Nutrient recycling from human urine

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Why recycle human urine?

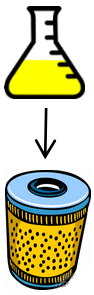
- Rich source of plant nutrients: 90% nitrogen (N) and 60% phosphorus (P) excreted by humans in urine fraction
- Phosphorus scarcity: uncertain remaining rock-phosphate reserves; need for alternative P fertilizers
- In developing countries, recovery of nutrients with fertilizer market value could trigger implementation of clean sanitation systems

Aim of MSc project

Evaluation of two urine based fertilizers (UBF), SNUS (Synthetic Nitrified Urine Solid) and Struvite as potential valuable recycling fertilizers. N & P plant uptake investigated with isotopic tracers ^{15}N & ^{33}P

M & M + Results: How were both fertilizers produced and evaluated?

1/ Production of synthetic urine & labeling with ^{33}P +^{15}N



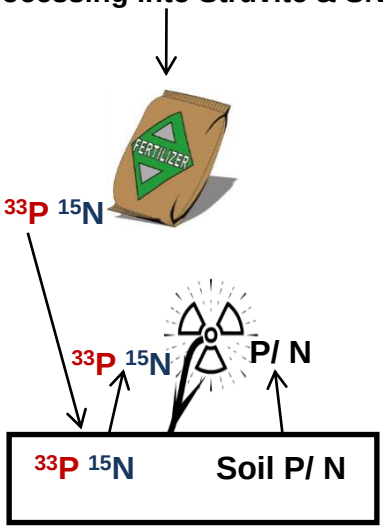
Struvite

- Magnesium ammonium phosphate
- Processing: precipitation + filtration
- Aim: recover all urine phosphate ions and a fraction of urine-N
- P fertilizer

SNUS

- Processing: nitrification + distillation
- Newly developed by *eawag*, 1st time tested as plant fertilizer
- Aim: recover all urine nutrients
- Complete fertilizer rich in N

2/ Processing into Struvite & SNUS



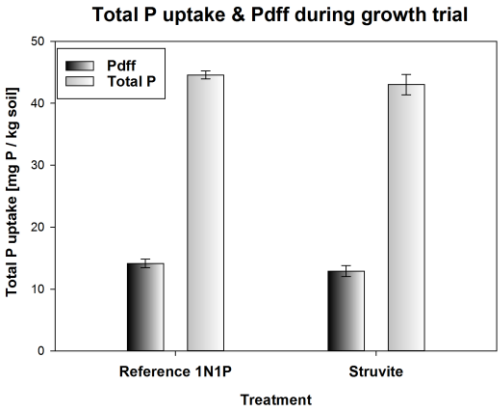


Fig 1: Struvite-P and reference water soluble KH_2PO_4-P taken up in equal amounts by plants Pdff = P derived from the fertilizer

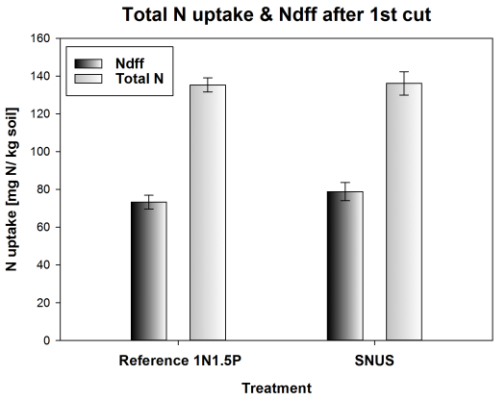


Fig 2: SNUS-N and reference water soluble NH_4NO_3-N were recovered equally by plants Ndff = N derived from the fertilizer

3/ Evaluate UBFs in plant growth study

Fig 3: Struvite powder before application to soil

Conclusions

- Struvite: equally effective as reference P fertilizer
- SNUS: similar N supply as reference N fertilizer
- Both UBFs are valuable N & P recycling fertilizers
- Further studies necessary with real human urine on other soils & crops

Fig 4: Italien ryegrass as test plant for growth trial

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