JÜLICH FORSCHUNGSZENTRUM

The Importance of Organic Fertilisation and Perennial Crops for Land Degradation Neutrality

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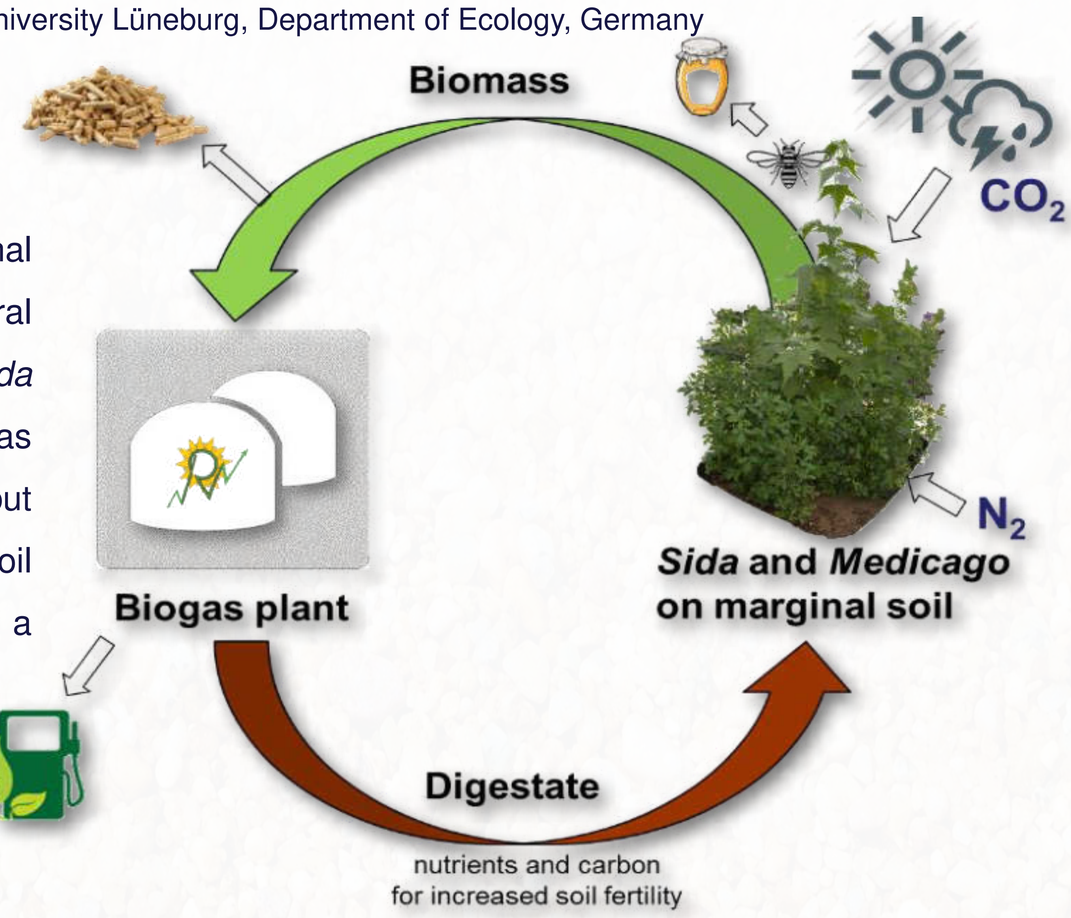
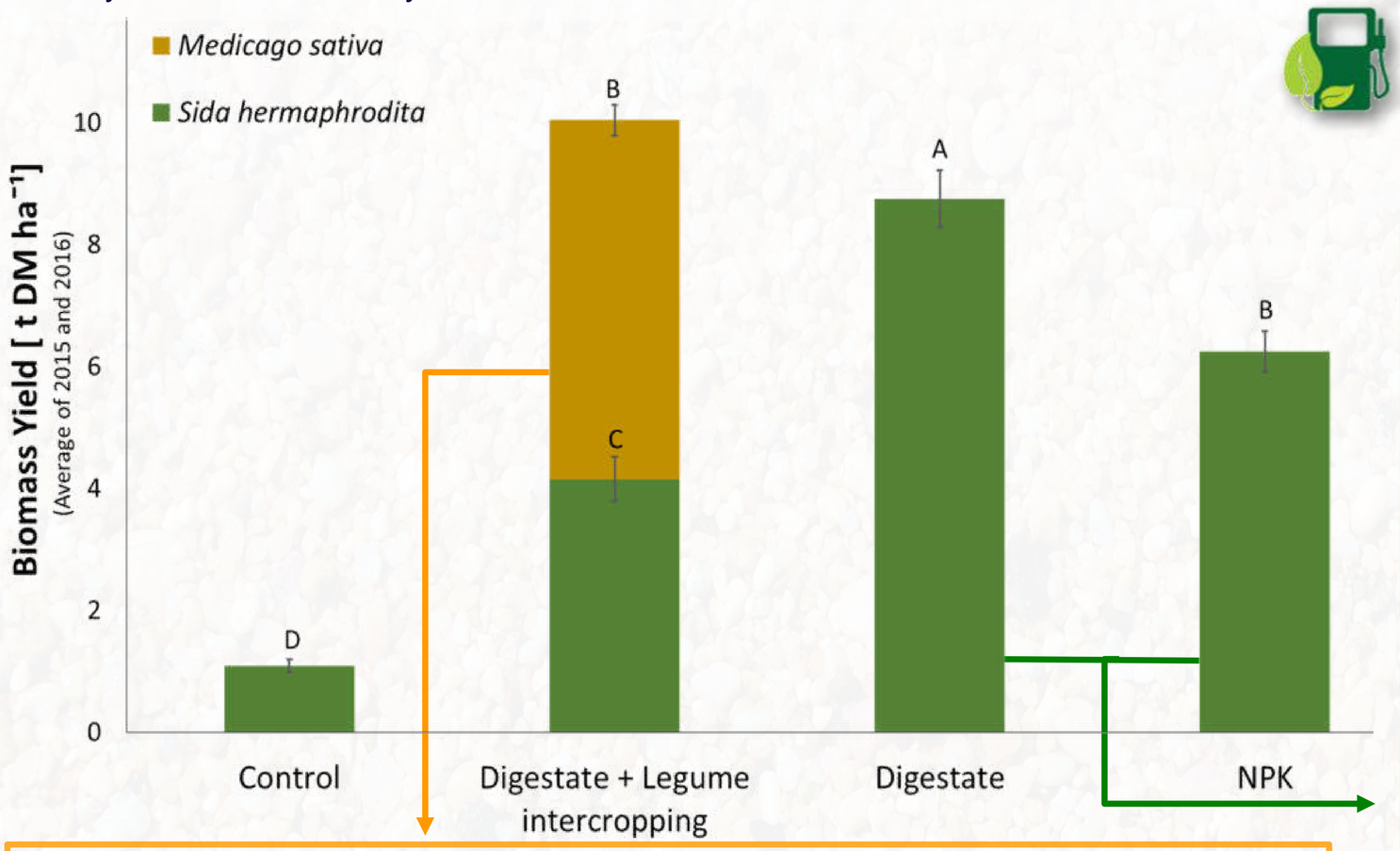
Motivation:

