

**Owareco LLC Feed Trials with RRR Black Soldier Fly Larvae**

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River Road Research (RRR) has received dry feed waste materials, from Owareco, to be tested for nutritional quality for growing larvae of the Black Soldier Fly (BSFL). Six samples have been received and experimented with labelled: Gracie, cafeteria waste; Good Luck, restaurant waste; Hospital, hospital waste; Food Link, food bank waste; Wegmans, grocery store waste; and Mt. Lowe, beer mash. Beer mash was used as a control.

RRR produces newborns of BSFL by incubating BSFL eggs. The newborns are grown for up to one week until they reach approximately 10-40 mg in weight when they are hardy enough to survive feed trials. In the first week of life the larvae were grown on wheat bran to medium size and then the larvae cohort was split into six experimental containers (L 53 cm x H 28 cm x W 45 cm). The size of the larvae (10-40 mg) is pertinent here because the larger larvae are able to eat larger particles of food waste.

In order to be fed to BSFL, food waste had to be ground in a food mixer and sifted prior to being used because original samples still had too large of particulates. After grinding and sieving the feed mixture contained only particles  $\leq 1$  mm in the largest diameter. The experimental containers had equal amounts of inert bedding, water, food waste and larvae. During the incubation food waste was continuously added to each experiment. The amount of food waste used in each container was tracked by measuring the initial food waste, adding equal amounts of it to the containers (taking food moisture content into account), and measuring the food waste left over. Incubations of the larvae has occurred at room temperature. The amount of food waste received from Owareco was only sufficient for one feed trial. The experiment was stopped when insufficient food waste remained.

At the end of the experiment beer mash was supplemented to each experimental container in order to bring the larvae to size large enough for efficient separation. Each container was then sifted to keep larvae only (using the RRR BSFL separator), and the larvae were weighed.

We have used a classical feed formula to determine the efficiency of growing on various feeds. This formula takes into account the amount of feed used (expressed in dry weight) and the amount of larvae produced (expressed in wet weight). The parameters derived is called Food Conversion Ratio (FCR). The smaller the value of FCR the better the quality of a feed.

| Samples       | Initial Food (g) | Final Food (g) | Food Eaten (g) | Beer Mash Fed (g) | Total Amount of Food (g) | Percentage Beer Mash | Final Weight of the larvae (g) | Food Conversion ratio |
|---------------|------------------|----------------|----------------|-------------------|--------------------------|----------------------|--------------------------------|-----------------------|
| Cafeteria     | 673              | 88             | 585            | 1400              | 1985                     | 70.53                | 985                            | 2.02                  |
| Food Bank     | 557              | 258            | 299            | 1400              | 1699                     | 82.40                | 954                            | 1.78                  |
| Grocery Store | 554              | 236            | 318            | 1400              | 1718                     | 81.49                | 912                            | 1.88                  |
| Hospital      | 567              | 213            | 354            | 1400              | 1754                     | 79.82                | 993                            | 1.77                  |
| Restaurant    | 331              | 52             | 279            | 1400              | 1679                     | 83.38                | 951                            | 1.77                  |
| Beer Mash     | 763              | 512            | 251            | 1400              | 1651                     | 84.80                | 795                            | 2.08                  |

Figure 1. Food conversion of food waste samples.

Some of the Owareco samples contained very large particulates that we were not able to grind to a usable size with our equipment. If this material was going to be utilized for commercial production of BSFL a very powerful grinder would be needed or some material would not be usable and would have to be discarded. The hospital waste did include cotton and other debris. There did not seem to be an issue when added to the containers because the larvae did consume most of debris. If it was recycled with the bedding and continually used, it would have most likely all of been consumed. Presence of foreign materials or contamination besides food waste could be a regulatory concern. Some of the large particulates could be mitigated by using our fermentation process. If desired, the Owareco-based feed may be improved in quality through the addition of feed supplements in order to improve the FCR. The optimal proportion or composition of supplements cannot be specified at this time because the materials received for feed trials did not come with a proximate analysis, nor were they of sufficient quantity for both proximate analysis and feed trials.

The analysis of each sample showed a good food conversion ratio for each Owareco sample. The best results were from the food waste sourced from the hospital, restaurant and the food bank. The results indicate that material produced by the Owareco process can be used to produce BSF larvae at a ratio of approximately 1 lb of larvae for each 1.8 lb of Owareco dry feed mixture.