

Our Black Soldier Fly farm



**WASTE IS NOT WASTE UNTIL
WE WASTE IT!**



**EUROPEAN
SOLIDARITY
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Prologue

First of all, before we begin discussing the important steps for the correct functioning of this farm it is important to understand reason behind the making of it and the numerous opportunities it may carry.

Black Soldier Flies are a type of insect that only feed on its larvae stage. During this stage the larvae feed on almost every type of organic waste, from animal manure to human leftovers. During the process, these tiny insects transform once waste into a valued source of food (Full of important minerals, vitamins, proteins and fat), furthermore as a byproduct they produce liquid gold (Fertilizer for plants). With this system is possible to have a continuous cycle and furthermore produce adult larvae that may be given as feed to chickens, pigs, dogs and even us Humans. The possibilities are many as we will discuss in the next chapters.

Hope this guide can serve as a stepping stone in the building of this beautiful project, also I hope this work can be continued by other volunteers with love and dedication. Afterwards feel free to add more information or correct some procedures to this guide, making it easier for other volunteers. In any case you can always contact me too!

Enjoy 😊

Nuno Henriques

August 2021, ESC Project “Have Less, Live More” at Initiative et Développement Citoyen, France

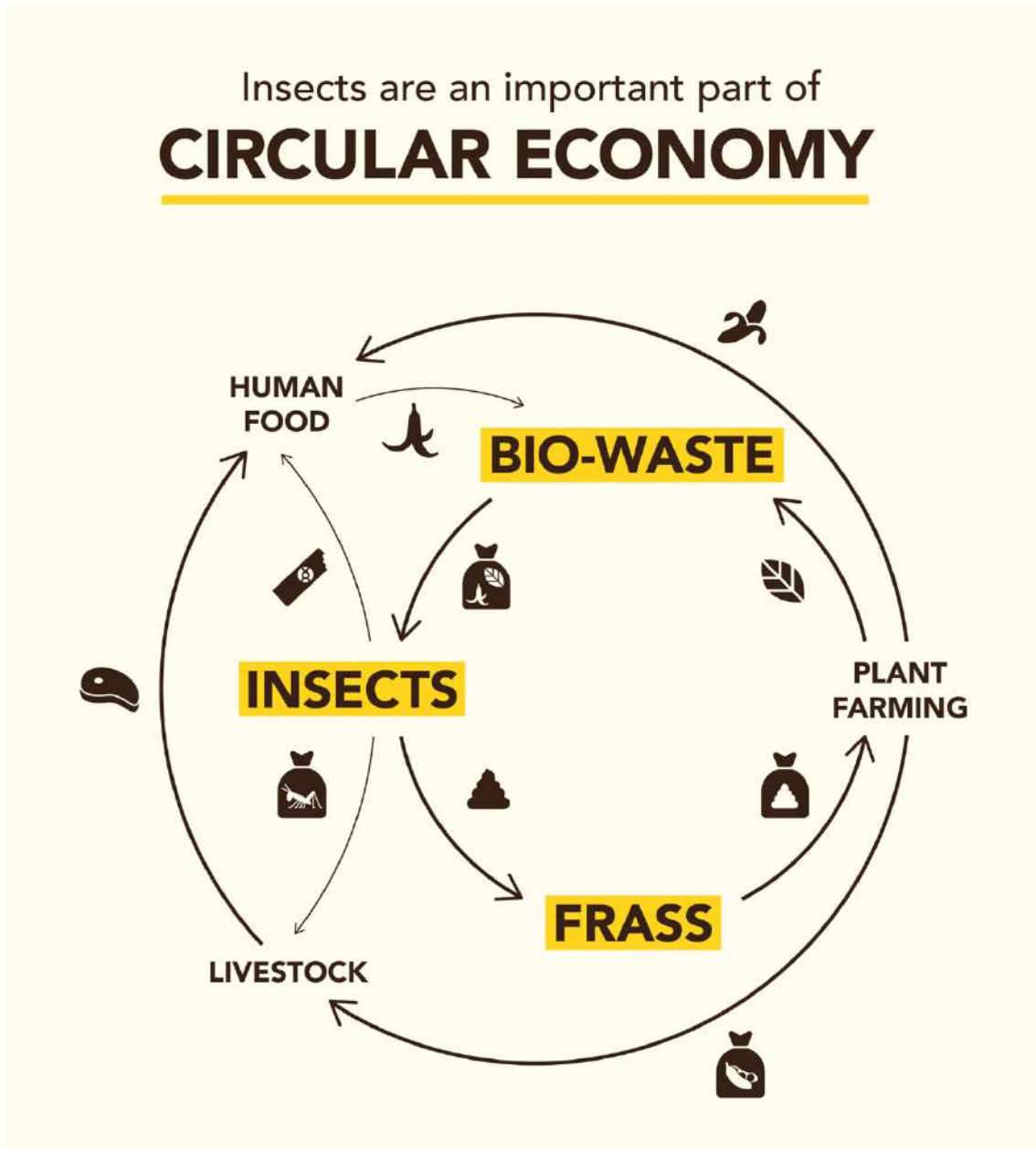
Purpose

