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

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Abstract

By 2050, agriculture needs to provide food and energy for 9 billion people. At the same time, agriculture is losing huge areas due to soil degradation. Within the UN sustainable development goals, land degradation neutrality indicates a key element to face this challenge. 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, legume intercropping and organic fertilisation. Following the idea of a closed nutrient loop, we do not only reapply nutrients but also use the carbon share of the organic fertilisation as a soil amendment, increasing soil fertility over time, allowing sustainable plant biomass production.

We present results of a three-year outdoor mesocosm experiment testing the perennial energy crop *Sida hermaphrodita* grown on marginal substrate with three kinds of fertilisation (biogas digestate, mineral NPK, and unfertilised control) in combination with legume intercropping. After three years, organic fertilisation (biogas digestate) reduced the nitrate concentration in leachate and increased the soil carbon content when compared to mineral fertilisation (NPK). On marginal substrate biomass yields of *Sida* were 25 % higher when fertilised organically, compared to mineral fertiliser. Further, we show that intercropped legume *Medicago sativa* fixed large amounts of N, especially when fertilised organically, whereas mineral fertilisation suppressed biological nitrogen fixation.

We conclude that the perennial energy crop *Sida hermaphrodita* in combination with organic fertilisation and legume intercropping has great potential to increase and restore the soil fertility of degraded and marginal soils, produce substantial biomass yields and thus contribute to the goals of land degradation neutrality.

Keywords: Marginal and degraded land, organic fertilisation, perennial biomass crops