l.mau@fz-juelich.de

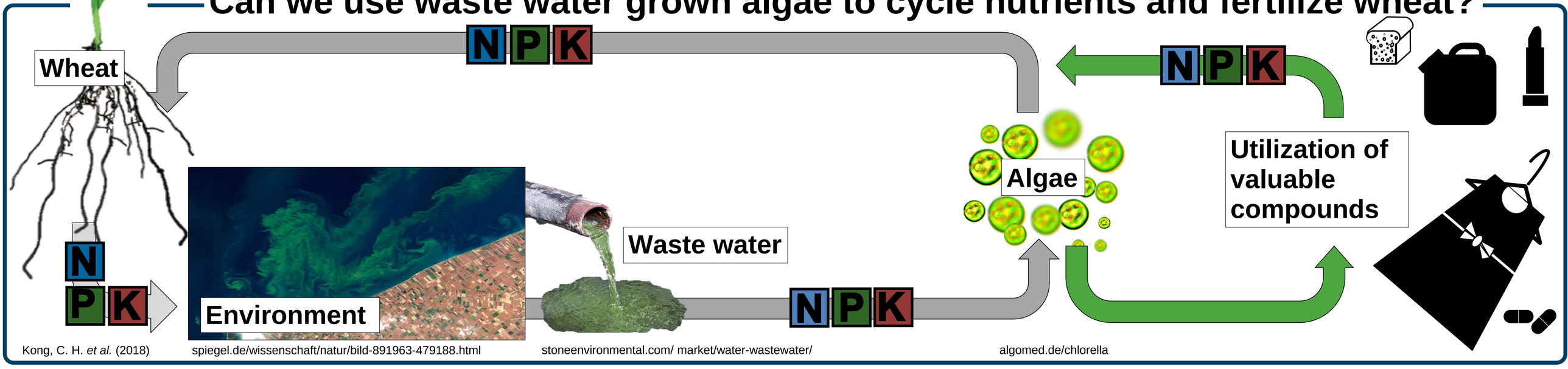
The effects of algae fertilizer on wheat root morphology

elucidated using modeling, phenotyping and metabolomics

Lisa Mau[1], Josefine Kant[1], Christina Kuchendorf[1], Ladislav Nedbal[1], Holger Klose[1], Ute Roessner[2] and Michelle Watt[1,3]

[1] *IBG-2 (Plant Sciences), Forschungszentrum Jülich, Germany,*
[2] *School of BioSciences, University of Melbourne, Australia,*
[3] *Faculty of Agriculture, University of Bonn, Germany*

Can we use waste water grown algae to cycle nutrients and fertilize wheat?

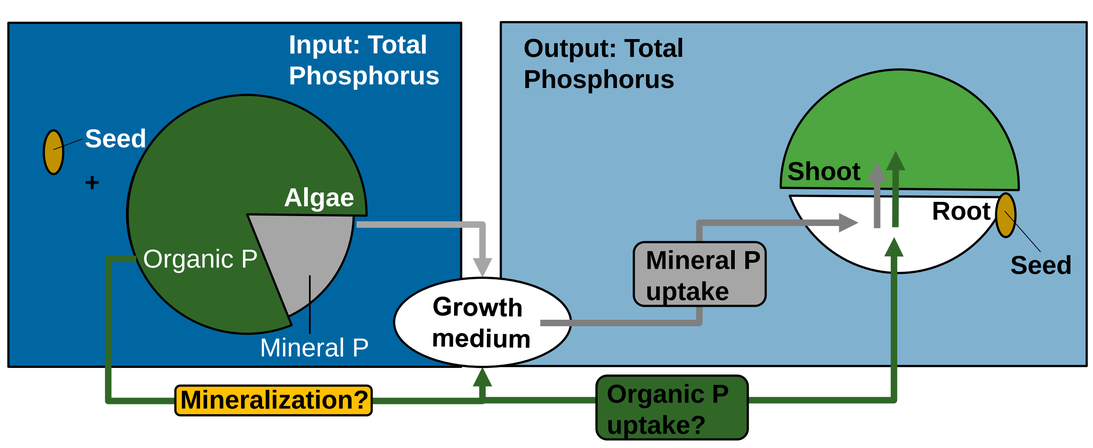


Kong, C. H. *et al.* (2018) spiegel.de/wissenschaft/natur/bild-891963-479188.html stoneenvironmental.com/ market/water-wastewater/ algomed.de/chlorella

