L'antibioresistance: Impact de l'épandage

Séminaire/Webinaire

Approche One Health de l'antibiorésistance

15 novembre, 2024

Ed TOPP
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RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité
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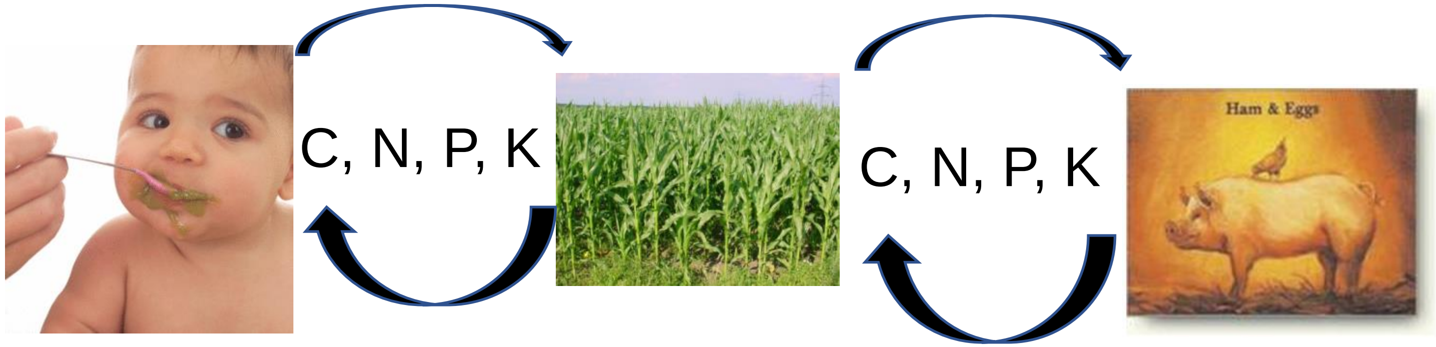
ANTIBIOTIQUES ILS SONT PRÉCIEUX, UTILISONS-LES MIEUX.

Recyclage des éléments nutritifs dans les systèmes de production agricole

Utilisation judicieuse des biosolides et des fumiers/lisiers :

- Recycle et conserve les nutriments
- Améliore la structure du sol
- Améliore les rendements des cultures

