

# Shall we fear medical residues from urine fertilizing?

By Robert Cossette, Engineer

NB: several links are embedded in this file and you can click on them.



For 6 years I have used 3 tons of urine as fertilizer. The results are extraordinary and make the ecological gains of this revolution accessible to all. **We can save 12 to 20 tons of water per person** (60 to 100 € per year), protect aquatic environments and reduce our GHG emissions nearly 10 %.

Plus, I got tomatoes with higher sugar content, higher growth and better taste. Strawberries, corn, squash, peas, garlic, sunflowers, flowers and salsify all grew perfectly with this free natural fertilizer. My tomatoes fertilized with urine were tasted by hundreds of people in France, Switzerland and Stockholm during WWW.

I am not the only experimenter to notice this quality in the garden. **Finnish** researchers measured more vitamins and less nitrates in tomatoes fertilized with urine. In Africa, the comparative taste tests of the **SEI** also indicated a preferred taste. Our tests in **Burkina Faso** resulted in sweeter tomatoes using less water.

At first I also wondered about the hypothetical risk of medical residues.  
But since I don't take any medication, I started my tests without having all the answers.





It is important to start this comparison with an awareness of the **actual risks with synthetic fertilizers**. For 100 years, nitrogen has been produced massively with gas to replace animal and human manures. Chemical fertilizers are very compact and highly concentrated. They were inexpensive until the last gas crisis. But chemical fertilizers are **explosive in addition to added CO<sub>2</sub> emissions**.

An explosion of ammonium nitrate **killed 31 people in France** in Toulouse in **2001**.

**15 people were killed** at the West Fertilizer Company, Texas **USA in 2013**

In 2020, an explosion **killed another 220 people in Beirut**.

There have been 22 such explosions worldwide according to this statement with more than 2,240 deaths

But that's not all. The production of mineral phosphate also leads to the diffusion of heavy metals which accompanies certain fertilizers sold and used for your vegetables.

Carcinogenic cadmium and uranium are detected in agricultural land.

A report on ARTE TV explained how these heavy metals arrive in the soil.

<https://www.quechoisir.org/actualite-cadmium-dans-les-aliments-la-faute-aux-engrais-n71151/>

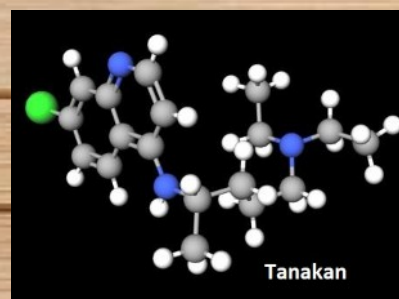
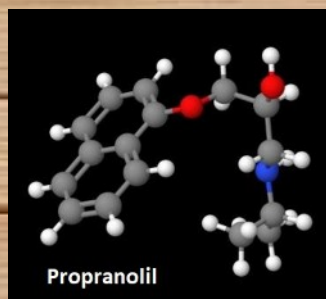
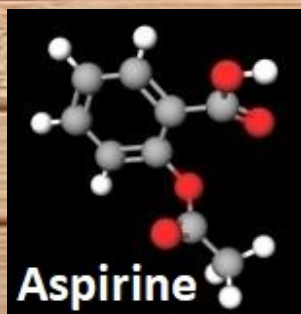
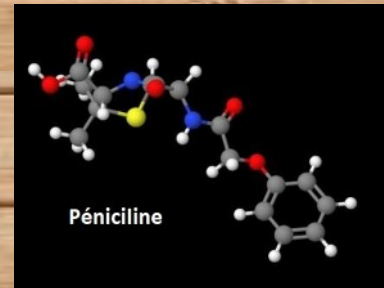
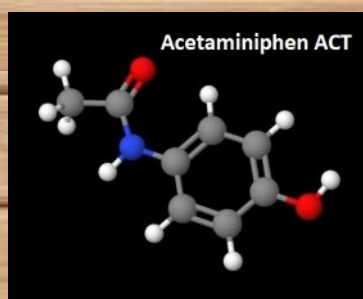
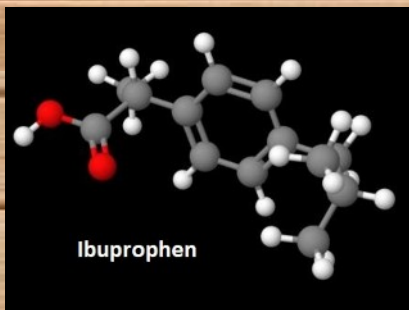
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<https://www.agrarforschungs Schweiz.ch/fr/2021/09/quelles-quantites-de-metaux-lourds-se-retrouvent-dans-les-sols-agricoles/>





