Fact sheet
November 2022

Emissions impacts of protein production

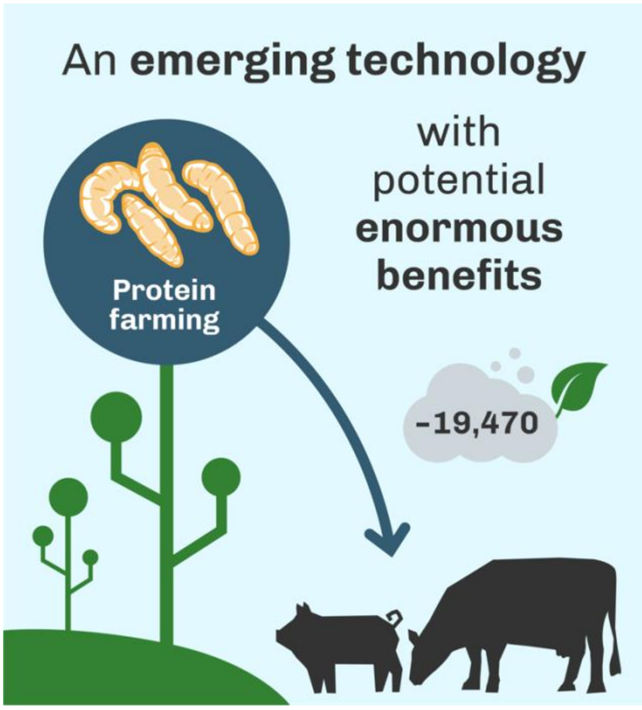
New food waste processing systems for recovery of nutrients for people and animals are being developed. One that has reached commercial maturity in NSW is the management of food waste by feeding it to insect larvae. The commercial outputs for this process are protein suited to stockfeed (insect meal) and a nutrient-rich soil conditioner (frass).

Introduction

This fact sheet is one of a series analysing the emissions impacts of different processing technologies for food waste in NSW. It draws on modelling of the greenhouse gas (GHG) emissions generated from protein farming at the site where the food waste is generated and where the food waste is transported 50 kilometres to an off-site protein farm.

About protein farming

Insect larvae such as black soldier fly are housed in temperature and humidity controlled secure units and fed macerated food waste. Larvae and frass are regularly harvested and replaced by new larvae. The harvested larvae are high in protein.



The benefits of protein farming include:

- reduced collection and transport costs (if units are on-site)
- fully contained management of food waste with odour control
- production of protein, which can be substituted for emissions intensive sources of protein
- production of an organic fertiliser

Potential limitations of protein farming are energy use, such as the power to heat and aerate the units, the need for management of liquid leachate and condensate, and the current need in NSW for outputs (protein and frass) to go to secondary processing sites if they are managed off-site.

Those considering using a protein farming system should ask about energy consumption and consider purchasing renewable energy as part of the supply contract.

Greenhouse gas benefits of protein farming

The GHG benefits of protein farming depend largely on the substitution of alternative source of proteins. Larvae can produce around 100kg of protein per tonne of wet food. This translates to an average protein offset of 5.5 tonnes CO_2-e per tonne of input food. However, if it substitutes for mammalian protein, it results in an offset of up to 10 tonnes of CO_2-e per tonne of input food.

Larvae produce around 200kg of frass per tonne of wet food. Assuming the frass has an organic carbon content of 30% by weight and 10% of this persists in the soil for 100 years, the sequestered carbon benefit would be approximately 22kg CO_2-e per tonne of input food.

Figure 1 compares scenarios where protein farm units are installed on-site and maintained by the service provider or organics are collected and transported 50 kilometres to centralised units. On-site units reduce collection and transport emissions, although this is relatively minor. The units have significant energy usage, but emission can be reduced by the purchase or use of renewable energy.

