THE EFFECT OF WASTE FOOD DIETS ON THE YELLOW MEALWORM LARVAE (*TENEBRIO MOLITOR*)

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ABSTRACT

- The world population is projected to grow to 9.8 billion by the year 2050 **(1)**
- Currently, 37.5% of arable land on Earth is used to feed livestock **(2)**
- Using pesticides, fertilizers and animal waste for crop maintenance of leads to land and water degradation **(3)**
- Globally, agriculture produces to one-third of methane emissions, 5.25 billion tons of carbon dioxide and 60% of nitrous oxide emissions **(3)**

We need an alternative protein source that can sustain people and livestock while producing significantly less greenhouse gases!

FUNDING/SUPPORT

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WHY MEALWORMS

Our research on Yellow Mealworm Beetle (*Tenebrio molitor*) larvae offers a solution to these problems in four ways.

Mealworms…

- **take up less space than traditional livestock**
- **can be fed less expensive & more sustainable diets and have reduced water requirements**
- **produce significantly less carbon emissions compared to traditional livestock**
- **have a greater nutritional density than beef**

METHODS AND MATERIALS

- Live mealworms were obtained from Wild Birds Unlimited in Surrey, BC
- Each life stage (mealworm larvae, pupae and beetles) were raised in Steralite containers
- All first generation life stages were raised on control diet of oatmeal pellets
- Second generation mealworm larvae were split into three groups of ~1000 worms, with each group being fed a different **(Fig 1)**
- A variety of metrics were collected every Monday Wednesday and Friday **(Table 1)**
- Components of each diet were sourced from a variety of locations **(Table 2)**
- All food items were dehydrated and converted into pellets using potato starch as a binder
- Diets were Control, Waste Food and High Protein/High Starch **(Table 3)**

DIET TYPE	COMPOSITION	SOURCE
Control	Oatmeal	Grocery Stores
Waste Food	Kitchen Scraps Organic Bins	Langara College Chartwells Researcher's Homes
High Protein /High Starch	Meat Brewer's Spent Grain	Grocery Stores Faculty Brewing

TABLE 1 – DIET SOURCES

METRIC	RATIONALE
Number of Alive Individuals	Track Population Numbers
Number of Dead Individuals	Assess Mortality Rate
Weight of Individuals (Alive Only)	Assess Average Gain
Initial Weight of Feed (g) & Amount of Remaining Feed (g)	Assess Feed Consumption
Initial Weight of Carrot (g) & Amount of Remaining Carrot (g)	Track Differences
Presence of Mold in Container	Assess Correlations with Feed Type of Mortality

TABLE 3 – DIET SOURCES

DIET TYPE	COMPOSITION
Control	Oatmeal + Water + Fresh Carrot
Waste Food Diet	Waste Food + Potato Starch + Fresh Carrot
High Protein/High Starch	Meat + Brewers Spent Grain + Potato Starch + Fresh Carrot