# Let's identify the enemy: pharmaceutical residue > large carbon molecules

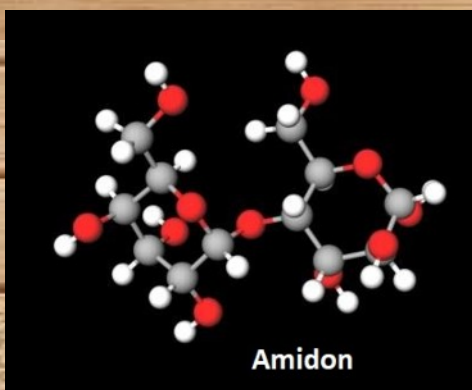


Medicines that our intestines, skin or mucous membranes easily absorb are made of large carbon molecules. Their presence in surface water or groundwater is a problem because sewer stations do not ensure their degradation.

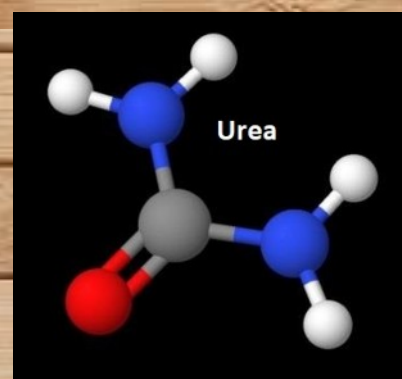
Antibiotics, anti-inflammatories, painkillers, beta-blockers have this type of molecules with several carbon atoms (in gray). Our digestive system readily absorbs these large drug molecules like fats, sugars, proteins and carbohydrates.

Our animal metabolism degrades these molecules which are then evacuated in the form of fragments or sometimes in intact molecules.

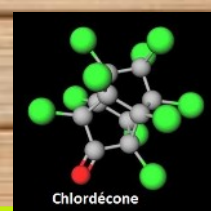
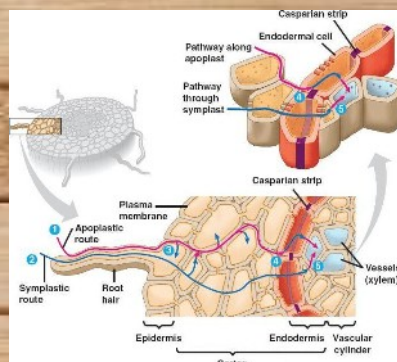
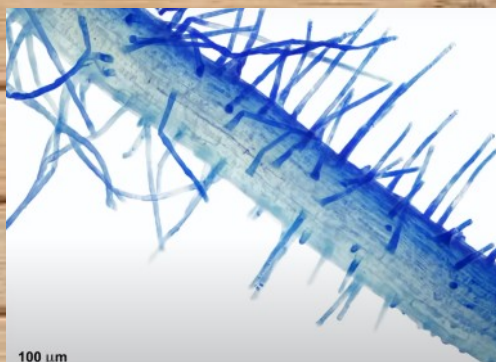
Our muscles also transform our carbonaceous foods into urea which will be filtered by the kidneys, evacuated in the urine. **UREA will become the best source of nitrogen for your plants.**



Muscular work  
and passing by  
liver and kidneys



**The roots of plants are much more filtering than our intestines.**  
**They absorb only**  
**very small molecules.**



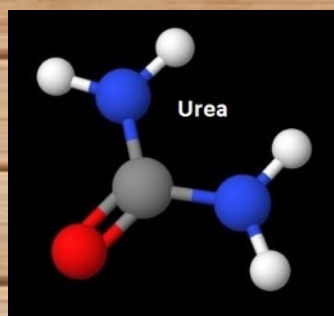
The roots of the plant are hyper-selective and much more filtering than our intestines or animal mucous membranes. The roots absorb water, minerals, ammonium, nitrate, phosphate.