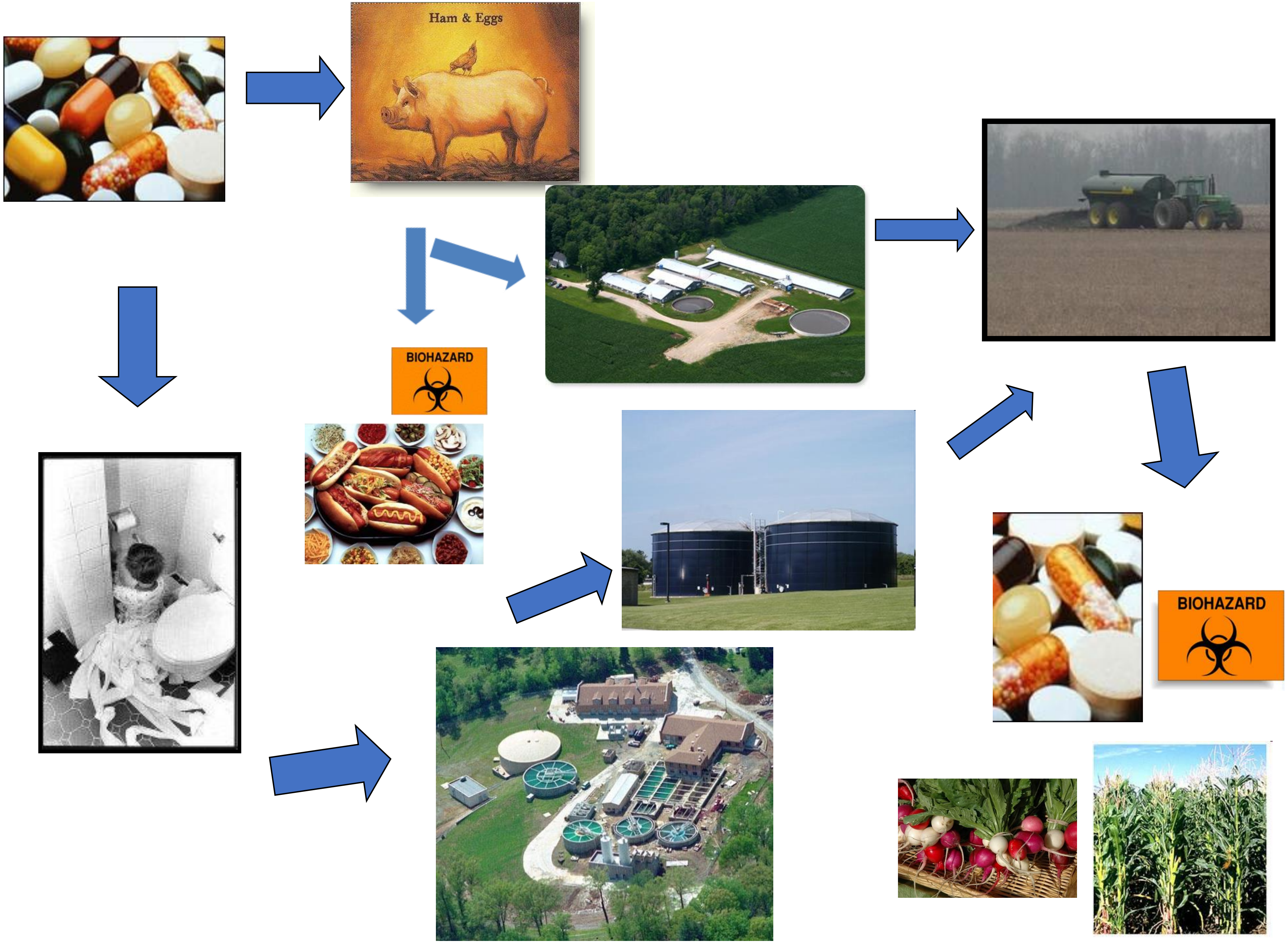


Contaminants biologiques et chimiques

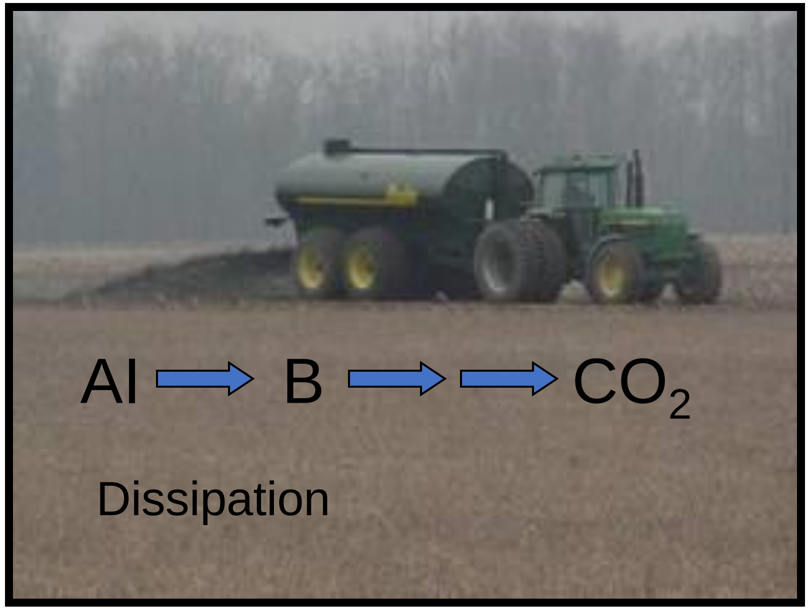
- Microorganismes. [agents pathogènes (virus, parasites, bactéries) <u>bactéries résistantes aux antibiotiques</u>].
- Produits chimiques à activité endocrinienne.
- <u>Antibiotiques</u> et autres produits pharmaceutiques, produits de soins personnels.
- Métaux (par exemple Cd, Pb, Hg)

Origine humaine (biosolides municipaux)

