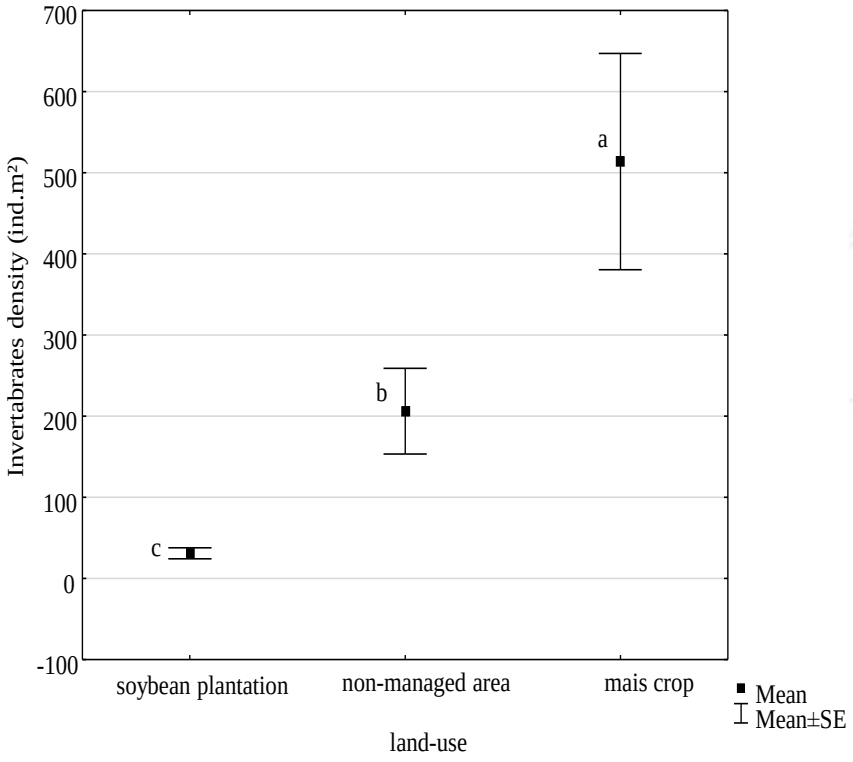
Ilsa Phillips 2013

Results

a)


1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
mg.kg-1
a
a
b
b
c
b
soybean plantation
non-managed area
mais crop
land-use
glyp
ampa

b)


700
600
500
400
300
200
100
0
-100
Invertabrates density (ind.m²)
a
b
c
soybean plantation
non-managed area
mais crop
land-use
Mean
Mean±SE

Results

Fields		ants	ew	coleo	term	gastro	others	ratio gly/invd	ratio AM/invd
soybean	Mean	16.0	1.9	5.6	2.1 b	0 c	3.5 c	7.9 a	10.9 a
	Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	Maximum	272.0	48.0	64.0	32.0	0.0	16.0	95.6	96.1
	Std.Dev.	40.9	7.3	13.8	7.5	0.0	6.6	20.4	20.3
mais	Mean	25.3	1.0	7.8	328 a	647.9 a	38.1 a	0.2 b	0.1 b
	Minimum	0.0	0.0	0.0	0.0	75.0	0.0	0.0	0.0
	Maximum	192.0	16.0	64.0	3328.0	1850.0	250.0	1.8	0.8
	Std.Dev.	49.2	3.9	16.0	783.3	617.4	57.8	0.4	0.2
non-managed area	Mean	17.9	4.5	3.2	19.8 b	188.8 b	16.4 b	3.1 b	3.0 b
	Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Maximum	300.0	96.0	32.0	560.0	2625.0	125.0	61.4	19.6
	Std.Dev.	44.9	15.0	8.0	79.8	579.5	27.1	9.4	5.7

Ilsa Phillips, 2018

Soil macroinvertebrates and ratios gly/invd (glyphosate/ invertebrates density), AM/invd (AMPA/ invertebrates density); ew: earthworms, coleo: coleoptera; term: termites; gastero: gasteropoda; others: soil invertebrates from other soil group taxa

Discussion

- Glyphosate is a component known to harm humans (Gasnier et al., 2009), soil life (Haney et al. 2000) and wild life
- In this study: 0.8-2.8 taxa
- other investigations in the region: 1-9 taxa (Huerta et al. 2008, Sanchez del Cid 2017
- Gastropods, most vulnerable group, not present in the soybean plantations

Ilsa Phillips, 2018

Thank you for your attention