Plants are autotrophic and do not eat sugar, starch, protein or fat like us. The carbonaceous molecules are almost impossible to get into roots. The drugs therefore remain in the soil to decompose naturally. At worst, molecular traces may exist on the surface of root vegetables but do not enter or rise into the fruit. Even the toxic chlordécone pesticide remains in the soil and the bananas are free.

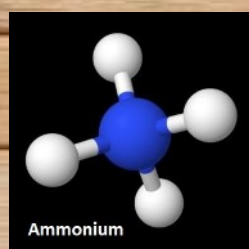
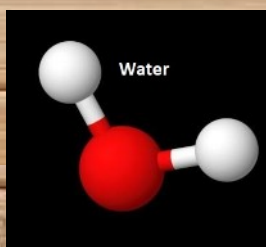
Urea with the essential nitrogen must be released from the carbon before entering through the roots. This small desirable molecule, must hydrolyze first to turn into **absorbable** ammonium  $\text{NH}_4^+$ . The unabsorbed part of  $\text{NH}_4^+$  can then transform into **absorbable and mobile** Nitrate  $\text{NO}_3^-$ .

Soil bacteria and their enzymes are responsible for breaking these molecules to remove the carbon atoms. Soil is a much more efficient degradation medium than water.

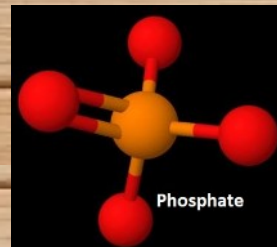
Urea with a single carbon atom  
**is refused by the roots**



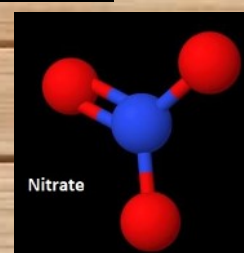
Hydrolysis



Absorbed by roots



Nitrification  
 ( if necessary)



Absorbed by roots



### First good news:

In fact, human urine contains less drug residues than animal manure.

Farm animals are treated at higher doses than humans.

And these veterinary doses are given to whole herds unlike humans treated individually.

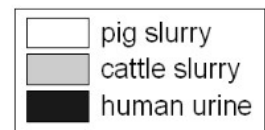
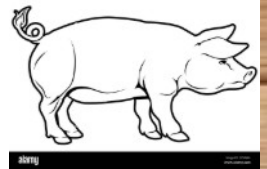
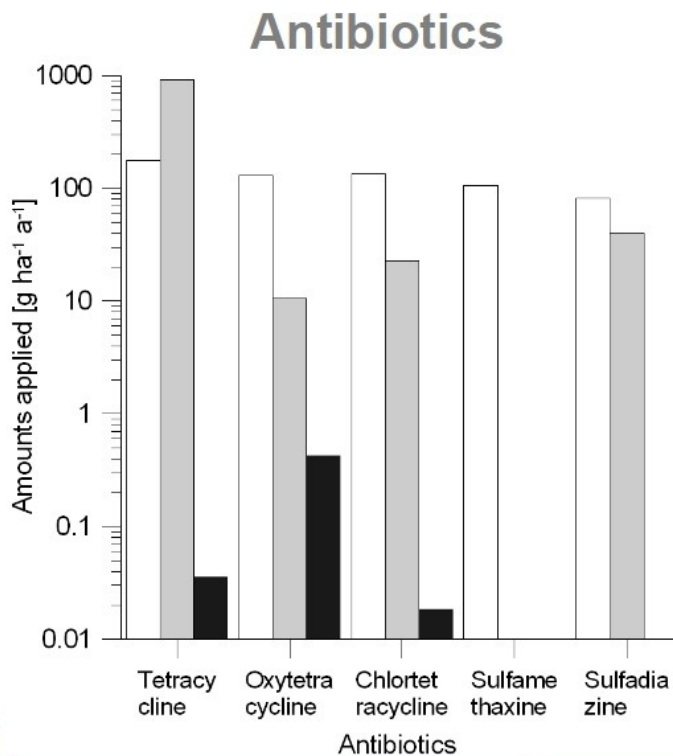
Here is a figure from the presentation made in 2007 by researchers Hammer and Clemens.