Origine animaux


Ham & Eggs
BIOHAZARD
BIOHAZARD

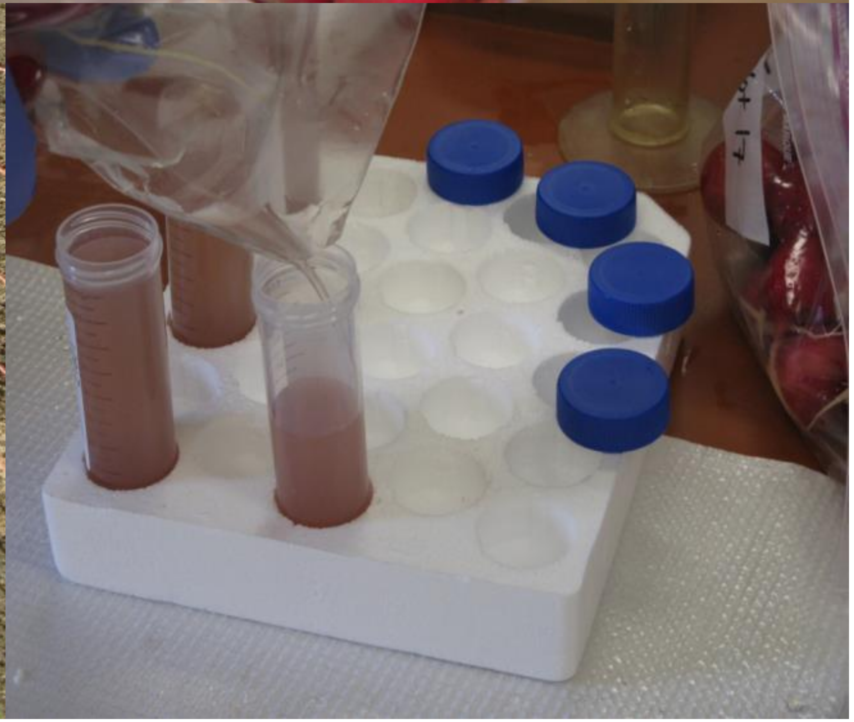
Comprendre le risque : préoccupations potentielles



Devenir des contaminants microbiens suite à l'application sur le sol

Field experiments

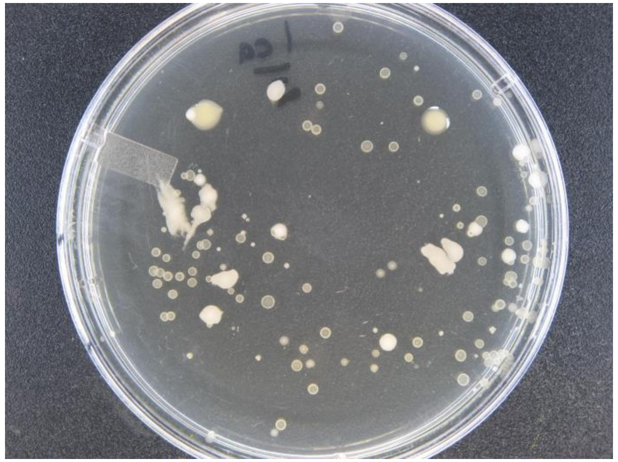




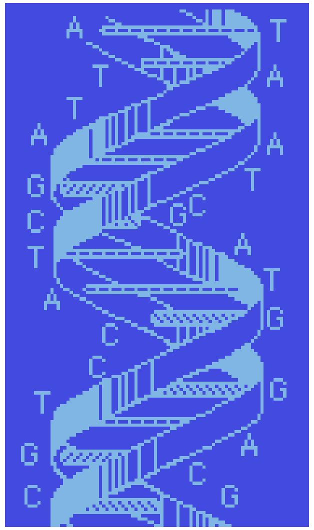
Culture [in]dependent analysis of populations

Vegetables, soil,

biosolids/manures



Enumerate, isolate and characterize abundance of bacteria of interest



qPCR quantify genes, metagenomic inventories

Science of the Total Environment 581–582 (2017) 32–39

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Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Impact of dairy manure pre-application treatment on manure composition, soil dynamics of antibiotic resistance genes, and abundance of antibiotic-resistance genes on vegetables at harvest

Yuan-Ching Tien [a], Bing Li [b], Tong Zhang [c], Andrew Scott [a], Roger Murray [a], Lyne Sabourin [a], Romain Marti [a], Edward Topp [a,d,*]