We propose a cropping system that aims to increase soil fertility of degraded and marginal sites and increases their potential for biomass production. For improved agricultural practice on degraded and marginal soils, we combine perennial biomass crops *(Sida hermaphrodita),* legume intercropping (*Medicago sativa)* and organic fertilization (biogas digestate). Following the idea of a closed nutrient loop, we do not only reapply nutrients but also use the carbon share of the organic fertilization as a soil amendment, increasing soil fertility over time, allowing sustainable plant biomass production. We present results of a three year mesocosm study under outdoor conditions.





Legume intercropping:

Nitrogen derived from atmosphere (*Ndfa mesocosm*$^{-1}$) of *Medicago sativa*

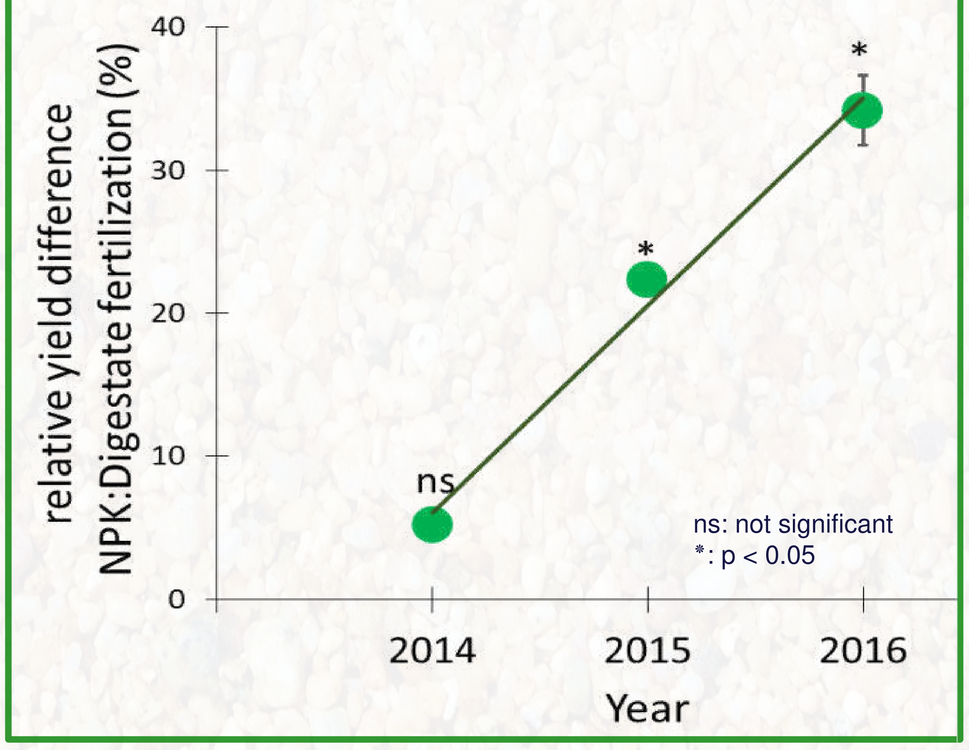
	Ndfa (%)	Ndfa (mg)
Control	74 ± 4	106 ± 27
Digestate	49 ± 5	1390 ± 83
NPK	2 ± 1	38 ± 3

+ Digestate fertilisation increased biological nitrogen fixation of *Medicago sativa*.
+ Legume intercropping increased the total biomass yield.
– Legumes decreased the biomass yield of *Sida hermaphrodita*.

Digestate fertilisation…

+ increased the soil carbon and nitrogen content in the top 30cm
+ increased water holding capacity
+ reduced nitrate concentration in the leachate
+ increased the soil respiration
– reduced the wettability

… of the marginal substrate compared to mineral NPK fertilisation.



Experimental set-up: Sida and Medicago growing in 250 L dustbins filled with sand in a completely randomized design (n=7)

Further Reading:

[1] M. Nabel, et al. Energizing marginal soils - The establishment of the energy crop Sida hermaphrodita as dependent on digestate fertilization, NPK, and legume intercropping, Biomass and Bioenergy. 87 (2016) 9–16.
[2] N.D. Jablonowski, T. Kollmann, M. Nabel, T. Damm, H. Klose, M. Müller, et al., Valorization of Sida (Sida hermaphrodita) biomass for multiple energy purposes, GCB Bioenergy. (2016) 1–13.

Acknowledgments

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