The aim of this manual is to serve as guide to ensure that our Black soldier Fly farm is running at its best, as well as being contamination free. First, this manual will give some general information about the life cycle of the black soldier Fly. After we will discuss the processes and procedures for the correct maintenance of the farm. And by last, how to use the final products produced by the farm in order to finish the cycle.

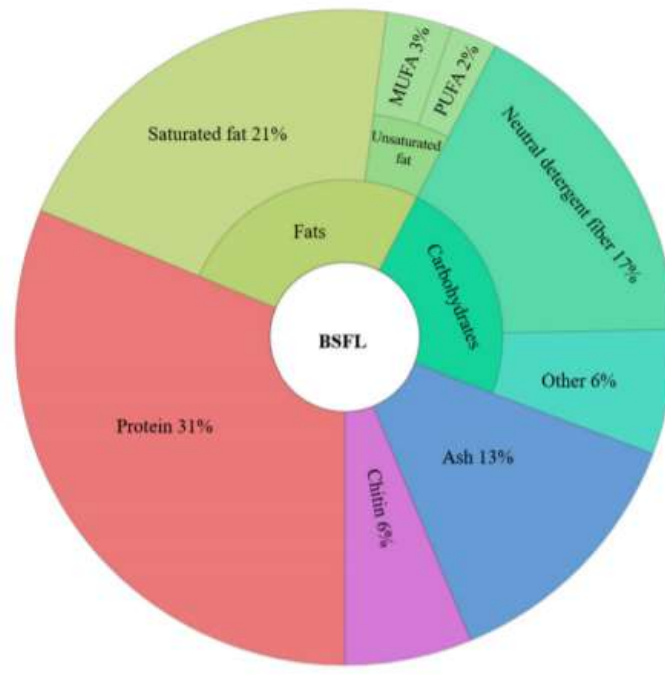
Why Insects?

This may be the question you are doing yourself at this present moment. Why is it important to have an insect farm in this camp? Okay my job here is to convince you, that yes, it is not important, it is fundamental!

First, because insects have a fundamental role in the circular economy:



Then, insects are an important source of minerals, vitamins, proteins and fat. Making it attractable for human consumption as well as to feed our animals (Loulou, Boubou, Hiroo, Keila, Snoopy and all our chickens). In this case Black Soldier Fly larvae which are really healthy, as we can see below.



As a byproduct the Larvae produce Frass. This Frass is an important fertilizer for soil. Helping our plants to grow bigger and healthier day by day.



To sum up... consuming insects has a number of advantages:

- They have high feed-conversion efficiency (an animal's capacity to convert feed mass into increased body mass, represented as kg of feed per kg of weight gain).
- They can be reared on organic side streams, reducing environmental contamination, while adding value to waste.
- They emit relatively few GHGs and relatively little ammonia.
- They require significantly much less water and land use than cattle rearing.
- They have few animal welfare issues, although the extent to which insects experience pain is largely unknown.
- They pose a low risk of transmitting zoonotic infections.

