DEPARTMENT OF
ENVIRONMENTAL SCIENCE
& TECHNOLOGY

Feasibility of Algal Biomass as a Feed Source for Vermiculture

Terrance Glover, Sarah Koskinen, John Turner, Ben Wells, and Lionel Wilson with support from Dr. Patrick Kangas, Dr. Peter May, and Dr. Jose-Luis Izursa

Introduction

Algae is produced as a byproduct of algal turf scrubber systems, with the goal of removing nutrients from eutrophicated water. This algal byproduct has been explored for various uses, including biofuel, bricks and methane production. Vermiculture is the process of rearing worms in a container filled with bedding and feedstock. The goal of this experiment was to test the utility of algal biomass as a substitute feedstock for red wiggler worms (*Eisenia fetida*). Algal biomass from Patrick Kangas' ATS studies and food waste from Campus Dining Services were compared as feedstocks and their effects on worm weight, survivability, and reproduction were observed.

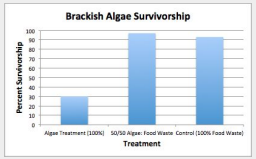
Methods

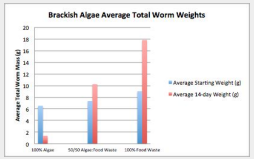
Three experiments were performed. Red wiggler worms *Eisenia fetida* were purchased from Uncle Jim's Worm Farm (Pennsylvania, USA). Worms were randomly divided into groups of 20 or 30 (experiments 3 and 2, respectively) and weighed. Three replicates were used for each treatment. 100% food waste was used as a control group. Two treatment groups were used in an effort to establish a response curve, a 50/50 homogenized mixture of algae and food waste, and 100% algal biomass (brackish or freshwater community). All treatments received uniform amounts of bedding, feedstock, and water. 0.5 liter of feedstock (control, 50/50, or 100% algae) were added to each replicate.

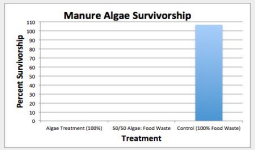
The containers were monitored and food was replaced weekly. The replicates were analyzed at weeks 0 (start), 2 to determine number of worms per replicate (survival), weight of total worms (g), and average worm weight (g). Raw data were analyzed using a series of statistical tests to determine significance of results. ANOVA tests were performed to determine differences in worm weights between treatments.

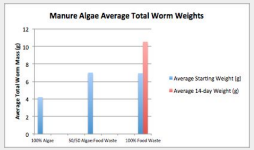
Results

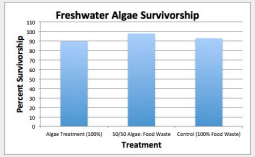
The first experiment failed to produce reliable data due in part to desiccation of the substrate. A second experiment was successful in producing reliable data. The data suggests that red wriggler worms respond negatively to the algae, freshwater or brackish. The algal treatments hindered survival rates of the worms in all treatments, and total worm weight and average worm weight decreased. A manure algal experiment was concluded when all worms in the algae and 1:1 mix replicates had died. The final experiment used freshwater algae and demonstrated that algal type may have an effect on worm growth rate and survivorship.

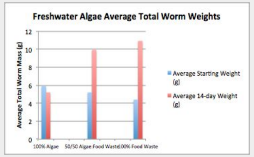












Discussion

We ran a series of experiments to determine if algae were a suitable feedstock for cultivation of red wriggler worms. We discovered that red wriggler worms did not respond positively to brackish or manure algae as a feed source, and remained in stasis (based on weight) in presence of freshwater algae.

In contrast, we discovered that the red wriggler worms from each experiment flourished in the presence of 100% food waste. The worms not only grew significantly in size and mass, but also produced offspring when in the presence of 100% food waste. We witnessed similar results for each experiment when red wrigglers were in the presence of the 50/50 mixture. The worms had significant growth in size as well as mass, but not to the extent of the 100% food waste.

The histograms and graphs produced in the results section help to show the trends observed throughout our series of experiments.

The data collected in combination with observation suggest that 100% brackish or freshwater algae are not viable substitutes for food waste as feed for *Eisenia fetida*. A 50/50 mixture of freshwater algae and food waste seems to support healthy worm growth based on our data. Further experiments are recommended to obtain more robust data and to explore other effects on *Eisenia fetida*.