Methods and results - Experiments to test if wheat can utilize algal nutrients

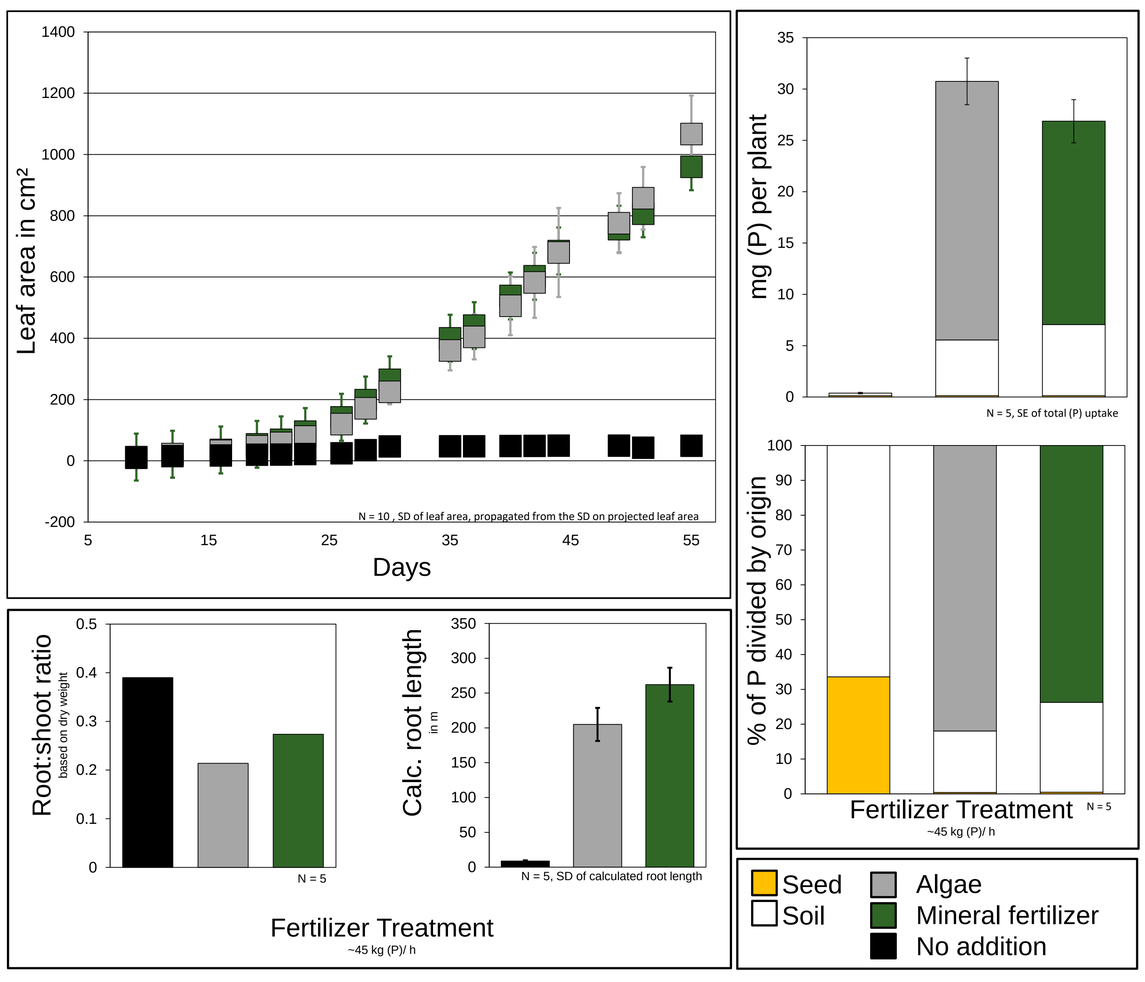
Modeling

Nutrients from algae are available to wheat root uptake.



Results so far:

Modeled phosphor (P) uptake from different sources based on data from Schreiber *et al*. 2018.



Schreiber, C. *et al.* (2018) "Evaluating potential of green alga Chlorella vulgaris to accumulate phosphorus and to fertilize nutrient-poor soil substrates for crop plants," *Journal of Applied Phycology*, 30(5), pp. 2827–2836.

Phenotyping

Roots respond to algae fertilizer with changes in root architecture and morphology that are different to conventional fertilizers.

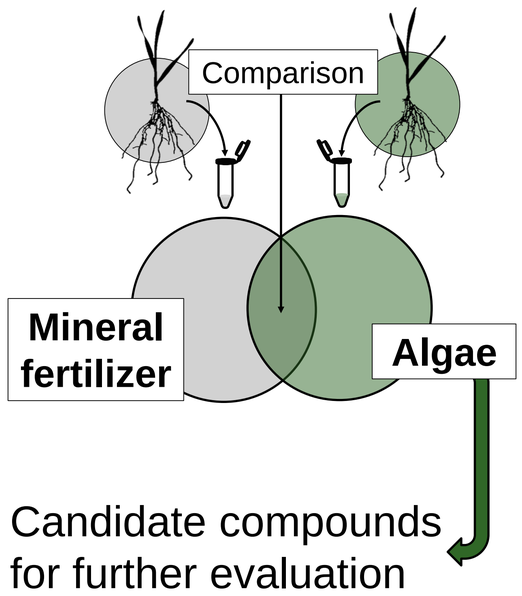
Sasse *et al.* 2019

➡ EcoFABs (Ecosystem FABrications, Gao *et al.* 2018)

Gao, J. *et al.* (2018) "Ecosystem Fabrication (EcoFAB) Protocols for The Construction of Laboratory Ecosystems Designed to Study Plant-microbe Interactions," *Journal of Visualized Experiments*, (134), pp. 1–16.

Metabolomics

Active response of roots to algal nutrients is reflected in an alternate mode of nutrient uptake.



Candidate compounds for further evaluation

Discussion of modeling results

- ➡ Algae fertilization supports shoot growth to a similar extend compared to mineral fertilization
- ➡ Root:shoot ratio and root length are affected by algae treatment
- ➡ Around 70% of plant phosphorus algae fertilized wheat is treatment related

Take home message

- ➡ Algae addition can support continuous wheat growth in a soil system
- ➡ Algae treatment facilitates phosphorus uptake compared to unfertilized controls

What´s next?

Wheat
Algae +
MS-micronutrients
P set to ½ MS
18 days

vs.

Wheat
½ MS medium

18 days