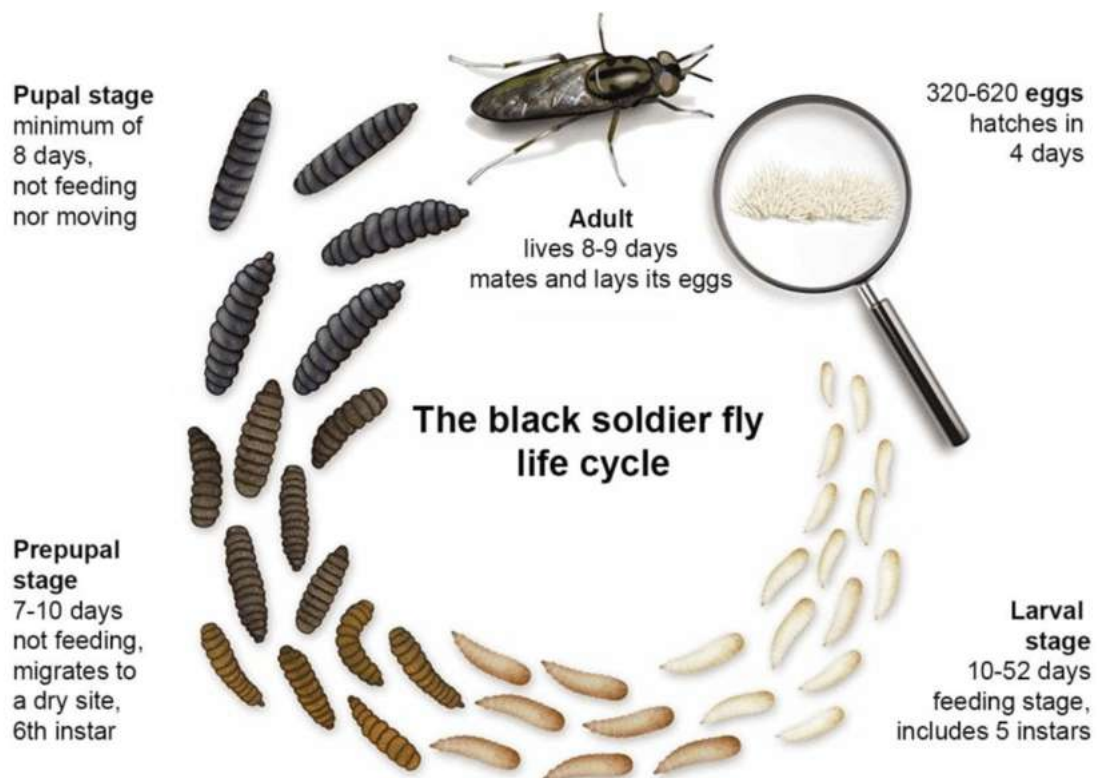
The basics

1) *Hermetia illucens*

What makes me special?

- I am not a disease vector, as other type of flies (Like my cousin house fly);
- I don't bother humans. Firstly, because I don't eat during my final stage of life, then because I must conserve my energy, so I don't spend it flying around.
- As a larva I eat all kinds of human leftovers, as well as animal manure. Moreover, my secret is that like humans I do love coffee, it helps speed up my metabolism, so please give me coffee grounds!

2) Black Soldier Fly Life Cycle and Farm stages



The egg starts a BSF life cycle and at the same time marks the end of the previous life stage: a fly laying a cluster of eggs (also called ovipositing). The female flies lay around 320 to 620 eggs near the decomposing organic matter, into small, dry, sheltered cavities. We chose this design with wood but others designs are possible.