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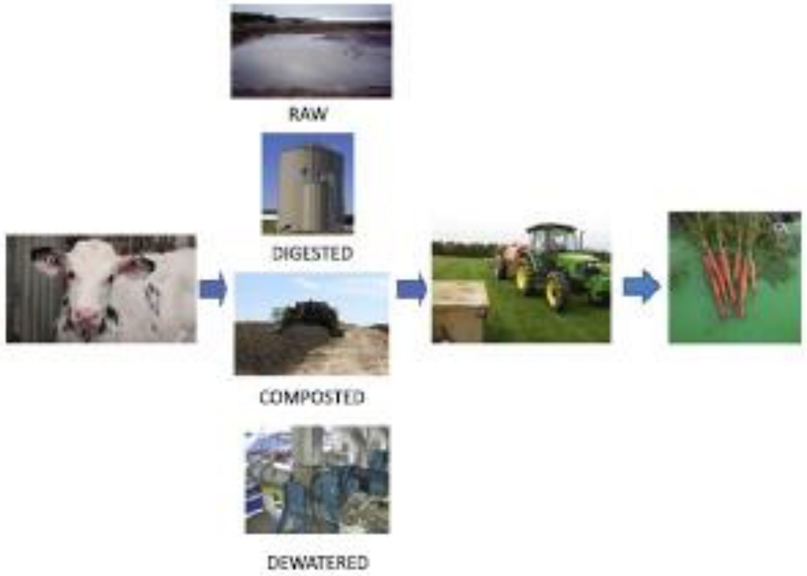


Table 4
The impact of manure application on the likelihood of detecting a gene target in soil or on the indicated vegetable at harvest.

	Raw manure	Digested manure	Dewatered manure	Composted manure
Soil				
Day 93	**5.48 (2.10, 14.29)**	**3.46 (1.38, 8.69)**	**2.81 (1.13, 6.99)**	0.89 (0.35, 2.29)
Day 111	**3.27 (1.21, 8.84)**	**4.42 (1.64, 11.93)**	2.15 (0.78, 5.92)	1.00 (0.33, 2.99)
Day 155	**6.00 (2.21, 16.31)**	**3.27 (1.21, 8.84)**	1.71 (0.61, 4.79)	1.52 (0.54, 4.29)
Vegetable				
Lettuce (93)	**7.20 (1.48, 35.09)**	4.03 (0.78, 20.75)	4.03 (0.78, 20.75)	4.75 (0.94, 23.98)
Radish (111)	1.00 (0.36, 2.75)	2.00 (0.77, 5.20)	2.22 (0.86, 5.74)	2.71 (1.05, 7.00)
Carrot (155)	1.79 (0.61, 5.22)	1.57 (0.53, 4.65)	1.00 (0.32, 3.17)	2.27 (0.79, 6.49)

Values are the odds ratio (upper and lower 95% confidence limits) of detecting a gene target, referenced to unmanured control soil. Values significantly different from the unmanured control are indicated in bold ($p < 0.05$). Indicated in brackets are the number of days between the vegetable harvests and the application of manures. Soils were sampled on the same dates. Dates for farm operations are detailed in Table S2.

NRC Research Press

ARTICLE

Enrichment of antibiotic resistance genes in soil receiving composts derived from swine manure, yard wastes, or food wastes, and evidence for multiyear persistence of swine *Clostridium* spp.

Andrew Scott, Yuan-Ching Tien, Craig F. Drury, W. Daniel Reynolds, and Edward Topp

Can. J. Microbiol. 64: 201–208 (2018) dx.doi.org/10.1139/cjm-2017-0642

Table 1. Summary of gene targets whose abundance was significantly increased relative to unamended soil (ANOVA, $P < 0.05$) following amendment in 1998 with food waste compost (FWC), yard waste compost (YWC), or swine manure compost (SMC).

Year	FWC (75 dry t/ha)	FWC (150 dry t/ha)	FWC (300 dry t/ha)	YWC (75 dry t/ha)	SMC (75 dry t/ha)
1999	*sul*1, *str*(A), *str*(B)	*sul*1, *str*(A), *str*(B)	*sul*1, *str*(A), *str*(B)	*str*(A), *str*(B)	*sul*1, *str*(A), *str*(B), *aad*(A), *int*1, *erm*(B)
2001	*str*(B)	*str*(B)		*str*(A), *str*(B)	*sul*1, *str*(A), *str*(B), *int*1, *erm*(B)
2003	—	—	*sul*1, *str*(A)	—	*sul*1, *str*(A), *str*(B), *erm*(B)
2009	—	—	—	—	—

Note: The application rate is indicated in tonnes per hectare (t/ha). The detailed ANOVAs for all treatments are available in Supplementary Table 3[1].

