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Economic assessment of the integrated generation of solid fuel and biogas from biomass (IFBB) in comparison to different energy recovery, animal-based and non-refining management systems

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HIGHLIGHTS

- Economic assessment of energy recovery from semi-natural grasslands.
- Energy recovery systems make profitable use of semi-natural grasslands.
- Animal-based systems rely on optimal framework conditions, otherwise not profitable.
- Mulching and composting systems are loss-making options of grassland preservation.
- Selected energy recovery systems can buffer changing environments best.

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ABSTRACT

The study aimed at the identification of favourable land use options for semi-natural grassland management and preservation. Economic assessments of energy recovery by the integrated generation of solid fuel and biogas from biomass (IFBB) in comparison with dry fermentation (DF) and hay combustion systems (HC), beef cattle production (BC) and non-refining landscape preservation measures, such as mulching (MU) and composting (CO), were carried out in this study. Energy recovery systems made profitable use of semi-natural grasslands with the highest economic returns attained by IFBB-AO (Return On Investment, ROI: 22.75%) and HC (ROI: 22.00%) systems, followed by the IFBB-SA (ROI: 7.71%) and the DF system (ROI: 6.22%). Animal husbandry (BC) and non-refining management systems (MU, CO) were not profitable considering the current framework conditions. Input parameters critical for profitability were modified in order to identify influences of changing framework conditions.

1. Introduction

The high nature value of semi-natural grasslands has been maintained by extensive agricultural utilisation for centuries (Eriksson et al., 2002) and will further depend on extensive management in the future to avoid biodiversity decline (Paracchini et al., 2008). The preservation of rare flora and fauna in established open agricultural landscapes not only conserves biodiversity but also provides external benefits by enhancing recreational value and tourism, therefore strengthening the micro- and macroeconomic development of regions (Pruckner, 1995). However, with up to 80% lower harvest yields compared to intensively managed grasslands and poor feed quality (Isselstein et al., 2005) the use of semi-natural grasslands for animal feeding becomes economically inefficient. In addition, the shift towards an intensification of grasslands or using concentrates grown on arable land to meet the requirements of increasing animal performances has lead to a rising abandonment of bio-diversity rich grasslands (Rösch et al., 2009).

On a European scale, great efforts have been made to maintain high-value vegetations. EU spendings for environment measures, including the preservation of semi-natural grassland habitats, account for nearly 20 billion € between the years 2007 and 2013,

Abbreviations: b, y axis intercept (gradient); BC, beef cattle; CH_4, methane; CHP, Combined Heat and Power plant; CO, composting; CV, critical value; d, day; DF, dry fermentation; DM, dry matter; € ct, Euro cent; FCF, Free Cash Flow; ha, hectare; HC, hay combustion; IFBB, integrated generation of solid fuel and biogas from biomass; IFBB-AO, IFBB-add-on system; IFBB-SA, IFBB-stand-alone system; IRR, Internal Rate of Return; LHV, lower heating value; lN, normalised litres; MU, mulching; MWth, Mega-Watt thermal performance; oM, organic matter; ROE, Return On Equity; ROI, Return On Investment; t, ton; yr, year.

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