According to their study, slurry contains 10 to 100 times more drug residues than human urine. We all know animal manure is currently authorized to fertilize the vegetables we eat.

It would therefore already be preferable to use human urine rather than slurry to reduce the possible risk of medical residues in your food.



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Institut für Abwasserwirtschaft  
und Gewässerschutz

**TUHH**  
Technische Universität Hamburg-Harburg

## Second good news:

In Stockholm, the SEI (Stockholm Environment Institute) has done a lot of work on the recovery of human urine.

The SEI explains that medical residues are much better degraded in the ground with the presence of 50,000 times more oxygen than in the water of sewage stations.

"... it is likely to be safer to discharge urine to soil, rather than to let it pass the conventional system. The micro-pollutants can be degraded better in the aerobic, biologically active soil layers (high concentration of micro-organisms per cubic centimetres) with long retention times than in water bodies whose ecosystems are much more sensitive. Soil is considered a more suitable medium for natural degradation of pharmaceuticals than water... » ( page 5).

According to this explanation, the recovery of urine on huge growing surfaces is much better for degrading medical residues than concentrating them at the outlet of treatment plants. After effective degradation by the soil, these residues will not pollute the water table or rivers. The problem is over.



## Third good news:

To go even further, absorption trials were carried out in the USA by the **Rich Earth Institute** to grow vegetables with collected urine and urine deliberately overloaded with medical residues. Together with the **University of Buffalo** and the **University of Michigan** they measured the content in urine, in soil, in lettuce, and in water after percolating through soil.

Their conclusion is that plants do not concentrate medical residues.  
On the contrary, the molecular traces in vegetables is lower than the starting concentrations.

Their measuring instrument was able to detect to the nearest nanogram ( $10^{-9}$  grams) atomic traces deposited on the surface.

For example, the molecular traces of Acetaminophen ACT in lettuces were about  $6 \times 10^{-6}$  g/kg with fertilization using collected urine. To absorb a dose of 1 gram of ACT, you would therefore have to ingest the molecular traces contained in 166 tons of these salads, i.e. 1 kg per day without interruption for 500 years.

For the antibiotic Ciprofloxacin (CIP) a rate of 2  $\mu$ g per Kg was measured in lettuce while the European standard authorizes 100  $\mu$ g per Kg of this antibiotic in meat. This is 50 times less than the norm.

The US measurements demonstrate the effectiveness of the soil in breaking down medical residues because the concentration of the recovered percolation water (Figure 11) had traces of residues about 1000 times lower.





## Analysis of Pharmaceuticals in Food Crops Grown in Urine- and Struvite-Fertilized Soil by Liquid Chromatography-Tandem Mass Spectrometry

Rachel A. Mullen<sup>1</sup>, Abraham Noe-Hays<sup>2</sup>, Kim Nace<sup>2</sup>, Rebecca Lahr<sup>3</sup>, Heather Goetsch<sup>3</sup>, Nancy Love<sup>3</sup>, Krista Wigginton<sup>3</sup>, and Diana S. Aga<sup>1</sup>

<sup>1</sup>University at Buffalo, <sup>2</sup>Rich Earth Institute, <sup>3</sup>University of Michigan

