

## Closing the loop: Black Soldier Fly (BSF) technology to convert agricultural waste

### BSF Project Update #4 June 2022

#### Overview

The final phase of experiments and trials are all underway, including a refinement of a granulated product representative of industry practices (Figure 1), plus a leaching experiment that will explore how the leaching differs between raw pork manure and BSF Frass that was reared on pork manure.

The emerging results are being written into papers for publication in scientific journals and inclusion in upcoming conferences. The team have been busy preparing Milestone Report 4 and ensuring an achievable plan is in place to deliver the Final Report on time.



Figure 1. images demonstrate milled manure frass being sieved (<500um) to enable the production of small, regular, granules.

#### Communication & Engagement

- ❖ Marit Kragt delivered a conference presentation on *Using BSF technology to turn livestock waste into profitable products* at the Terra Envision Conference, Utrecht, Netherlands. 28th June, 2022.
- ❖ Engagement with government agencies has established that no classification exists for the BSF process being developed under this project.
- ❖ 6 Fact Sheets are being developed for industry to communicate research outcomes.
- ❖ Presentation on *Manure as a Substrate for Black Soldier Fly Larvae Rearing: An Australian Analysis of Biosecurity Risks* delivered by Lachlan Pearson at the Insect Industry Program at the [AMC/PIX](#) event on Swine and Poultry, Gold Coast, 15-17th May, 2022.

#### Snapshot of results

- BSF optimisation trials using livestock waste substrates showed that application of BSF can reduce wet waste volumes by over 80% depending on the substrate.
- Growth accelerator data and reaction vessel nitrogen transformation trials indicate that formulating the BSF protein meal with urea and adjusting the Carbon:Nutrient ratio can create fertilisers that enable a 72% yield improvement over conventional urea fertilizer as an N source.
- The inclusion of BSF Frass to a sandy soil type led to a doubling of wheat grain yield and 2-4 greater pasture productivity of rye grass and clover than when mineral fertilisers were applied in isolation.
- The engineering team is able to reliably produce granules typical of industry size ranges using milled manure frass to aid in commercial dispersal.
- Survey indicates that farmers view rearing insects as a complex operation, akin to operating another farming enterprise, and hence individually managed facilities on-farm are unlikely to be adopted.

## Research Activities

### Screening and optimisation of waste streams

- Experiments to optimise the insect rearing processes was extended to wastes from poultry, dairy, abattoirs, and cattle paunch. Trials reveal that livestock wastes require longer processing than 'clean' vegetable wastes to achieve waste reduction and larvae production.

### Economic feasibility, socio-economic costs and benefits, and market evaluation

- Some transport costs of waste for the average producer were identified, however no generalizable conclusions can be drawn due to the minimal number of costs obtained.
- Insufficient quality responses were received on the waste producer's survey to augment the data collected for the [farm animal waste volumes report](#) therefore can't predict waste supplies in geographical locations.
- Centralised Vs Decentralised was unable to be analysed as technology still in experimental stage, however some insight gained from interviews related to this topic will be included in the Final Report.

### Assess the biosecurity risks of BSF products (frass and larvae)

- The literature has been reviewed extensively and a testing protocol for pathogens has commenced.
- The successful rearing process of Black Soldier Fly larvae on pig manure was completed.

### Assess the environmental risks of BSF products (frass and larvae)

- A report on the environmental risks with BSF products has been drafted and is under internal review.
- Pot trials to determine the nutrient and heavy metal leaching potential of different frass products applied to a range of soil types are in progress.
- The review has been completed on the complex regulatory processes that will need to be navigated to avoid classification of BSF fertilisers as a waste by-product. Regulatory discussions are ongoing.

### Assess the benefits of using BSF frass and/or larvae as a soil improver

- The results of the nitrogen cycling dynamics have been written into a paper and submitted to a journal.
- A pot trial has been completed assessing the impact of applying different rates of BSF Frass on soil biology and plant productivity. The results are being drafted into a paper.
- A glass house experiment was carried out to determine the best application rate of BSF Frass.
- Final harvest of field trials was completed. Analyses of soil, plant tissues and grain quality are ongoing.

### Develop a granulated and/or pelletised fertiliser product

- A ballistic model, capable of predicting the trajectory of spherical particles in a wind flux in the presence of drag, has been developed.
- Granules are now being produced using milled manure Frass. Identification of appropriate milled material flowrate and final recipes that correspond to the desired engineering attributes is underway.
- Optimisation of the disk pelletising process in the context of manure Frass is now underway.

### Develop a slow release encapsulated fertiliser product (DAF, Queensland)

- A microbial community analysis will be completed at the end of the current pot trial run.
- Growth accelerator and reaction vessel trials have been completed, with additional trials in progress.
- Investigations on nitrogen supply profiles in several soils are underway using Pak Choy as a model plant.

### Public perception

- Australian farmers reported no negative perceptions towards BSF-based fertilizer products. The analysis and the willingness-to-pay estimates for BSF-based products will be reported next quarter.
- A scientific paper has been drafted based on the survey results, which will be updated if more responses are received in time.

### Next Steps

Research activities continue to gain as much data and knowledge for inclusion in the Final Report. In addition, the team are focused on implementing the Communication & Engagement Plan and will produce a quality video as well as deliver a series of webinars and factsheets that will communicate the research outcomes of the project to our industry partners, farmers and the scientific community.