Syn-Energy II wird aus Mitteln des Klima- und Energiefonds (www.klimafonds.gv.at) gefördert und im Rahmen des Programms „NEUE ENERGIEN 2020“ durchgeführt.

Title: **Syn-Energy II – Synergetic Biogas production from cover crops and sustainable cropping systems**

Synopsis: The investigation of the potentials for a synergetic increase of agricultural biogas production is the main objective of Syn-Energy II. Synergetic increase means, that it primarily makes use of biomass from cover crops and therefore provides for higher cropping system yields while it reduces the risk of nitrate leaching, erosion as well as emissions of nitrous oxide and beyond that doesn't cause any negative impact on food supply security.

Abstract

Biogas production is confronted with criticism, because the use of maize for energy production is blamed to cause decreasing food supply security and increasing environmental risks (e. g. erosion, nitrate leaching). Therefore, Syn-Energy II aims at the identification of potentials for synergetic biogas production based on feedstock not in competition with food or feed production (a. o. cover crops, straw, agro-wastes, manure etc.). Simultaneously it also takes additional benefits into account such as the protection of ground water and soil as well as the reduction of nitrous gas emissions and the increase of humus content. The effects are determined for conventional and organic cropping systems. Additionally the effects of conservation tillage and no-till systems on the profitability of cover crop production, soil fertility and water infiltration capacity is tested. Finally biogas production from cover crops is evaluated through a comprehensive life cycle assessment.

In field experiments different kinds of intercrops are cultivated and monitored to state on yields and effects on ground water, soil and nutrition aspects. By means of biogas digester lab scale experiments the potential biogas is measured. The scope of work involves i) the cultivation of cover crops in five different areas in Austria, ii) the scientific monitoring to evaluate biomass yields, model the leaching into ground water, eco-, N- and C-balancing, iii) measurement of biogas potential of cover crops biomass in the lab scale, iv) to define further R&D needs and to disseminate results.

Cover crop dry matter yields varied considerably. On average between 4 and 5 tons of dry matter with a methane yield of 1260 m^3 ha^{-1} can be expected. Considering the total energy invested from cultivation to compression for biofuel use a net energy yield of about 1000 m^3 CH_4 ha^{-1} is remaining. This amount is sufficient for a driving performance of more than 20.000 km with a medium-sized

vehicle. Alternatively it would cover the overall electricity demand and half of the heat requirement of an average household. In comparison to catch crops, remaining on the field as green manure, or to complete fallow between main crops the effects on soil, water and climate can be improved if cover crops are harvested without soil compaction and digestate is returned to the field in an amount equivalent to cover crop removal. In this way the risk of nitrate leaching can be reduced approx. by 25 % and the risk of erosion approx. by 75 % in comparison to full fallow. The risk of nitrous oxide emissions may be reduced up to 25 % by contrast with cover crops serving as green manure. The effects on humus content are slightly better than those of cover crops used as green manure, when the same amount of biomass was produced. With higher biomass production the positive effects increase even if cover crops are harvested and only digestate is brought back to the fields. The ecological footprint of arable farming can be reduced by approx. 50 % considering the substitution of natural gas with CH_4 produced from cover crops. Unfortunately cover crops are only able to compete with maize if their positive value added is considered also economically, which is not the case at the moment. Therefore, a change of conditions is required. On the one hand it would be necessary to integrate incentives in agro-environmental measures for cover crop growing. On the other hand a relative increase of reimbursement for energy from cover crops would be required.

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