Table 3. Enumeration of *Clostridium* spp. in unamended control soil or in soil receiving swine manure compost (SMC), yard waste compost (YWC), or food waste compost (FWC) at the indicated application rates.

	Clostridium spp. (CFU/g dry soil)					
Year	Control	SMC (75 dry t/ha)	YWC (75 dry t/ha)	FWC (75 dry t/ha)	FWC (150 dry t/ha)	FWC (300 dry t/ha)
1999	BDL (4)	760, BQL (2)	BDL (3)	BDL (4)	BDL (4)	BDL (3)
2001	BDL (3)	1373±121	BDL (3)	BDL (3)	BDL (3)	BDL (3)
2003	BDL (3)	653±364	BQL (1), BDL (2)	BDL (3)	BDL (3)	BDL (3)
2009	BQL (1), BDL (2)	587±583	BDL (3)	BDL (3)	BQL (2), BDL (1)	BQL (2), BDL (1)

Note: The application rate is indicated in tonnes per hectare (t/ha). BQL indicates values were below the quantitation limit of 400 CFU/g dry soil; BDL indicates values were below the detection limit of 20 CFU/g dry soil. Values in parentheses indicate the number of replicates.

Conclusions générales

La suite standard d’indicateurs et d’agents pathogènes énumérés s’épuise en une saison. Pas les clostridies..

Une seule saison de croissance ne suffit pas pour réduire l’abondance des gènes de résistance aux antibiotiques dans les sols à l’état de fond.

Une plus grande abondance de gènes de résistance aux antibiotiques sur les cultures cultivées en contact avec des engrais fécaux.

Importance des endophytes transitoires?

frontiers in Microbiology

ORIGINAL RESEARCH
published: 31 October 2015
doi: 10.3389/fmicb.2015.01207

CrossMark

Systemic colonization of clover (*Trifolium repens*) by *Clostridium botulinum* strain 2301

*Matthias Zeiller[1], Michael Rothballer[1], Azuka N. Iwobi[2], Helge Böhnel[3], Frank Gessler[3,4], Anton Hartmann[1] and Michael Schmid[1]**

[1] Research Unit Microbe-Plant Interactions, Department for Environmental Sciences, German Research Center for Environmental Health – Helmholtz Zentrum München, Neuherberg, Germany, [2] Bavarian Health and Food Safety Authority, Oberschleißheim, Germany, [3] Institute for Applied Biotechnology in the Tropics at the Georg-August University Goettingen, Goettingen, Germany, [4] miprolab GmbH, Goettingen, Germany

Trends in
Plant Science

CellPress

Opinion

The risk of transmitting antibiotic resistance through endophytic bacteria

Nazareno Scaccia[1], Ivone Vaz-Moreira[1,@] and Célia M. Manaia[1,*]

Environmental Science & Technology

pubs.acs.org/est

Article

Sewage Sludge Promotes the Accumulation of Antibiotic Resistance Genes in Tomato Xylem

Wen-Jing Li,[#] Hong-Zhe Li,[#] Jiayang Xu, Michael R. Gillings, and Yong-Guan Zhu*

