

Black Soldier Fly Larvae as a Compost Accelerant

Senior Capstone 2020

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Introduction

- *Hermetia illucens*, Black soldier fly (BSF) are flies native to Tennessee that can be utilized in a closed loop compost accelerant system (Popa et al. 2012)
- In the summer of 2019 The University Farm successfully implemented and ran a BSF system
- The goal was to create a sustainable system where food waste is more quickly broken down and converted into compost

Study Objectives

- Test viability of the system
- Understand the true capacity of the system and how much compost could be used weekly
- Increase the amount of compost collected by the University Farm from McClurg dining hall and Sterling's' Coffee House

Study Location



Figure 1: Location of Sewanee, Tennessee (in red)

Methods

- First, we went and picked up food waste from McClurg and Stirlings Coffee House.
- Then, we brought the food waste back to the farm and sorted through it. We removed most dairy and then filled two five gallon buckets with the food waste.
- The food waste inside the five gallon buckets would then be equally distributed among the larvae in feeding bins one and two.
- This process would be repeated daily, the older larvae would then eventually begin to consume at a faster rate and need to be given an increased amount of food waste.
- Once the larvae begun to eclose*, their feeding slowed and they were put into a crawl off container.
- In the crawl off container, the oldest larva were collected and moved back into the breeding cage to soon hatch into flies and start the process over again.
- Larvae that was not collected for breeding was spread onto an open compost pile nearby.
- The eclosing larvae in the breeding cage would soon hatch into flies, breed, lay eggs and die (Caruso et al. 2013)
- There were daily inputs of eclosing larvae into the breeding case and daily inputs of eggs into the larvarium to hatch into larvae.
- This completed the closed loop system.
*the larvae become rigid and create a hard shell for themselves then emerge as an adult (Caruso et al. 2013)

Life cycle of BSF in system

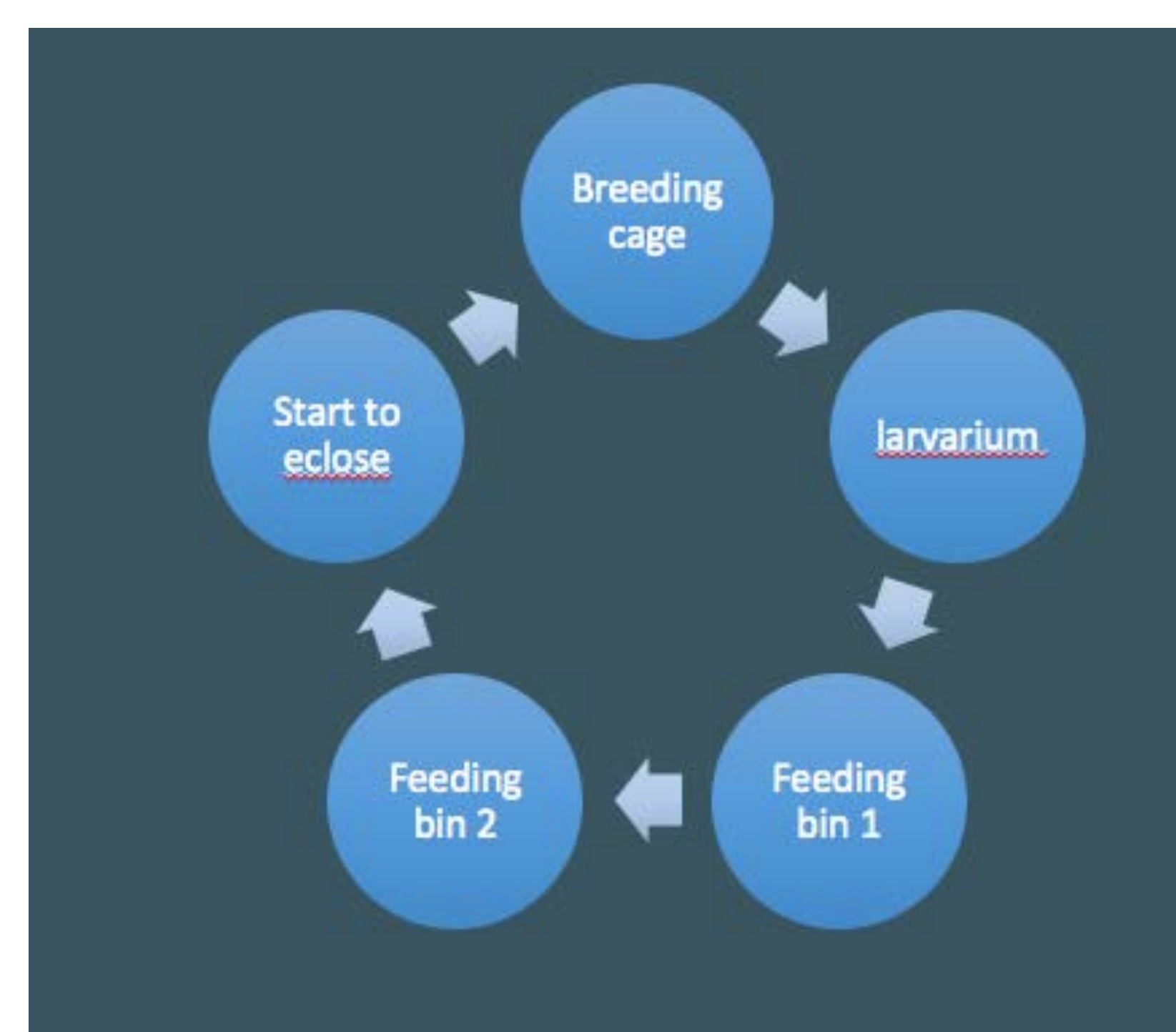


Figure 2: Life cycle of BSF in the University Farm's system

- Breeding cage- this is where the BSF mate and lay eggs in pieces of corrugated cardboard
- Larvarium- Cardboard with eggs are placed into temperature and humidity controlled environment to hatch and begin feeding on high nutrients substrate (chicken feed)
- Feeding bin 1- as larvae grow they are put in larger containers and begin being fed food waste
- Feeding bin 2- Larvae are moved into larger feeding bins and are still fed food waste
- Start to eclose*- as the larvae grow they begin to prepare to become flies, they are then moved back into the breeding cage to eclose and become flies, then mate (Diener et al. 2011)
- The process restarts



Figure 3: Feeding bin two with larvae and frass (excrement) after feeding.