Figure 1 Wodden eggies

On average, the eggs hatch after four days and the emerged larvae, which are barely a few millimeters in size, will search for food and start feeding on the organic waste nearby. The larvae feed voraciously on the decomposing organic matter and grow from a few millimetres size to around 2.5 cm length and 0.5 cm width, and are of cream-like color. The baby larvae will fall down from the eggies into the the nursery container. This container has an attractant (Smelly) in order to attract the flies to lay their eggs nearby (in this case in the eggies). Moreover there is a plastic cover separating the eggies from the box so that the flies do not escape and to be easier to take them out when they die.



Figure 2 Eggies and nursery container

Under optimal conditions with ideal food quality and quantity, the growth of the larvae will require a period of 10-16 days. However, the BSF larva is a very resilient organism and has the ability to extend its life cycle under unfavorable conditions up until 52 days. The larval stage is the only stage during which the BSF feeds and, therefore, it is during this time of larval development that enough fat reserves and protein are stored that allow the

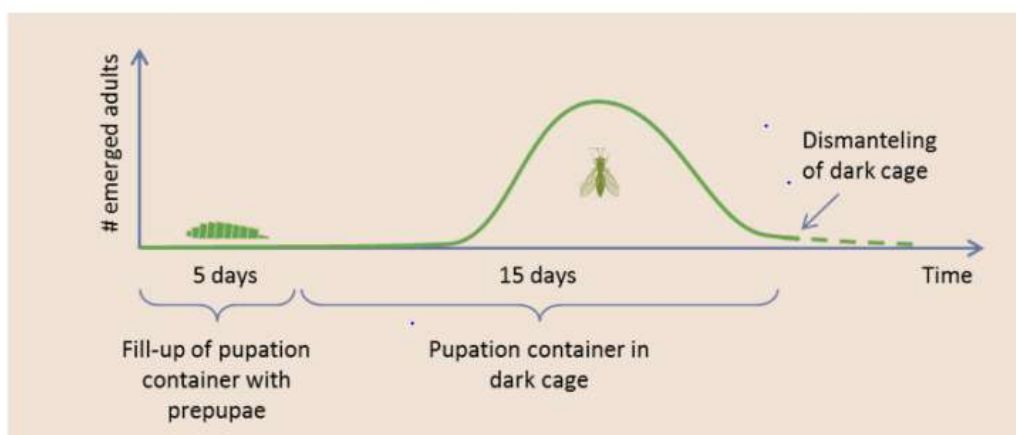
larvae to undergo pupation, emerge as flies, find mates, copulate and (as a female) lay eggs before dying.

The treatment unit: (Photo of the place) (The treatment unit should be emptied and cleaned every: days)

(Advices: Experience has shown that for each larvero, three feedings of equal amount over the development period of 12 days is suitable: on day one, day five and day eight. · The amount of waste is also limited by the layer thickness of waste in the larvero. If the depth of the waste in the larvero is more than 5cm, larvae will have difficulties to process it entirely and the waste on the bottom will remain unprocessed. · Larveros can be stacked upon each other to optimize surface area requirements. However, it is necessary that the larveros are well ventilated to allow the moisture-saturated air to be replaced. Also, provision of oxygen is crucial for the well-being of the larvae. For these purposes, we suggest to keep enough open space between the stacked larveros (Figure 16) to allow for free flowing aeration.)

After having gone through five larval stages, the larvae reach the final larval stage: the prepupa. When transforming into a prepupa, the larva replaces its mouthpart with a hook-shaped structure and becomes dark brown to charcoal grey in colour. It uses this hook to easily move out and away from the food source towards a nearby dry, humus-like, shaded and protected environment that it deems safe from predators. This stage usually takes from 7 to 10 days. In our farm, we have a system where the prepupa self-harvest themselves using the ramps into the bucket. This bucket must be changed every 4/5 days, putting some prepupa to continue the cycle (into the prepupa containers) and some to feed our animals.

The process of pupation is the transformation from a pupa into a fly. The pupation stage is initiated when the prepupa finds a suitable location and becomes immobile and stiff. For a successful pupation, it is best if the environmental conditions do not change too much or, in other words, that they remain warm, dry and shaded. Emergence of the adults starts ten days after they were put into the pupation box, then follows a bell-shaped curve and ends with a few latecomers after 25 days.