Cite This: *Environ. Sci. Technol.* 2024, 58, 10796–10805

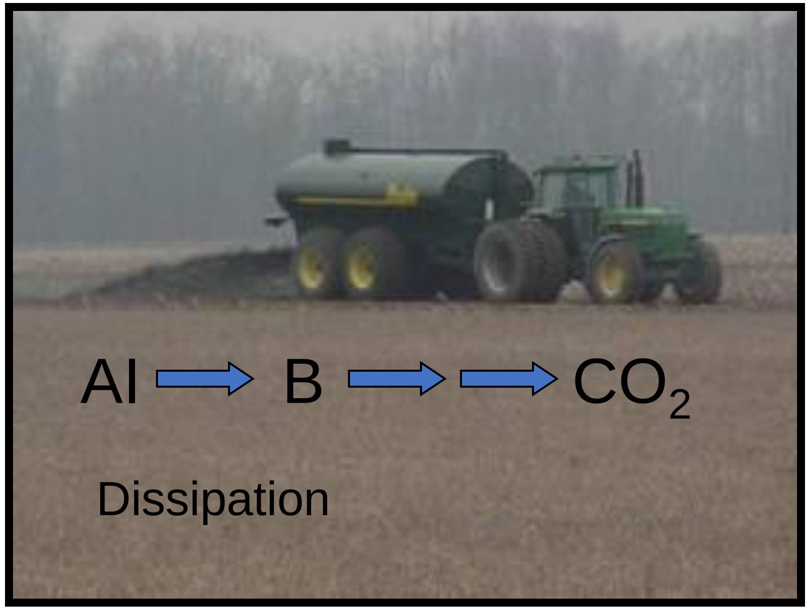
Read Online

Impacts des antibiotiques suite à l'application sur le sol

Produits pharmaceutiques dans les biosolides (microgram/kg)

Triclocarban	6030	Amlodipine	120	Atorvastatin	15.1
Ciprofloxacin	5870	Norverapamil	94.7	Cotinine	14.8
Triclosan	4680	Carbamazepine	94.3	Codeine	14.6
Norfloxacin	1750	Fluoxetine	89.8	Naproxen	14
Ofloxacin	1068	Valsartan	76.5	Hydrocodone	11
Diphenhydramine	781	Verapamil	70.2	Diltiazem	10.1
Sertraline	497	Clarithromycin	67.4	Enrofloxacin	10.1
Miconazole	477	Norfluoxetine	59.6	Gemfibrosil	7.89
Amitriptyline	448	Anhydrotetracycline	55.8	DEET	6.89
4-Epitetracycline	386	Doxycycline	42.4	Erythromycin-H_2O	4.06
Tetracycline	341	Cimetidine	42.1	Ranitidine	3.26
Azithromycin	213	Digoxigenin	38.1	Propoxyphene	2.9
Ibuprofen	167	Propranolol	35.4	Atenolol	2.88
Triamfarene	153	Anhydrochlortetracycline	32.9	Benztropine	2.46
Amphetamine	147	10-OH-amitriptyline	23.3	Desmethyldiltiazem	2.05
Paroxetine	130	Thiabendazole	16.5	Diazepam	0.845

Comprendre le risque : préoccupations potentielles



Étude d'exposition à long terme aux antibiotiques à la ferme d'AAC à London Ontario

Microparcelles répliquées
Application printanière annuelle de divers mélanges de médicaments simulant ce qui pourrait être entraîné dans le fumier ou les boues d'épuration, ou les eaux usées recyclées
2010-

Traitements [0.1 or 10 mg/kg sol]

- Sulfamethazine + tylosin + chlortetracycline
- **Erythromycin + clarithromycin + azithromycin**
- Ciprofloxacin + norfloxacin
- Ceftiofur + cefotaxime + cefalexin
- Lincomycin, spectinomycin

- Coccidiostats: roxarzone + amprolium
- Antivirals: tenofovir + tamiflu + acyclovir
- Antifungals: miconazole, clotrimazole
- Anticancer: prednisone + cytarabine + 5-fluorouracil + capecitabine

•

L'exposition aux antibiotiques augmente-t-elle l'abondance des gènes de résistance aux antibiotiques?

Abundance de GRAs [Année 10]