### Pharmaceuticals Levels in Each Matrix

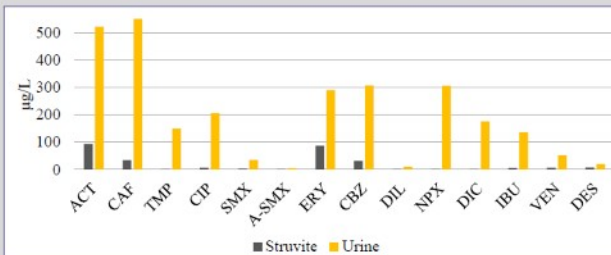


Figure 5. Pharmaceuticals in Struvite and Urine



Figure 6. Pharmaceuticals in Spiked Urine

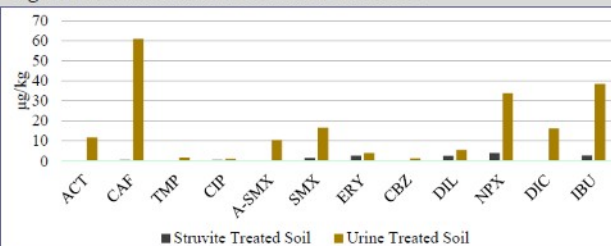


Figure 7. Pharmaceuticals in Soil Treated with Struvite and Urine

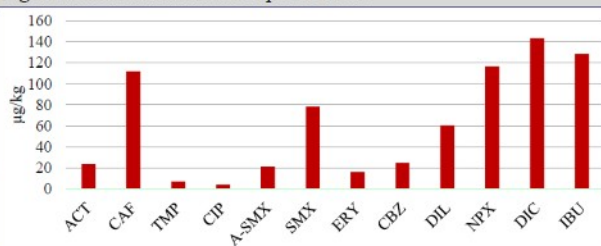


Figure 8. Pharmaceuticals in Soil Treated with Spiked Urine

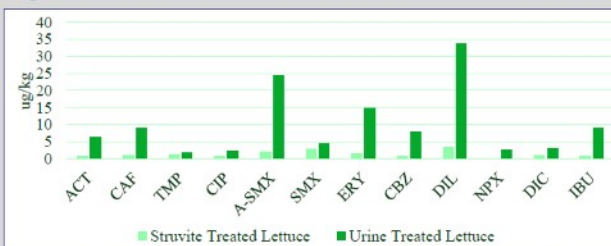


Figure 9. Pharmaceuticals in Lettuce Treated with Struvite and Urine



Figure 10. Pharmaceuticals in Lettuce Treated with Spiked Urine

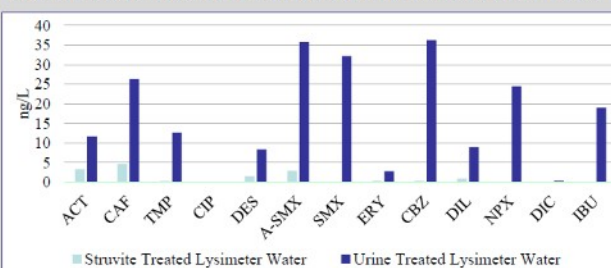


Figure 11. Pharmaceuticals in Water Treated with Struvite and Urine

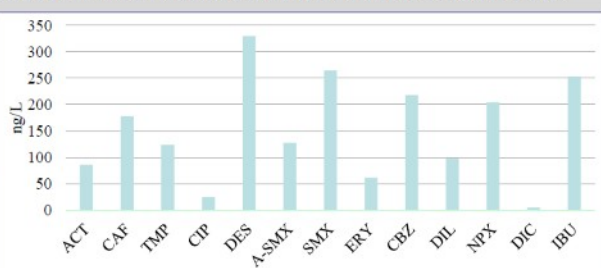


Figure 12. Pharmaceuticals in Water Treated with Spiked Urine

## LC-MS/MS

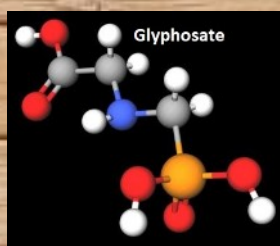
All spectra was acquired using a Agilent 6410 triple quad mass spectrometer equipped with an 1100 HPLC system. Separation is achieved using a beta basic column and ionization is achieved in positive mode using electrospray ionization. A representative separation of the pharmaceuticals in this study can be seen in Figure 3 below.