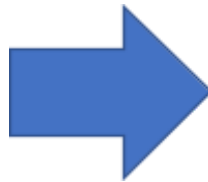
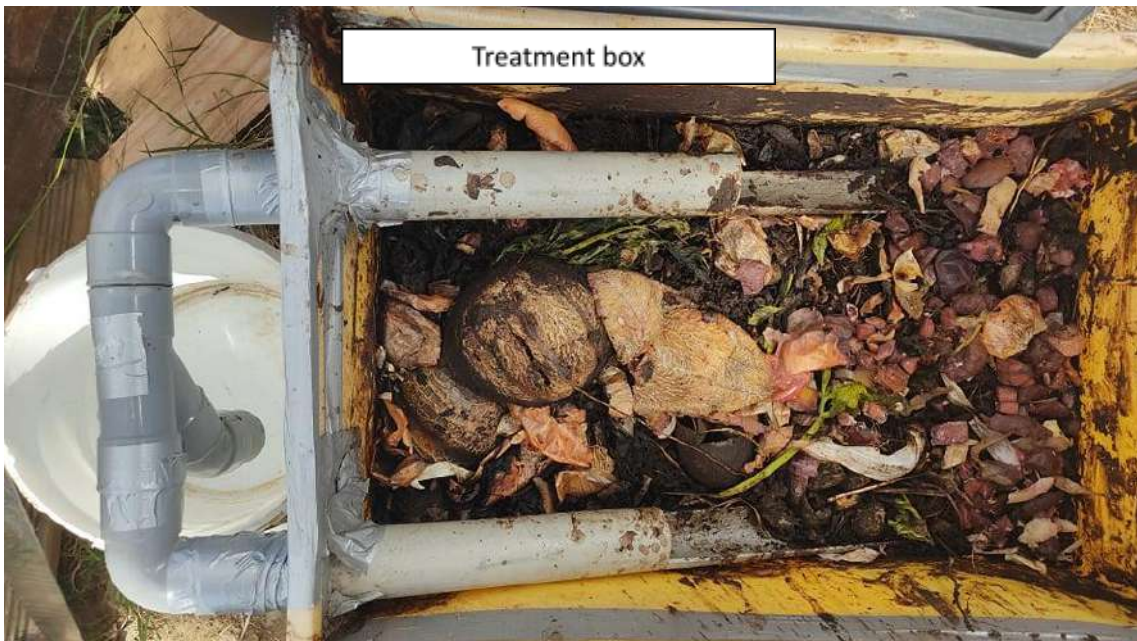


Pupation unit: We have 3 pupation unit. So, we should divide the population into dates.

First the bucket with the prepupa goes into the 1st container, 5 days later another to the 2nd container, 5 days later another to the 3rd container. (Total of 15 days). At this time, 1st container is emptied into the love cage and filled with a new bucket.

After emerging, the fly lives for about one week. During this short life, it will search for a partner, copulate and (for the female) lay eggs. As a fly, BSF do not feed. Only a source of water or a humid surface is required to stay hydrated. What is important in this life stage is an abundant amount of natural light and a warm temperature (25-32°C). A humid environment may prolong the life span and, thus, enhance the chance for successful reproduction. It has been observed that the flies prefer to copulate in the light of the morning and that they need a plant. After copulation, the females then search for an ideal location to lay their eggs (In our farm we use carton paper cuts).

3) Summary with images:







Empty the nursery box every 5- 6 days (Depending)



Also, in order to lay their eggs, the flies need an attractant near the eggies. In the following text are the procedures to do a good attractant:

Ingredients: 1) Water; 2) Rotten bananas or any fruit with a strong smell; 3) Rice or coffee husk

Step by Step guide: First mix the same quantity of water and Bran, leave it for 4 days. Then, smash the fruits in a blender with some water. Mix in a ratio of one to one with the husk. And Voilá. Just put in the box besides the eggies.





