Greenhouse Gas Mitigation Potential of Anaerobic Digestion on Irish Pig Farms

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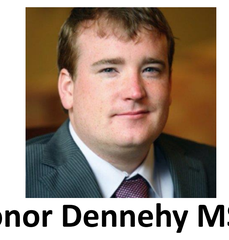

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Conclusion

During conventional manure management on a typical Irish farm, 435 kg of CO_2 eq is emitted per sow per year. If anaerobic digestion is undertaken and the resulting biogas is burned to generate heat and electricity, 737 kg of CO_2 eq can be mitigated per sow per year. Undertaking anaerobic digestion has the potential to convert pig manure management into a net greenhouse gas-mitigating activity.

Introduction

Currently, Irish greenhouse gas (GHG) emissions from agriculture contribute to 29.1% of total national emissions. It has been estimated that pig manure management contributes at least 2% to overall GHG emissions from agriculture. Greenhouse gas emissions from animal production are mainly comprised of direct methane emission from livestock, methane and N_2O emission from manure storage and N_2O emission from soils after land application of manure.

Objectives

The aim of this study was to estimate the mitigation of GHG emissions from pig manure management using an on-farm anaerobic digestion (AD) system.

Methodology

- Estimations were based on a typical Irish pig farm (654 sows). GHG emissions from livestock enteric fermentation and land application of manure were not considered.
- Direct N_2O and methane emissions from storage of pig manure were estimated according to Equation 10.25 (N_2O) and Equations 10.22 and 10.23 (CH_4) of the Intergovernmental Panel on Climate Change (IPCC) guidelines for the inventory of GHG emissions from animal manures (IPCC, 2006).
- Methane generation rates from pig manure were taken from site data generated by a 450 L digester which operated in Teagasc Moorepark in 2011-2012 (Figure 1; Xie *et al.,* 2011).
- Data assessing the difference in inorganic nitrogen content between raw manure and digested manure were also collected from this pilot study (Xie *et al.,* 2011).

Figure 1. Pilot-Scale Anaerobic Digester located at Teagasc, Moorepark

- The following factors were analysed in order to assess the effect of AD on GHG emissions:
  - the replacement of fossil fuels through biogas utilization
  - the use of digestate to replace inorganic fertiliser, the manufacturing of which manufacturing results in GHG emissions; and
  - reduction in N_2O emissions from land application of digestate in comparison to the use of inorganic fertilizers. Digestate has higher nitrogen availability than raw pig manure (Xie *et al.,* 2011)

Results and Discussion

- The annual GHG emissions from conventionally managing pig manure from a 654 sow farm was found to be 279 tonnes of CO_2 equivalent (t CO_2 eq).

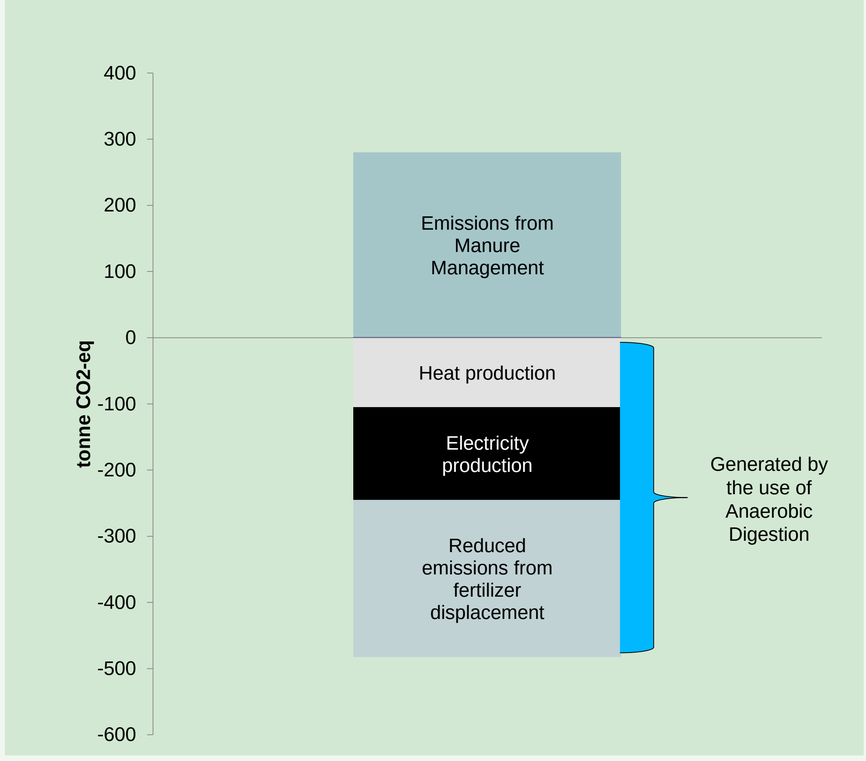

Figure 2. GHG emissions from a typical Irish pig farm and GHG mitigation potential of anaerobic digestion

- However, undertaking AD can result in the mitigation of 482.2t CO_2 eq every year. This means that AD can result in pig manure management no longer being a process which emits GHG

- The impact of AD on GHG emission mitigation was mainly due to replacement of fossil fuels with methane-rich biogas and, to a lesser degree, reduced fertiliser use by using the inorganic nitrogen-rich digestate. This is illustrated in Figure 2.

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References

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