

### **Entrepreneurs Working on Solutions for Urine-recycling**

31st SuSanA Meeting , 16 – 20 August, 2021

www.susana.org

Linus Dagerskog (moderator)



- Linus Dagerskog: Introduction to pee-cycling
- Robert Coisette: ORIAZ Solar Dripper (France)
  - Jenna Senecal: Sanitation360 (Sweden)
- Raluca Anisie:

Mosan (Guatemala)



- The entire session will be recorded
- Turn off your video and microphones the less background noise, the better
- During the session you can communicate via the chat to say hello to the community and to ask questions
- The session will take 60-90 minutes take care of yourself



### We excrete what we eat – and most resources with urine



World market fertilizer prices for June 2021 from www.indexmundi.com (urea, TSP, KCl)

- Enable recycling of the bulk of nutrients in excreta/wastewater to agriculture
- Reduce nutrient pollution of waterbodies
- Reduce nutrient/micropollutant loads to wastewater treatment plants
- Water saving from no flush toilets
- Urine diversion can reduce odors in dry toilets (if well managed)
- Comparatively low pathogen load

### Some pee-cycling challenges...





Photo: Linus Dagerskog

Ammonia volatilization



Pipe clogging



Urine scale (Kai Udert, 2002)

**Micro pollutants** 

Photo: www.britannica.com/science/drug-chemical-agent



Salt

Photo: Wikipedia (CC)







Illustrations: www.thoughtco.com/folkways-mores-taboos-and-laws-3026267

#### Two main situations:

- Household scale pee-cycling ("easy")
- Community/city scale pee-cycling (tricky...)

Pathogens

## Household scale pee-cycling: Example from Ethiopia







Photos: Linus Dagerskog

## **Popular variant – direct composting of urine**



Ethiopia





Burkina Faso



Niger

## Household scale – example of innovation: "Golden watering can"



Guldkannan (Sweden) https://www.guldkannan.se/en-GB

## Innovations for public pee-cycling through straw composting

"Uri-tonnoir"







"Uri-trottoir"



sur l'île Feydeau à Nantes - J. Urbach/ 20 Minutes



A Uritrottoir in Nantes. Photograph: Courtesy of www.uritrottoir.com

Faltazi (France) https://www.faltazi.com/

### Female public urinal – 1300 liter collection capacity



#### The female urinal

Lapee ensures a cleaner, safer, more efficient option for womxn to pee. No more endless lines at outdoor events.



Lapee (Denmark) https://www.lapee.dk/

# Urine diversion toilets...

Google	urine separating toilet				



sustainable

sanitation alliance





Urine-Diverting Dry Toilet (UDDT) | SSWM - Find to ...

Kildwick Classic Separator / U... kildwick.com · I lager



Separett - Child Seat Ur... separett.com

sswm.info



Urine Diverting Toilets - GreenLatrine Co... pinterest.cl

Urinetrap.com

urinetrap.com



Reinventing the toilet - urine di...

en.wikipedia.org



trobolo.com · I lager

my-composting-toilet.com



How to find the right Urine Separator Ins...



Rich Earth Institute : Ur... richearthinstitute.org



Urine diversion - Wikiwand wikiwand.com



EcoFlush and EcoDry ecovita.net





urine diverter (For Male... ebay.com · I lager







....

3

ecotechproducts.net





Examples of urine-separating toilets (a) R...







kildwick.com · I lager

Urine-diverting toilets insert (whit...

trobolo.com · I lager





theconversation.com

Kildwick Compact Urine Diver...

0 9

Urine diversion - Wikipe...