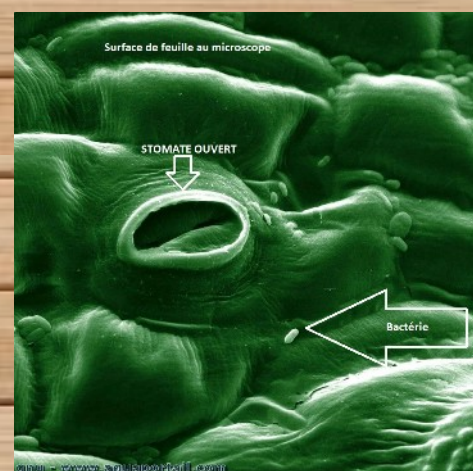




The classic application with a watering can deposits droplets on the surface of the foliage. These droplets may contain possible pathogens, medical residues or chemicals such as Glyphosate. **The leaves are less filtering than the roots.** **It is better to avoid this entry route.**



**Surface Spray**



Application with the Solar-Dripper.  
**No drops on the foliage**  
and a more precise dosage.



#### Fourth good news: a precise application.

The World Health Organization has identified a clear benefit of underground urine application without spraying the edible parts or foliage. According to the WHO guidelines the risk of pathogen presence is reduced by a factor from 100 to 1,000,000. (Volume 2 page 77).

In 2012, the WHO was unaware of the existence of the ORIAZ solar dripper and its unique capacity to allow particles larger than 2 mm to pass, to tolerate salts and biofilms. Thanks to its patented regulator, the ORIAZ Solar-Dripper can use rainwater without filtration. It is 10 to 100 times more clog tolerant than conventional drippers. The water is directed only to the heart of the roots with a flow rate 10 to 100 times slower than conventional drippers.

In 2012, I also didn't know that my urine could be used so easily as a fertilizer. I had used and tested all types of industrial fertilizers, bio fertilizers, mycorrhizal inoculants and bio stimulants for 15 years before testing urine fertilizer in 2017. Impressive success from the start with higher quality and more abundant crops with my free urine compared to commercial fertilizers.

The precise application only in the soil prevents pathogens to go on the surface of the leaves. This underground application also avoids traces of medical residues on the foliage.

Foliar absorption by plants is much less filtering than root absorption. Phytosanitary products are sprayed in droplets to settle on the foliage. For example, Glyphosate can enter through foliage. But it is not recommended to apply in the ground because it will all be wasted.

This precise method of applying urine avoids both the deposit of any medical residues and any possible pathogens on the leaves. The risk of absorption of medical residues will therefore be further reduced with the application using the ORIAZ Solar-Dripper.



Conclusions: the risk of absorption of medical residues with fertilizing urine of human origin is less than with animal manures already usable in organic or industrial farms.

The molecular size and the presence of carbon atoms in the pharmaceutical residues prevent their absorption by the roots. It is simply preferable to avoid the foliar application and to remove the possible surface deposit on the root vegetables like most people already do for other reasons.

The degradation of medical residues on huge growing surfaces is a viable solution to the current problem of concentration at the outlet of sewage plants. Medical and hormonal residues can present a danger to the animal world and fish, **but are magnificently refused by the roots of plants.**

In the end, the controlled recovery of your human urine into fertilizer is a solution to protect the environment from medical residues. This method has demonstrated its ability to produce superior food.

In addition, this solution ensures a renewable source of nitrogen and phosphorus for future generations. Watersaving, protecting rivers and reducing greenhouse gases are your bonus reward.

The collection method without cross-contamination with the **ORIAZ Urinette** and the method of application in the ground with the **ORIAZ Solar-Dripper** reduce risks to a negligible level.

You can use your urine right now in your garden and share your delicious crops!



Contact us for a pack of 6 Solar-Dripper or a complete ORIAZ **SYMBIO** equipment for your demonstration garden In France +33 6 76 94 27 97 commande @ oriaz.com  
Retailers and distributors welcome



Online store : **ORIAZ x6** **SYMBIO** Garden kit **ORIAZ Urinette 3D**