TABLE 2 – DIET COMPOSITION

500 WORMS	500 WORMS	500 WORMS
500 WORMS	500 WORMS	500 WORMS

FIG 1 – THE EXPERIMENTAL SETUP AND DIETS

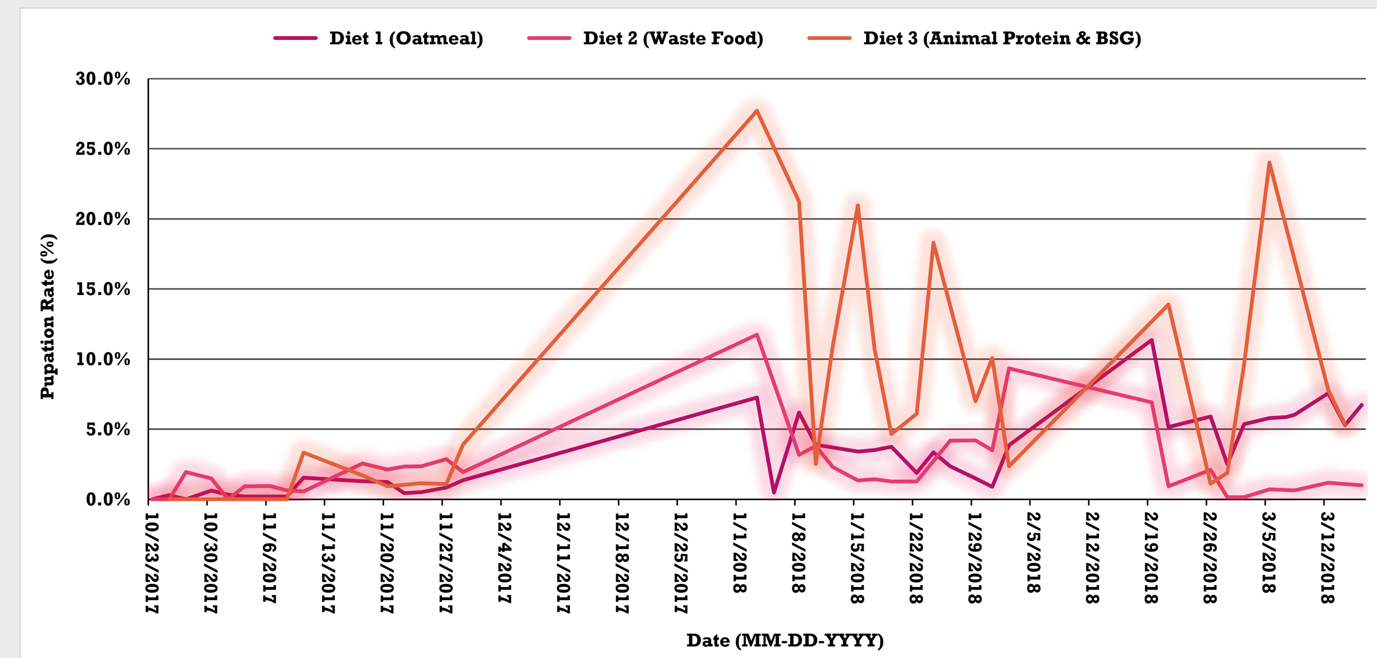

FIG 2 – PUPATION RATE

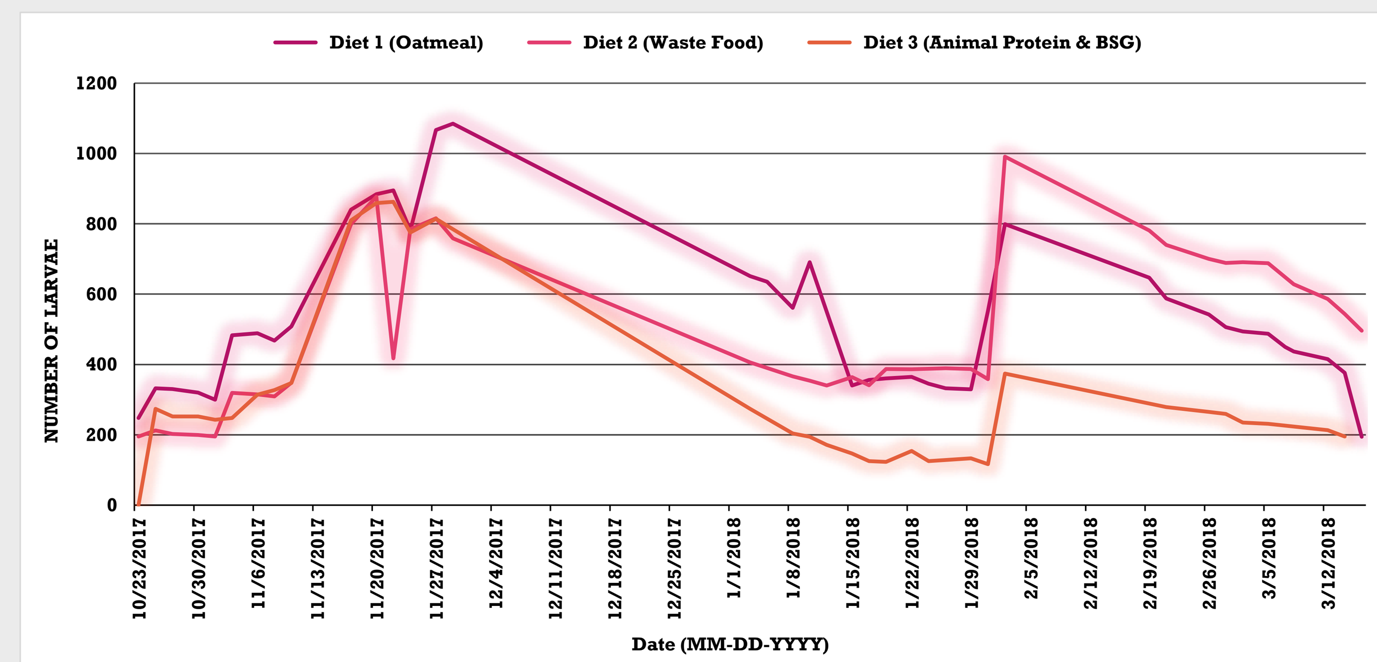

FIG 3 – CHANGE IN LARVAE OVER TIME

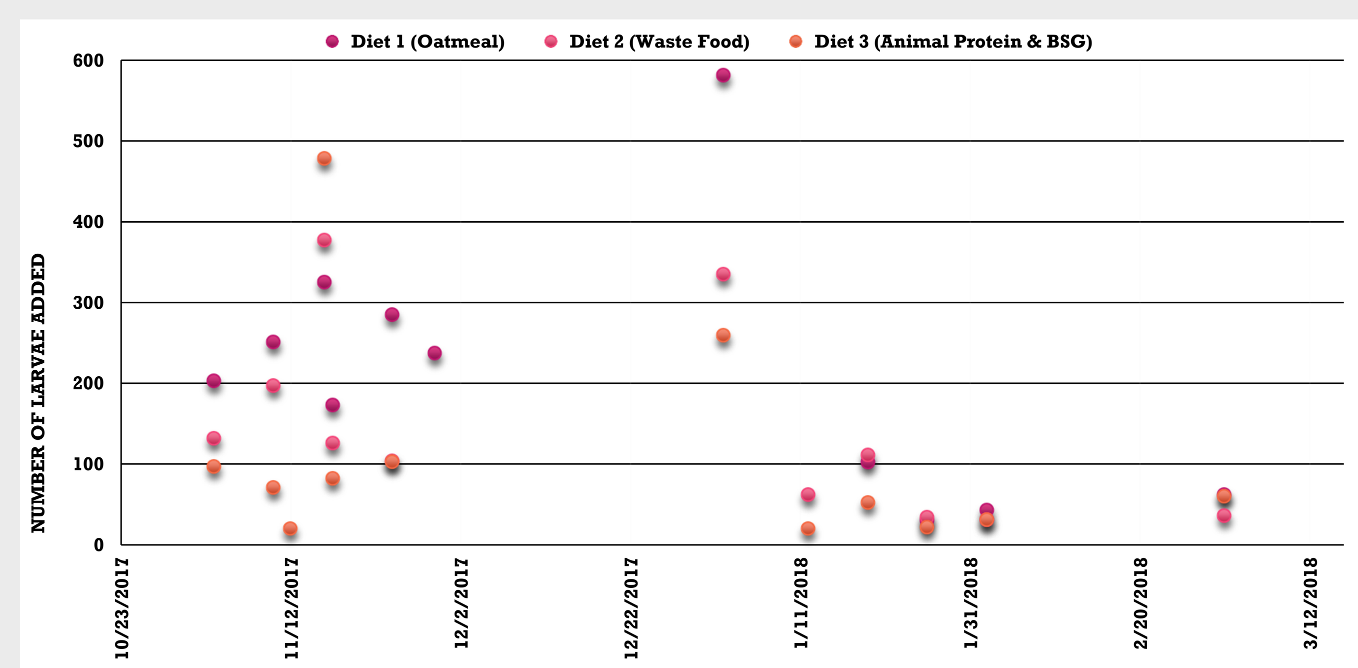

FIG 4 - MEALWORM LARVAE ADDED OVER TIME

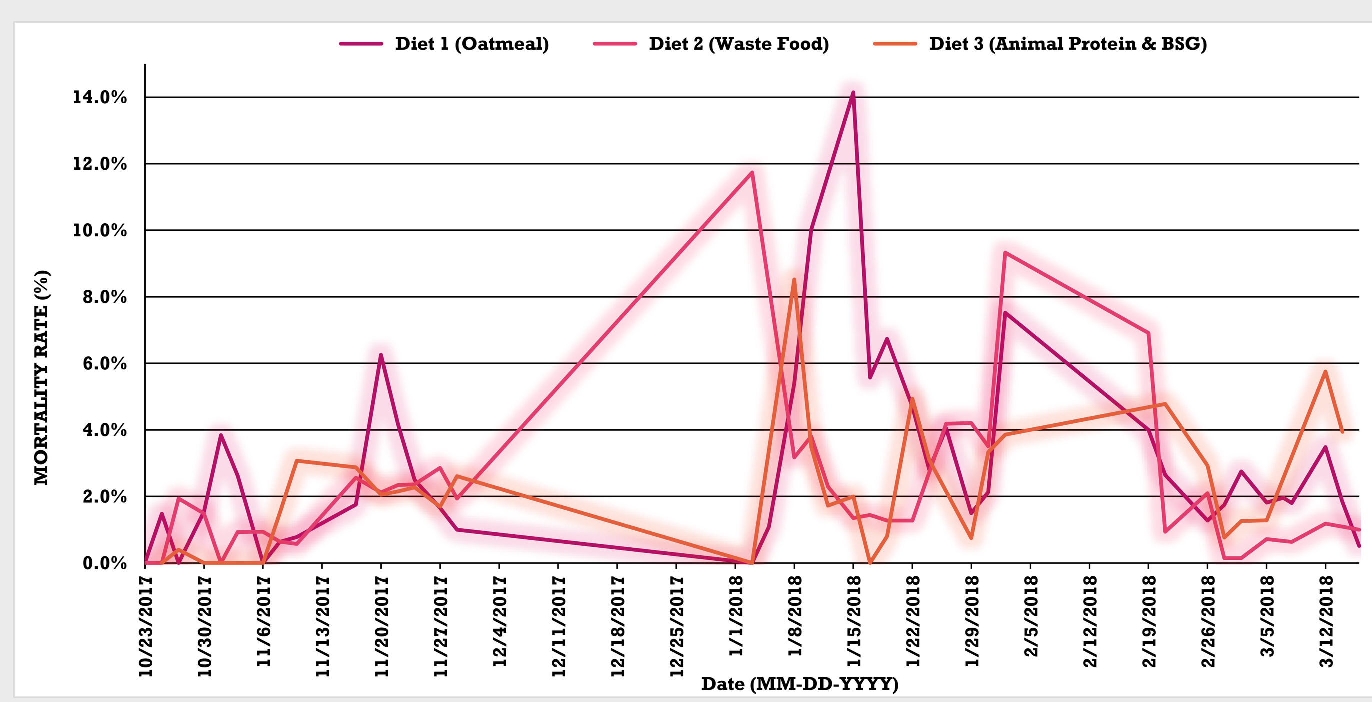

FIG 5 – MORTALITY RATE

RESULTS

- Mealworms on the Control and Waste Food diets had higher population numbers compared to the High Protein/High Starch diet **(Fig 2)**
- Waste Food and Control diets both had lower average mortality rates (2.2% ± 2.5 and 2.2% ± 2.0) compared to the High Protein/High Starch diet (3.0 % ± 2.9) **(Fig 3)**
- Transition from larvae to pupae (pupation rate) was significantly higher for High Protein/High Starch diet **(Fig 4)**
- The Waste Food diet produced a lower amount of new larvae compared to the control **(Fig 5)**

CONCLUSIONS

It is feasible to raise mealworms on a waste food diet. Further study is needed to determine if yellow mealworm larvae can act as an alternative nutrition source for humans

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