An economical DIY urine-separating ...

pinterest.at

Composting Toilet Seat and urin...

abetterwaytogo.com.au











### New urine diversion toilet – invisible separation with "urine trap"

### EOOS (Switzerland) http://urinetrap.com/



**Fig. 2** Basic principle of urine-separating flush toilets using the teapot effect. Copyright EOOS.



**Fig. 3** The urine-separating toilet safe! from LAUFEN, implementing the urine trap. The special structures at the front-end of the toilet direct the urine towards the (nearly invisible) urine trap.<sup>112</sup> Copyright LAUFEN.<sup>123</sup>

Source (Larsen et al. 2021)

### Tips: Some books and guides for the public



Steinfeld (2004)



Looze (2016)



Rich Earth Institute (2019) https://richearthinstitute.org/

### *Tips: Some urine guidelines from ~2010*



Generic guideline



 ECOSAN TOLET

 ECOSAN TOLET

 Interview

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 ECOSAN TOLET

 Interview

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#### Philippines

A Practical Field Guide



# Thank you!

PS. Most gold in your morning urine...



# optimized application of fertilizing urine

sustainable sanitation alliance

oriaz.com Robert Cossette, engineer, NRC Bio innovation,

**SuSanA** 

Meeting

online

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ARIMA

CIENT SO

NOK,

OK

# Numerous publications explain the fertilizing value of urine.







Made in Annecy, France

# The ORIAZ Solar-Dripper is a watering system for plants





oriaz.com Robert Cossette, engineer, NRC Bio innovation,



# **ORIAZ** watering is synchronized with the needs



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SOLAR DRIPPER



# > Oxygenated soil

The cone maintains a ideal oxygenation in the heart of the roots.

This oxygenation allows the favorable development nitrifying microorganisms.





# **Clogging FREE**

SOLAR DRIPPER

**ORIAZ** is Ultra Tolerant to Clogging.

It allows particles larger than 2 mm and biofilms to pass. = No filtration required.



Mitutovo







oriaz.com Robert Cossette, engineer, NRC Bio innovation,

SOLAR DRIPPER



Fair trade definition : Give to the plant the water, nitrogen and minerals it needs and it nourishes you with fruits and vegetables full of vitamins.

#solardripperchallenge



# Solar-dripper.com

oriaz.com Robert Cossette, engineer, NRC Bio innovation,



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Application of fertilizing urine May 30th

120 ml of urine per bottle diluted in 800 ml of solution, i.e. 15% urine. The irrigated area is 40 cm x 60 cm per bottle, i.e. 0.24 m<sup>2</sup>. With an estimated initrogen rate of 0.6% (ref: Renaud De Looze) this application represents approximately 3 grams of nitrogen equivalent per m<sup>2</sup>. This operation can be carried out 6 times in the season not to exceed 20 g / m<sup>2</sup>.



# Lasagna garden



oriaz.com Robert Cossette, engineer, NRC Bio innovation,



### Tasted in Annecy, Lyon, Dijon, Geneva, Lausane, Zürich and Stockholm

### World Water Week at Stockholm 2019

They tried tomatoes fertilized with urine and applied with the Solar-Dripper solar-dripper.com





### Tasted in Annecy, Lyon, Dijon, Geneva, Lausane, Zürich and Stockholm WWW

OK

# **Mission Possible**

Save drinkable water costs 72 € / year
Save 18 tons of water per year
Save the purchase of fertilizer €\$£
Save the cost of sanitation €\$£

- Protect aquatic environments

The natural transformation of urine into fertilizer saves water and protects the environment.

In addition, it is a very effective free fertilizer.

Fair trade definition from to the plans the water, minogen and minorals it needs and , it nourishes you with fruits and wegetables full of mamins.





Marie Curie took great risks to discover radioactivity.



To find out the fertilizing value of urine in your plants, there is no big risk.

All you need is the courage to collect your urine the first time, dilute it and apply it. Then observe or taste the harvests.