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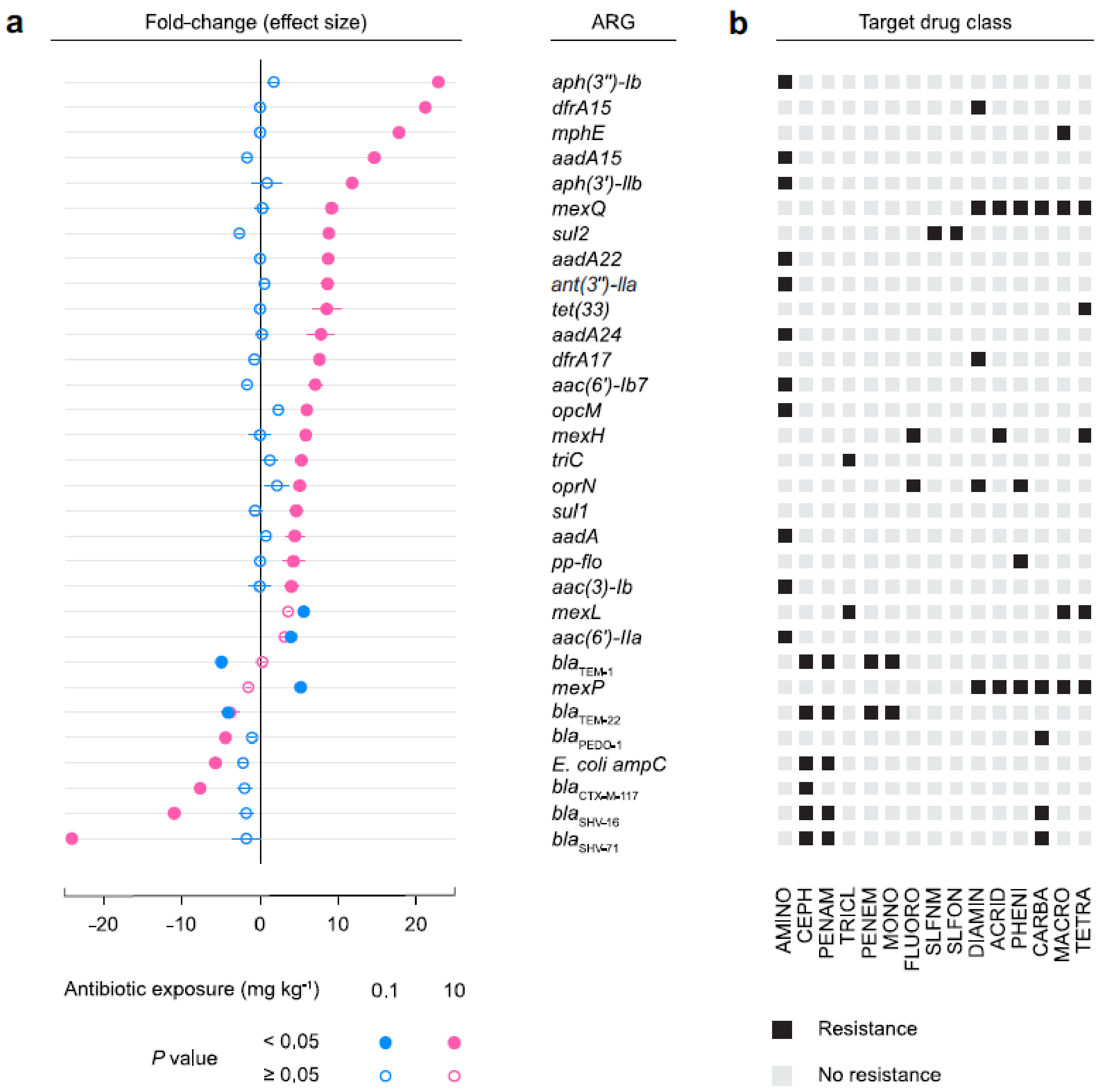
PUBLIC AND ENVIRONMENTAL HEALTH MICROBIOLOGY

Check for updates

Responses of the Soil Bacterial Community, Resistome, and Mobilome to a Decade of Annual Exposure to Macrolide Antibiotics

Liam P. Brown,[a,b*] Roger Murray,[a] Andrew Scott,[a] Yuan-Ching Tien,[a] Calvin Ho-Fung Lau,[c] Vera Tai,[b] Edward Topp[a,b]



L’exposition aux antibiotiques augmente-t-elle l’abondance d’éléments génétiques mobiles ?

Abondance des EMGs [année 10]

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Responses of the Soil Bacterial Community, Resistome, and Mobilome to a Decade of Annual Exposure to Macrolide Antibiotics

