

## BSFL Frass as Fertilizer:



### Use of Insect Larvae Residuals as Soil Amendment for Lawn and Garden, Fruit and Vegetable, and Crop Production

Frass refers to the excrement of insects and will often contain other components such as exoskeleton sheds and food residue. The frass of commercially-produced insect larvae, including the black soldier fly (*Hermetia illucens*, BSF) and mealworm (*Tenebrio molitor*), have great potential as a fertilizer with many applications, and are also a sustainable source since commercially-produced insects are a way of utilizing pre-consumer food by-products that may otherwise create waste streams. Additionally, the use of insect frass can reduce the need for chemical fertilizers.

#### N-P-K<sup>1, 3</sup>

Nitrogen (N), phosphorous (P) and potassium (K) are the three macronutrients used by plants for 1) growth and development of foliage (N), 2) growth and development of roots (P), and 3) to aid plant overall function (K). Insect larvae frass has been found to contain nutrients in readily-available forms compared to traditional fertilizers, and have as high of N-P-K values as chicken manure. This would indicate a consistent distribution and slow release of minerals from frass into the soil. Across BSFL frass lots from various sources, average nutrient content (DMB) was reported as 3.39% nitrogen (N), 2.85% phosphorous (P<sub>2</sub>O<sub>5</sub>), and 3.47% potassium (K<sub>2</sub>O).

#### Literature Findings<sup>1, 2, 3, 4</sup>

- Nitrogen mineralization in soil containing mealworm frass was rapid for the first 17 days after application to barley plants (*Hordeum vulgare*), then continued more slowly for the remainder of the incubation period.

- Over 28 days of ryegrass (*Lolium perenne*) growth, phosphorous bioavailability was 10% higher with BSFL frass compared to the control of a standard ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>) fertilizer. All treatments contained 40 mg N/kg.
- No detectable *Escherichia coli* (*E. coli*) or *Salmonella* spp. in soils with BSFL frass compared to the control (standard NH<sub>4</sub>NO<sub>3</sub> fertilizer) when growing ryegrass. There were also lower soil coliforms with BSFL frass application.
- Spring onion plant height was positively affected by the application of BSFL frass.

#### Conclusions

1. BSFL frass can be used as partial or full alternative to standard fertilizers.
2. Sustainable source of fertilizer due to BSFL use of pre-consumer food by-products as feed source, vertical farming capability, lower greenhouse gas emission than some other agricultural products.

#### EnviroFrass™

As the first US commercial scale BSFL production facility, EnviroFlight prides itself on using the best processes and procedures to yield our products: EnviroFrass™ – residuals of black soldier fly larvae production, EnviroBug™ – whole dried BSFL, EnviroMeal™ – pressed dried larvae, and EnviroOil™ – BSFL oil fraction. EnviroFlight processes are first tested in our dedicated ‘Research and Development’ facility before implementation in our commercial-scale production facility, so you can be sure our processes are tried and true in the USA!

1. Klammerstein, T., V. turan, S. Oberegger, H. Insam, M. Fernandez-Delgado Juarez. 2019. University of Innsbruck. Presented at the 7<sup>th</sup> International Conference on Sustainable Solid Waste Management.
2. Houben, D., G. Daoulas, MP. Faucon, AM. Dulaurent. 2020. Potential use of mealworm frass as a fertilizer: Impact on crop growth and soil properties. Scientific Reports.
3. Schmitt, E. and W. de Vries. 2020. Potential benefits of using *Hermetia illucens* frass as a soil amendment on food production and for environmental impact reduction. Current Opinion in Green and Sustainable Chemistry.
4. Zahn, NH. 2017. The effects of insect frass created by *Hermetia illucens* on spring onion growth and soil fertility. Undergraduate dissertation. University of Stirling.