![](_page_30_Picture_8.jpeg)

![](_page_31_Picture_0.jpeg)

### Sweeter tomatoes, more vitamins and free fertilizer.

### Tomatoes fertilized with urine

From 9° Brix to 12.2 ° Brix Average 10.6 ° Brix

![](_page_31_Picture_4.jpeg)

Tomatoes from the organic store

From 7.5 to 9.0 ° Brix Average 8.1 ° Brix

© Robert Cossette oriaz.com

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![](_page_32_Picture_0.jpeg)

# **Regular application : from 2 to 5 % urine**

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![](_page_33_Picture_0.jpeg)

STURY D

acout an hugag

# Average urine content :

![](_page_33_Picture_2.jpeg)

# Guide pratique pour produire ses fruits et légumes en utilisant les urines et composts locaux

# 0,6 % N 0,1 % P 0,2% K Ref Renaud De Looze

![](_page_33_Picture_5.jpeg)

Renaud de Looze URIN - Flüssiges Gold für den Garten Düngen mit Urin und Kompost

![](_page_33_Picture_7.jpeg)

> The same average contents were measured in USA at the University of Vermont in 2013

![](_page_33_Picture_9.jpeg)

![](_page_33_Picture_10.jpeg)

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![](_page_34_Picture_0.jpeg)

# Method :

![](_page_34_Picture_2.jpeg)

Measure urine by weight to calculate the Nitrogen content

Drench gun to ease application

# Measure urine by volume density is about 1,01

![](_page_35_Picture_0.jpeg)

![](_page_35_Picture_1.jpeg)

![](_page_35_Picture_2.jpeg)

![](_page_35_Picture_3.jpeg)

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### Material for a garden: rainwater tank, baskets, ORIAZ Solar-Dripper and a drench gun.

![](_page_35_Picture_6.jpeg)

![](_page_36_Picture_0.jpeg)

# **New Available ORIAZ solution**

#### Retail product available

![](_page_36_Picture_3.jpeg)

#### Solar-Dripper +Free Fertilizer • for life !

Your fertilizing wrine contains abo nitrogen per liter \* as natural ure phosphorus, potassium and mines performs as well or better than ch

In addition, you save water and p from pollution. The ecological and are outstanding. You will also redu greenhouse gases with this SYMBIO

With the precise ORIAZ Solar-Dripper there are no loss and no odor.

Examples of urine dosage :

Indoor plant : 50 ml every 2 months Balcony : 50 ml each month Tomatoes : 100 ml each month

> OK OK Save 18 m<sup>3</sup> of water per year

ORIA

SOLA DRiPP

#### utteur-Sola

ORIA7

by:

De Looze

# **ORIAZ SYMBIO**

# 5 € per unit

with basic guide for urine fertilizing

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![](_page_37_Picture_0.jpeg)

### Solar-Dripper +Free Fertilizer ♥ for life !

Your fertilizing wine contains about 6 grams of nitrogen per liter \* as natural urea. With soluble phosphorus, potassium and minerals, this fertilizer performs as well or better than chemical fertilizers.

In addition, you save water and protect rivers from pollution. The ecological and economic gains are outstanding. You will also reduce your greenhouse gases with this SYMBIO solution.

With the precise ORIAZ Solar-Dripper there are no loss and no odor.

SOLAR DRIPPER

Examples of urine dosage :

Indoor plant: 50 ml every 2 months Balcony: 50 ml each month Tomatoes: 200 ml each month

![](_page_37_Picture_8.jpeg)

![](_page_37_Picture_9.jpeg)

Tested in USA by :

![](_page_37_Picture_11.jpeg)

Symbio Guide

ORIAZ Solar-Dripper

on your tomatoes!

per month and never had

RIMP

I dilute about 200 ml of wrine

such tastefull tomatoes.

Happy gardening to all!

ORIAZ is compatible with all types of fertilizer concentrates including Aurin.

![](_page_37_Picture_14.jpeg)

Open the video with this code

![](_page_37_Picture_16.jpeg)

Visit us on oriaz.com

DRiPPER

RICH

![](_page_37_Picture_19.jpeg)

Robert Cossette, engineer, NRC Bio innovation, oriaz.com

![](_page_38_Picture_0.jpeg)

#### **ORIAZ SYMBIO 88**

Full set with:

88 ORIAZ Solar-Dripper Two baskets 12 calibrated rigid bottles

+ an adjustable drench gun from 0 to 70 ml to measure urine or any biological or conventional fertilizer.