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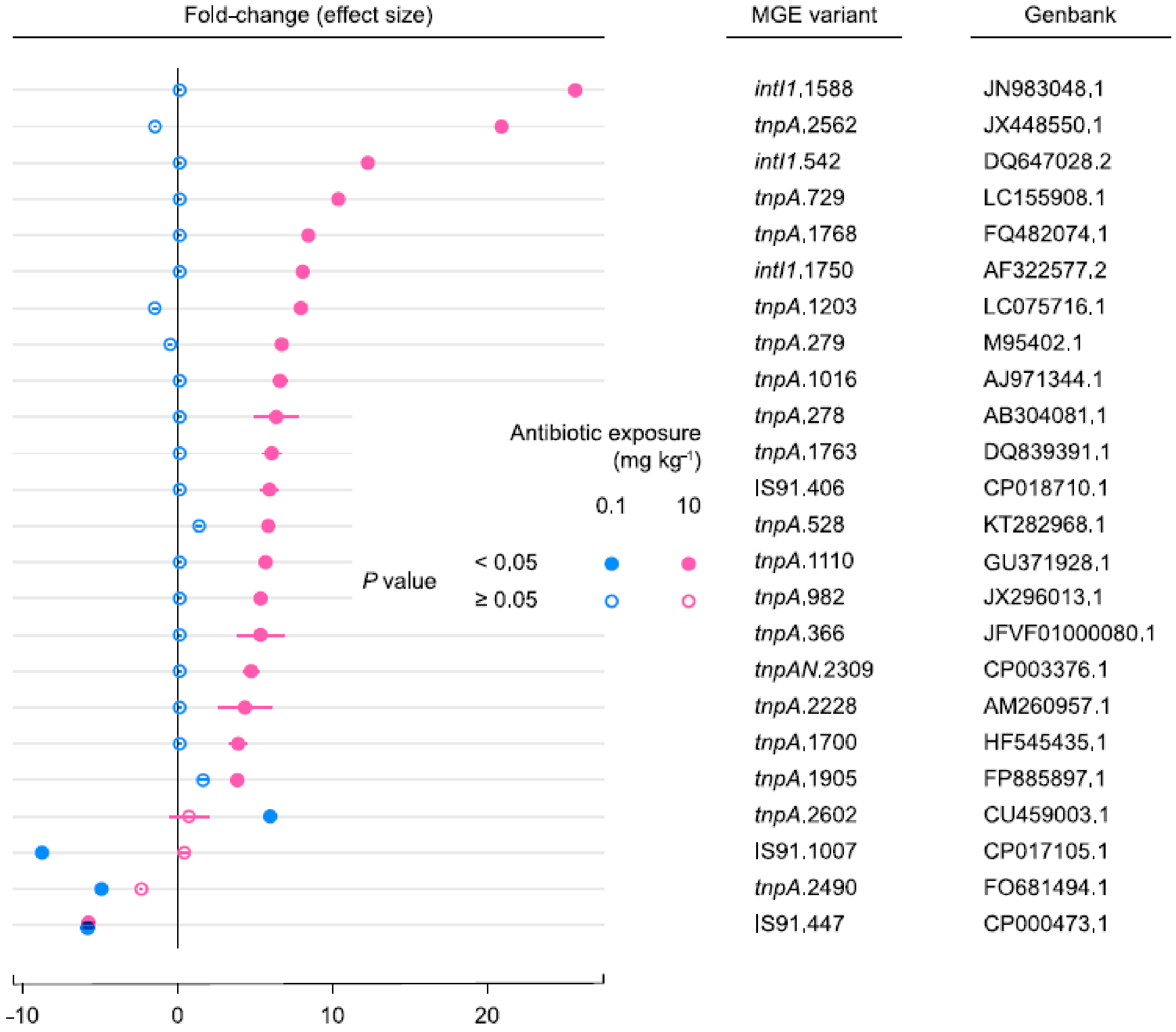

Merci, si le sujet vous tien au coeur..

https://www.unep.org/resources/superbugs/environmental-action

SCIENTIFIC OPINION

EFSA Journal

ADOPTED: 29 April 2021

doi: 10.2903/j.efsa.2021.6651

Role played by the environment in the emergence and spread of antimicrobial resistance (AMR) through the food chain

EFSA Panel on Biological Hazards (BIOHAZ),
Konstantinos Koutsoumanis, Ana Allende, Avelino Álvarez-Ordóñez, Declan Bolton,
Sara Bover-Cid, Marianne Chemaly, Robert Davies, Alessandra De Cesare, Lieve Herman,
Friederike Hilbert, Roland Lindqvist, Maarten Nauta, Giuseppe Ru, Marion Simmons,
Panagiotis Skandamis, Elisabetta Suffredini, Héctor Argüello, Thomas Berendonk,
Lina Maria Cavaco, William Gaze, Heike Schmitt, Ed Topp, Beatriz Guerra, Ernesto Liébana,
Pietro Stella and Luisa Peixe

Merci