4) Optimal environmental conditions for farming

Optimal environmental conditions and food sources for the larvae can be summarized as:

- **Warm climate:** the ideal temperature is between 24 and 30°C. If too hot, the larvae will crawl away from the food in search of a cooler location. If too cold, the larvae will slow down their metabolism, eat less and develop slower.
- **Shaded environment:** larvae avoid light and will always search for a shaded environment, away from sunlight. If their food source is exposed to light, they will move deeper into the layer of food to escape the light.
- **Water content of the food:** the food source has to be quite moist with a water content between 60% and 90% so that the larvae can ingest the substance.
- **Nutrient requirements of the food:** substrates rich in protein and easily available carbohydrates result in good larval growth. Ongoing research indicates that waste may be more easily consumed by the larvae if it has already undergone some bacterial or fungal decomposition process.
- **Particle size of the food:** as the larvae have no chewing mouthparts, access to nutrients is easier if the substrate comes in small pieces or even in a liquid or pasty form.

5) Feeding the BSFL larvae

- Our leftovers

Black Soldier fly larvae love to eat rotting food, and cooked leftovers are often rotting and very soft. However, remember to prepare the food so that it has a minimum moisture content of 60%, which helps to feed the fly larvae and convert food. The leftovers also include Bread or chocolate. Leftovers of dairy products and well as sugary food was not tested.

- **Coffee grounds**

Coffee grounds can be used mixed with other food sources. They are high in protein and help accelerate the metabolism of the larvae. Also, is it possible to use rotten coffee grounds which can no longer be used to our mushroom farm. So it is a way of reusing coffee that its not suitable for mushroom grow.

- **Vegetable and fruits**

The BSFL larvae love rests of Fruits and veggies, and the best part is they prefer the rotten ones. So, any type of veggie that is rotting on our kitchen can be given to them.

Onion peels by experience they don't like a lot.

- **Animal Manure**

Animal manure that is good for BSF larvae is chicken and pig manure. The feces from herbivores like cows, goats or horses may not be the best food source for your larvae. Because they are fairly fibrous and contain lignin or cellulose, our fly larvae may not digest as well. The obvious downside to using animal manure is that it stinks will spread throughout your farm. But in return, the fertilizer is cheap with an abundant supply.

Don't: The larvae don't digest cellulose, so don't feed them wood nor paper.

6) Procedures

Once again, we will start by the eggs. The eggies are inside the love cage just below it's a box where the babies will hatch (The nursery).

Nursery box – Where it all begins

Basically, the Nursery box must be changed every 5 to 6 days depending on the number of babies. The eggs take until 4 days to hatch, then the larvae begin to grow and should be moved to the treatment box after 2 to 3 days of growing in the nursery. The substrate needs to be moisturized if not it will become hard, so every day should be sprayed a bit of water.

For more information check youtube video: [youtube.com/watch?v=qQwr0I05HLc](https://www.youtube.com/watch?v=qQwr0I05HLc)

Treatment box

We have two treatment boxes. They will work in continuous mode with the self-harvesting system. But from time to time the substrate must be all replaced (new soil for garden) and drained for liquid fertilizer. (I haven't figured out from when to when to do it).

The food must be put every 2 days. Also, the substrate needs to be mixed and the humidity checked. If it is to dry spray some water.

Buckets

The buckets where the mature larvae self-harvest must be checked every day. And some prepupae should be put in the pupation box in order to continue the cycle and other can be used for feeding.

Pupation box – Should be filled with sand or dry top soil

There are two boxes in order to have different lots of ages.

Should be cleaned every month in order to take out the rest of the skeletons of the prepupae.

Love cage

Should be cleaned regularly with a vacuum cleaner because the flies will die in the ground. Also the plant should be watered depending on the outside temperatures.

7) Final Product

1) Animal consumption: Adult Larvae ready to give



2) Flour



3) Fertilizer



**DON'T FORGET TO KEEP ADDING
AND UPDATING THIS MANUAL!**