Figure 4: Crawl off container before larvae are moved into breeding cage and eclose

Results

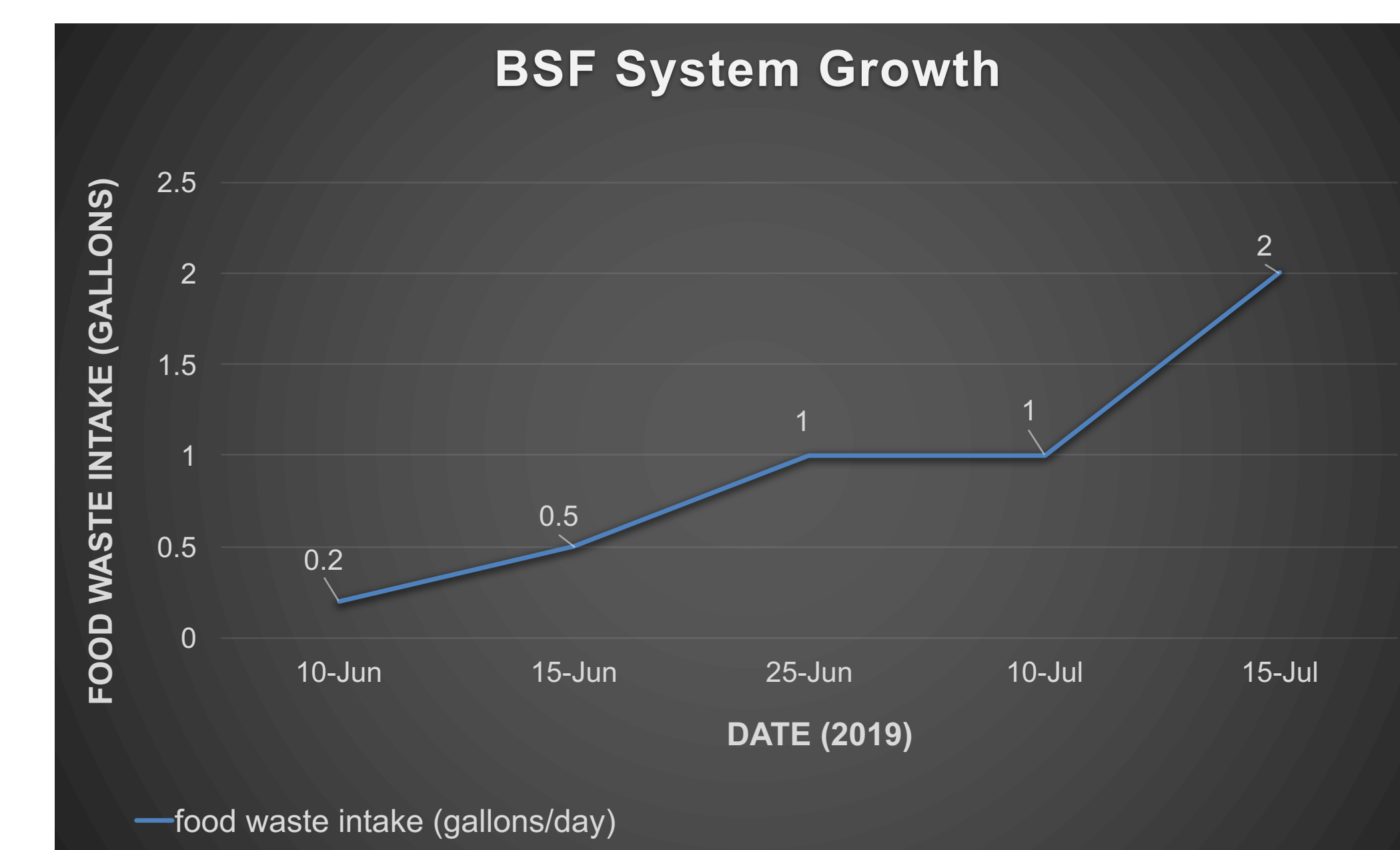


Figure 5: Increase in the intake of food waste over a 35 day period

Discussion

- The lack of prior research impacts the ability for current systems to be successful
- Many systems are in the trial and error stage
- In the future, this system has potential to make a major impact on the acceleration of composting food waste
- There will be an exponential increase in food waste being processed as system grows
- McClurg produces around 60 tons of food waste a year
- The Farm can take around 10 tons of food waste annually
- Food waste intake will increase alongside the growth of the BSF system

Conclusion

- The concept is still in its early building phases
- In order to grow the system and work at a higher capacity
- There needs to be an improvement of the facilities in which the system is located
- Looking forward, there is ample room for growth
- As the system grows it will gain the ability to make a sufficient impact on the food waste intake that the University Farm is able to manage.
- The BSF system would take one person 30 hours a week to run and sustain growth

Acknowledgements and Sources

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