Sustainable **Water treatment** and
Agricultural reuse options in Europe

Info-package 2
Agricultural Advisory Services

Fact Sheet 2.3 – **Water and fertilizer savings when using reclaimed water: facts and figures**

SUWANU EUROPE is a H2020 project aiming to promote the effective exchange of knowledge, experience and skills among practitioners and relevant actors on the use of reclaimed water in agriculture. This factsheet is part of a total of 5 factsheets in Info-package 2 aimed at agricultural advisors, that describes water and fertilizer savings in water reuse.

1. Introduction:

Water reclamation and reuse can lead to consistent water savings. It is often the major objective targeted by projects. Water savings can be direct or indirect : 1) “direct” if we substitute a conventional water resource with reclaimed water or 2) “indirect” if we re-load a natural water resource that is then used for different uses. In case reclaimed water is used to supply “new” water uses or to increase water consumption then it is not strictly speaking leading to water savings.

Nevertheless, indirect impacts of water reuse can also be stated on agronomic systems (soils and crops) either negative as soil degradation (contamination or salinization) if water reuse is not properly managed, or positive as it may lead to increased fertility and yields. Those fertilizer savings, contrary to the water savings described before, are often more variable and difficult to foresee. This factsheet focuses mainly on the underestimated fertilizer savings benefits of water reuse. It is based on literature review.

2. Nutrients recovery potential from raw domestic wastewater

The WHO estimated in 2010 report that if all N and P from domestic wastewater were reused then it would contribute to save respectively 33% and 22% of the chemical fertilizers sold over the world (theoretical equivalence). It is also estimated that less than 1% of the volume of domestic wastewater comes from urine that represents around 80% of the nitrogen and 50% of the phosphorus treated by wastewater treatment plants. The remaining nitrogen and phosphorus mainly comes from faeces (Ecosec).

As a source of example : in Pakistan, the lease price of land with access to wastewater is 2.5 times higher than the price of land with access to surface water, which gives an idea of the value of nutrients (Ecofilae, 2011, Blue plan 11). Irrigation with urban raw wastewater applied in low and middle-income countries shall be accompanied with appropriate sanitary practices (IWMI references).

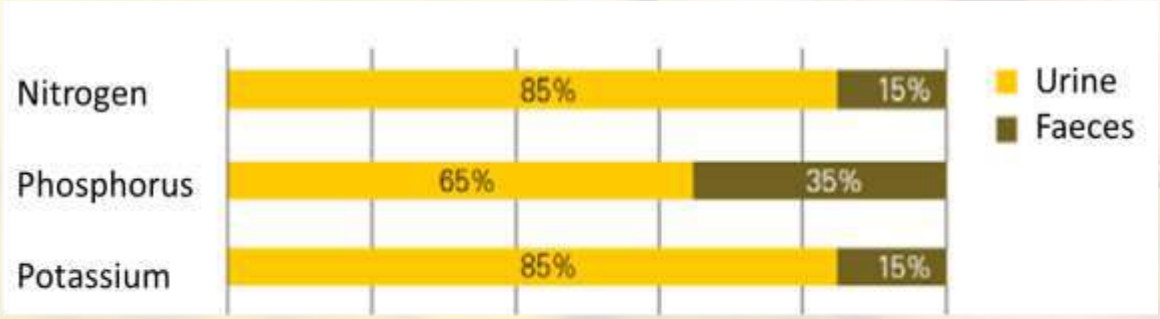

Figure 1: Nutrient share of human waste products (urine and faeces) (Source: ECOSEC, 2017 after eawag)

3. Fertilizer savings potential from reclaimed water

Fertilizer benefits from reclaimed water come mainly from **Nitrogen (N), Phosphorus (P) and Potassium (K)** but also from **organic matter** content that might be assessed with the COD (chemical oxygen demand) and COT (cut-off trench) parameters. The irrigation with reclaimed water has a degree of **similarity to fertigation**, but results compared to other studies becomes complicated as the nutrients concentrations and contents is directly linked to **wastewater origin** (town-country), as well as to **treatment techniques** used by reclamation plant. **Combined with sludge valorization** on agricultural fields water reuse could of course contribute to reach higher levels of nutrients circular economy. After conventional activated sludge systems concentrations of total N and P are generally between 15 and 35 mg/L for N and between 4 and 10 mg/L for P.

Below are detailed some key figures from different experimentations and case studies.

3.1 Experimentation in Lisboa (Portugal)

The Institute of Agronomy (ISA – Portugal) carried out a test to assess the "short term potential of reclaimed water and sewage sludge for ornamental lawn fertilization and irrigation. […] Irrigation with reclaimed water compared to public water irrigation showed a positive effect on lawn installation through higher growth of grass and higher dry matter yield. This effect increased even more, when sewage sludge produced in the wastewater treatment plant (WWTP) was applied to soil, which proves once more its benefits as an organic fertilizer. At the end of the experiment, an increase of some soil parameters (pH, electrical conductivity, organic matter, Ca^{2+}, Na^{+}, K^{+}, Mg^{2+} and $NH4^{+}$) was observed, indicating that reclaimed water irrigation can cause a soil sodization."

3.2 Experimentation in Gruissan (France)

In Gruissan the INRA carried out tests to assess the benefits of reclaimed water on fertilizer savings for vineyards irrigation. The results highlight that fertilizer contribution of reclaimed water would be important. In this study 19–39 Unit N, 0.5–1.1 Unit P and 14–28 Unit K/Ha were supplied with reclaimed water while the total annual fertilization needs are 20-70 Unit N, 3-10 Unit P and 25-70 Unit K/Ha.

3.2 Case study of Sainte-Maxime (France)

The Golf of Sainte-Maxime (France) switched from potable water to reclaimed water in 2006, thus leading to consequential water savings for the city relying mainly on water resources supplied by other regions. Beyond direct financial benefits related to water price the Golf also constated afterthought indirect benefits in terms of fertilizers : fertilizers purchases were divided by 3 but, during the first years, the greenkeeper had some difficulties to adapt his fertilization plan and he had to hire additional seasonal employments to face the increased need for mowing and even to purchase growth retarders (France, IRSTEA-Ecofilae, ONEMA 2014).

Reference/further readings

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[6] Sousa, Gonçalo, David Fangueiro, Elizabeth Duarte, et Ernesto Vasconcelos. « Reuse of treated wastewater and sewage sludge for fertilization and irrigation ». Water Science & Technology-IWA Publishing, n° 64.4 (2011): 871-78.

CONTACTS:
Coordinator
Rafael Casielles (BIOAZUL SL)
Avenida Manuel Agustin Heredia nº18 1º4 Málaga (SPAIN)
Mail | info@suwanu-europe.eu **Website |** www.suwanu-europe.eu

CONTACTS:
Rémi Dec lercq
ECOFILAE
remi.declercq@ecofilae.fr **| www.ecofilae.fr |** +33 7 63 07 89 30

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