Can eating insects reduce greenhouse gas emissions? Assessing the environmental impacts of insect agriculture.

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BACKGROUND

- As the human population rises unabated, the demand for food using traditional agriculture is likely to exacerbate the effects of anthropogenic climate change.
- Food production accounts for 25% of all anthropogenic greenhouse gas (GHG) emissions worldwide (Simion et al., 2019).
- The United Nations suggests that entomophagy, the consumption of insects, could mitigate food insecurity and do so in a way that is more environmentally friendly than traditional agriculture (van Huis et al., 2013).
- Cultural aversions to entomophagy notwithstanding, without adequate scientific backing for the efficacy of insect agriculture, no regulatory agency will support the introduction of insects into the food supply system.
- For every 1 hectare (ha) of land required to produce mealworm protein, 2.5 ha is required to produce a similar quantity of milk protein, 2–3.5 ha for pork or chicken protein, and 10 ha for beef protein (van Huis et al., 2013).
- Sufficient scientific data to fully assert the environmental benefits of insect agriculture over traditional livestock is still unavailable (Doberman et al., 2017).

HYPOTHESIS

Large-scale insect agriculture is associated with decreased land use and reduced greenhouse gas emissions, as compared to traditional agricultural production *(figure 1)*.

According to Mason et al. (2018), there are five aspects to be considered when introducing entomophagy to consumers and regulators:

1. Delineate authentic health benefits.
2. **Explore means of optimizing insect husbandry and food processing.**
3. Examine cultural barriers to acceptance
4. Formulate workable approaches to marketing
5. Address relevant food regulations

This study seeks to address aspect #2 regarding environmental impacts.

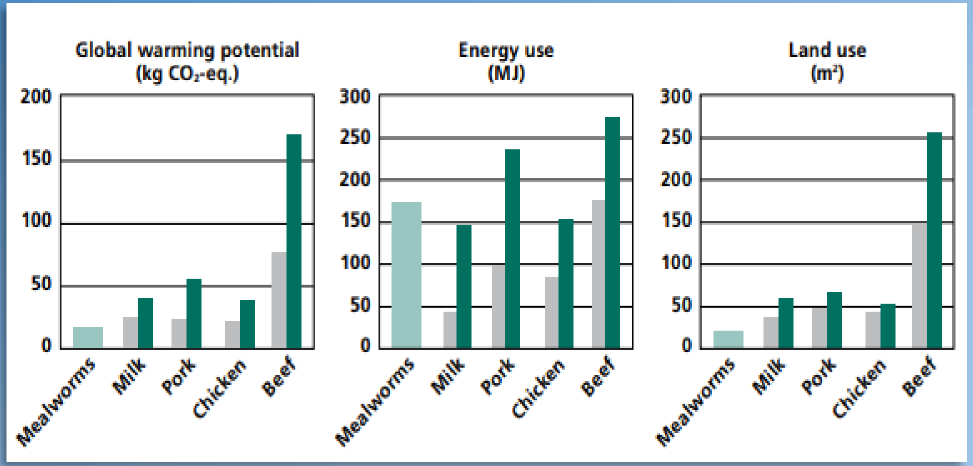

Figure 1. Comparison of the global warming potential, energy use, and land use required to produce 1 kg of protein from traditional agricultural products vs. the mealworm. Graphic obtained from van Huis et al. (2013).

*note: grey bars are minimum values, & dark green bars are maximum values

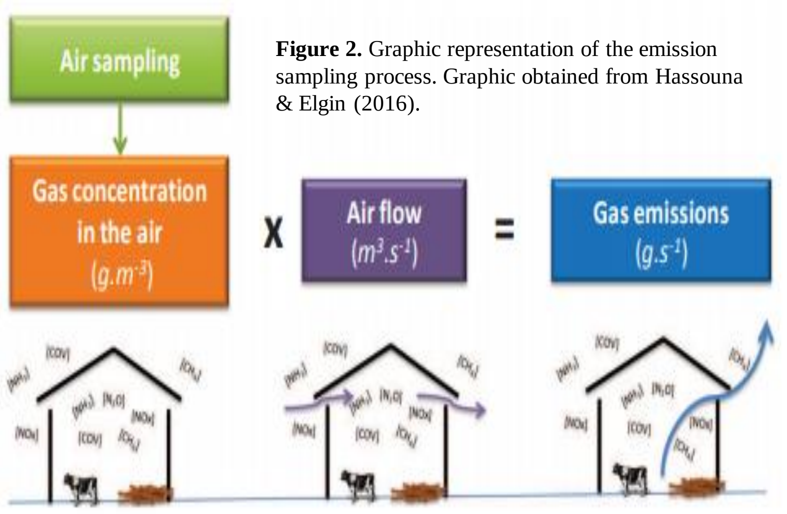

Figure 2. Graphic representation of the emission sampling process. Graphic obtained from Hassouna & Elgin (2016).

STUDY DESIGN & ANALYSIS

One hectare of land will be used to cultivate mealworms for consumption in order to measure the resulting GHG emissions and test the land use claims made by van Huis et al. (2013). A passive diffusion sampler will sample ambient air outside the mealworm enclosures in order to determine a baseline of atmospheric composition against which to compare mealworm GHG emissions. Gas chromatography will be used to analyze the concentrations of GHG emissions produced by the mealworm livestock *(figure 2)*. Regression analysis will be administered to analyze the data in order to determine the strength of the correlation between the independent variables (size of the study area and the insect chosen to study) and dependent variable (mealworm GHG emissions). The results of the analysis will be compared to available GHG emissions data from traditional livestock production, in order to see if mealworm production produces fewer GHG emissions per hectare.

Figure 3. An example of insect-based foods. A niche market already exists for insect-based sources of protein. Graphic obtained from https://nutribug.com/product/cricket-protein-bars/

BENEFITS OF RESEARCH

- Reduced greenhouse gas emissions could mitigate anthropogenic climate change.
- Establishing scientific support for the environmental value of entomophagy clears the way for companies to establish a mainstream insect-based culinary culture, given regulatory support *(figure 3)*.
- Use of insects in livestock feed can aid in mitigating greenhouse emissions in those cultures averse to human entomophagy.

Literature Cited

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