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.

Further Reading:

Acknowledgments

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Further Reading:

Digestate fertilisation...

+ increased the soil carbon and nitrogen content in the top 30 cm
+ 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.

Legume intercropping:

Nitrogen derived from atmosphere (Ndfa mesocosm⁻¹) of Medicago sativa

<table>
<thead>
<tr>
<th>Nitrogen Derived from Atmosphere (Ndfa (%))</th>
<th>Ndfa (mg)</th>
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</thead>
<tbody>
<tr>
<td>Control</td>
<td>74 ± 4</td>
</tr>
<tr>
<td>Digestate</td>
<td>49 ± 5</td>
</tr>
<tr>
<td>NPK</td>
<td>2 ± 1</td>
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</table>

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

Relative yield difference NPK:Digestate fertilization (%)

- ns: not significant
- *: p < 0.05

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