+ A 100 ml measuring cup + guides and posters.

OK B

OK

![](_page_39_Picture_5.jpeg)

![](_page_39_Picture_6.jpeg)

Tested in USA by

![](_page_39_Picture_8.jpeg)

349 €

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Made in Annecy, France

Made in France

![](_page_40_Picture_1.jpeg)

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![](_page_41_Picture_1.jpeg)

![](_page_41_Picture_2.jpeg)

![](_page_41_Picture_3.jpeg)

Kong F1 Sunflowers fertilized with ORIAZ Solar-Dripper

![](_page_41_Picture_5.jpeg)

![](_page_41_Picture_6.jpeg)

![](_page_41_Picture_7.jpeg)

#### 18 juillet 2021 246 cm

Aujourd'hui la bataille pour le climat réussira ensemble. La photosynthèse est notre arme naturelle.

![](_page_42_Picture_3.jpeg)

Avant

A DECEMBER OF A

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![](_page_43_Picture_1.jpeg)

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![](_page_44_Picture_1.jpeg)

Cet ail rose de 115 cm a été fertilisé avec de l'urine dans notre jardin test d'Annecy.

![](_page_44_Picture_3.jpeg)

Méthode de culture en anneaux 6 gousses d'ail plantées autour d'un goutteur Solaire ORIAZ.

![](_page_44_Picture_5.jpeg)

![](_page_44_Picture_6.jpeg)

![](_page_44_Picture_7.jpeg)

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![](_page_45_Picture_0.jpeg)

![](_page_46_Picture_0.jpeg)

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# $\gamma$

![](_page_47_Picture_1.jpeg)

# sustainable sanitation alliance

### **Mosan - The Circular Sanitation Solution**

![](_page_47_Picture_4.jpeg)

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#### www.susana.org

![](_page_47_Picture_7.jpeg)

Swiss Agency for Development and Cooperation SDC

![](_page_47_Picture_9.jpeg)

**Forbes** 

SUPPORTED BY

EXPO LIVE

![](_page_47_Picture_12.jpeg)

![](_page_47_Picture_13.jpeg)

![](_page_47_Picture_14.jpeg)

cewas international centre for water management services

![](_page_48_Picture_0.jpeg)

### Mosan in Guatemala since 2018

In Guatemala 6 million people lack access to safe sanitation.

Per second 500 liters of untreated wastewater into Lake Atitlán. Around 20% receive some type of primary treatment.

### **Mosan – The Circular Sanitation Solution**

![](_page_49_Figure_2.jpeg)

# Mosan System for Rural Communities: Off-grid, modular, low-tech, community-led, replicable

![](_page_50_Picture_2.jpeg)

![](_page_51_Picture_1.jpeg)

![](_page_52_Picture_1.jpeg)

![](_page_53_Picture_0.jpeg)

![](_page_53_Picture_1.jpeg)

**Exchange of Containers** 2 times per week, Client Care, Payments

![](_page_54_Picture_1.jpeg)

# for Visibility, Educational Events & Marketing

Transport to the Mosan Transformation Center, manually with pushcarts and/or with trucks

NS / 14

![](_page_56_Picture_1.jpeg)

### Urine Processing via Precipitation into Struvite

### Feces Processing via Pyrolysis into Biochar

### Urine Processing - currently

![](_page_57_Figure_2.jpeg)

# **Biochar Fertilizer Development** Enriched Biochar research

![](_page_58_Picture_2.jpeg)

Development of a biochar-based fertilizer for agriculture collaboration between Mosan, ETH Switzerland and Vivamos Mejor

- development of a nutrient recovery treatment for urine
- development of fertilizer mixes
- field and greenhouse trials on traditional crops and reforestation trees
- participatory field trials with farmers

![](_page_58_Picture_8.jpeg)

# Alkaline dehydration experiments

![](_page_59_Picture_2.jpeg)

![](_page_60_Picture_1.jpeg)

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