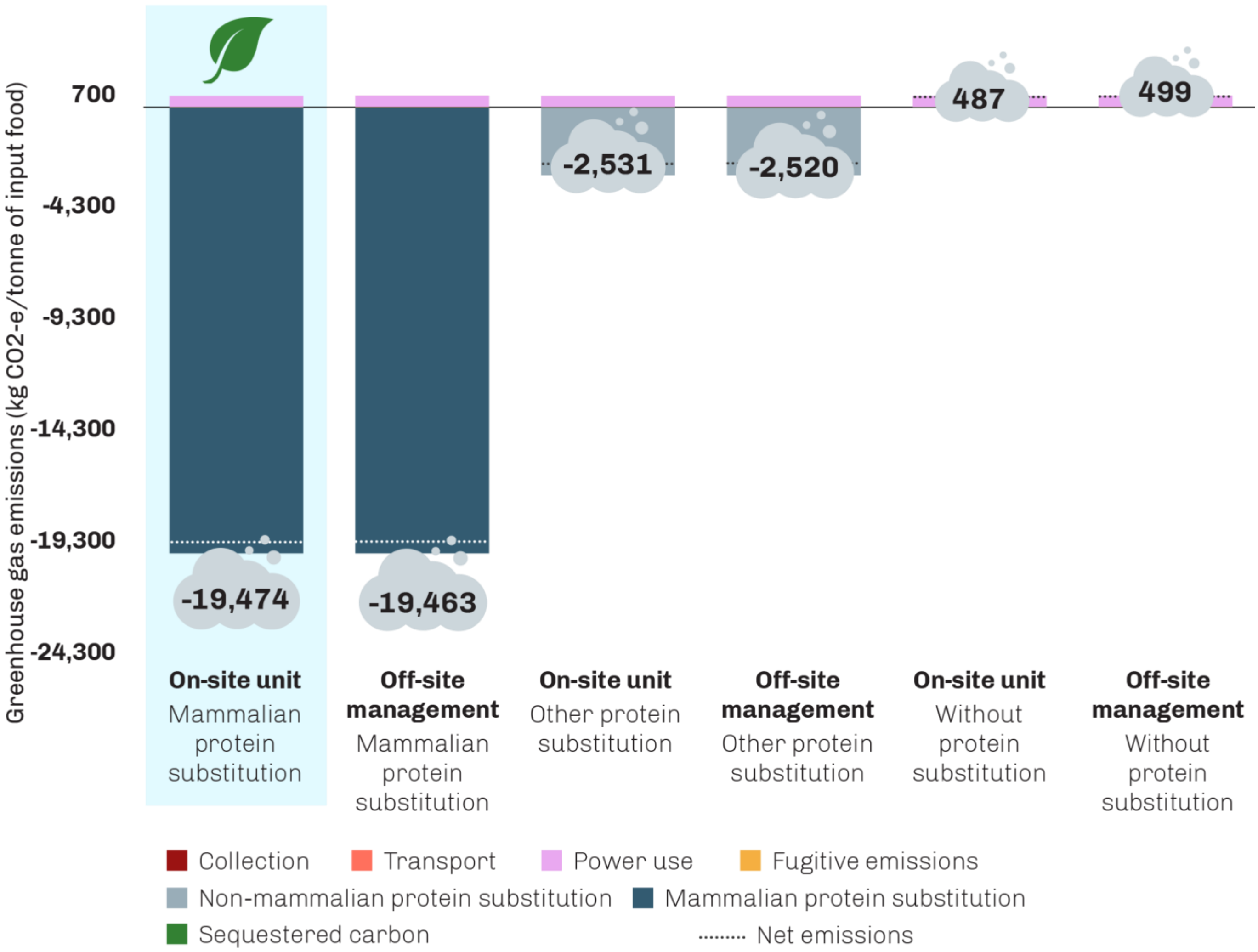


Figure 1 Comparison of emissions and offsets from protein farming

A key finding is the potential GHG offset that can be achieved by the insect larvae's conversion of food into protein. This offset is very large (column 1 and 2 of figure 1) if the protein causes a reduction in the production of mammalian protein, however this is questionable because stockfeed protein is typically non-mammalian or derived from by-products from meat processing. The assessment shows (in column 3 and 4 of figure 1) there is a smaller but significant potential benefit in insect larvae protein substituting other non-mammalian forms of protein. This benefit is also uncertain as the larvae protein may add to the total protein production rather than replace other sources.

References

Blue Environment, 2021, Organics processing technology assessment.

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