



# Use of nitrified urine fertilizer (NUF) in a hydroponic Bato bucket system

Caroline Stäheli<sup>1</sup>, Selina Ilchmann<sup>1</sup>, Anett Hofmann<sup>2</sup>, Benjamin Wilde<sup>2</sup>

<sup>1</sup>Institute of Agricultural Sciences, ETH Zurich

<sup>2</sup>Institute of Agricultural Sciences, Sustainable Agroecosystems group, ETH Zurich

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## 1 Contribution to Sustainable Food Systems

- Human urine is re-used as a fertilizer → less usage of mineral fertilizer, which is expensive and energy consuming to produce
- NUF may help developing as well as developed countries obtaining a cheaper source of fertilizer and re-use urine waste from cities

## 2 Method Overview

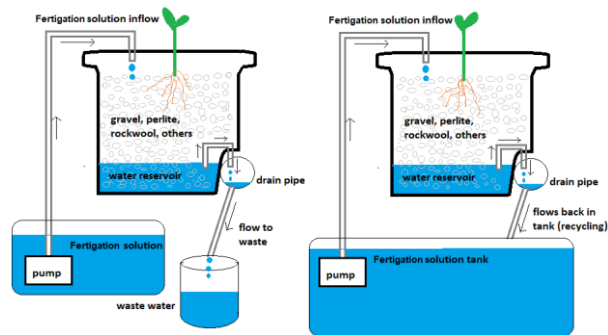


Fig. 1. A Bato Bucket connected to a nutrient tank for fresh fertigation solution inflow and a drainpipe for wastewater outflow [left] and a recycled setup [right] (figures by Caroline Stäheli)

TICA tomatoes were grown in a hydroponic Bato bucket system with NUF compared to a mineral fertilizer. Plants were fed with fertigation solution containing water and one of the following fertilizers:

- Mineral fertilizer
- NUF
- NUF + Calcium
- NUF + Calcium + Magnesium
- NUF (recycled)

NUF contains a lot of  $\text{NH}_4^+$ ,  $\text{NO}_3^-$ ,  $\text{K}_2\text{O}$ , medium amount of  $\text{P}_2\text{O}_5$  and a high amount of  $\text{Na}^+$  and  $\text{Cl}^-$ .

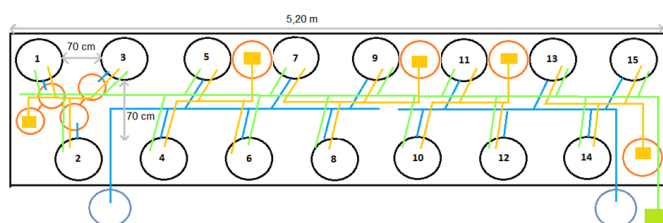


Fig. 2. Setup sketch (by Caroline Stäheli)



Fig. 3. Photos of the hydroponic Bato bucket system setup (photo by Caroline Stäheli)

## 3 Results and Discussion

- Measurements: plant nutrients/EC/pH of in- and outflow of the fertigation solution, nutrients in leaf and fruit tissue, SPAD, a.o.
- Calcium uptake, as well as leaf and fruit content was lower in NUF treatments compared to mineral fertilizer - same for Mg



Fig. 4. NUF treatment plants show crinkled leaves with "yellowing/burning" leaf edges [left, middle] and blossom end rot (BER) on some fruits [right] (sketch and photos by Caroline Stäheli)

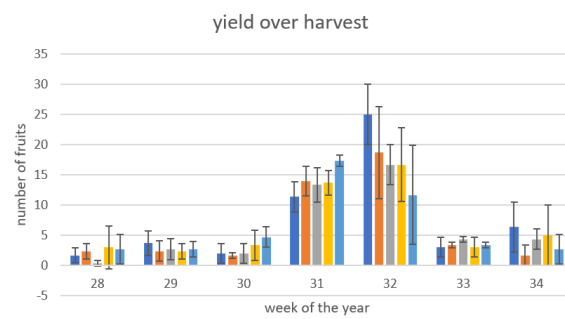


Fig. 5. Mineral fertilizer plants had higher yield overall (plot by Selina). Additional note: More NUF fruits showed BER

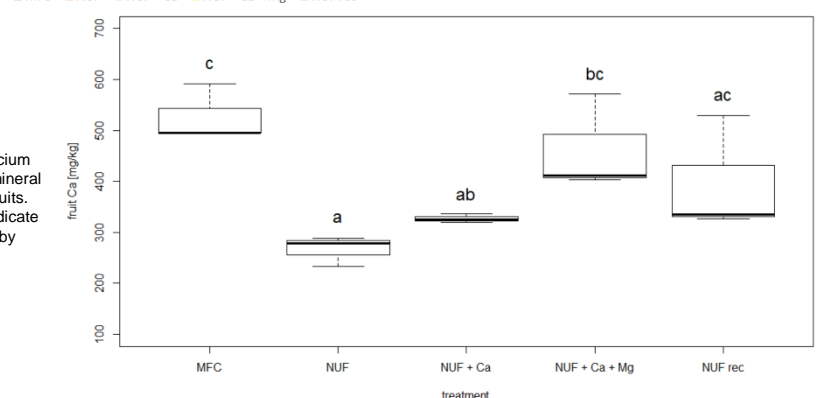


Fig. 6. Higher Calcium content of MFC (mineral fertilizer control) fruits. Different letters indicate significance. (plot by Selina)

## 4 Challenges & implications in further studies:

- Lower yield, leaf "yellowing" and BER in fruits may be due to a lower  $\text{NO}_3:\text{NH}_4$  ratio or higher  $\text{Na}^+$  concentrations in the NUF fertigation solutions
- Low pH around NUF treatment plant roots and less uptake of Calcium in NUF treatment plants may be due to a high  $\text{NH}_4^+$  concentration

- increase  $\text{NO}_3:\text{NH}_4$  ratio in nitrified urine fertilizer
- increase pH around plant roots through mixing additional lime/ $\text{CaCO}_3$  into perlite substrate
- decrease the  $\text{Na}^+$  content in NUF or use salt tolerant tomatoes

## 5 References

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