



Spent brewery grain as fish feed supplement

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Brewer's grain is a waste product created in large amounts at *The Plant*. In addition to the other methods by which it is currently being reused, we wanted to investigate how much, if any, commercial fish feed could be replaced with it.

INTRODUCTION:

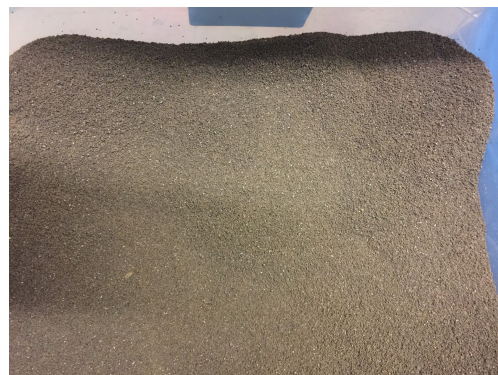
Spent grain, the remnants from the beer making process, can constitute as much as 85% of a brewery's total by-product. At Plant Chicago, we believe in a circular economy in which one business's "waste" is another business's input. In this case, that input is fish food. Whiner Beer Company is a brewery in *The Plant* that creates approximately 2,000 lbs of spent grain per batch. We tested the grain as a replacement for the commercial (and expensive!) fish food we currently feeding our tilapia used in the aquaponics farm. If the fish could survive and thrive off of the grain, this would eliminate feed cost as well as reduce waste by the brewery.

For this experiment we tested four tanks of tilapia with an average of 22 fish in each. One tank was fed commercial feed only, another tank ate only grain and the other two traded off both feeds. We took their initial average weights and reweighed again after one month of testing. Based on these numbers, we decided if spent grain is a viable food source for the tilapia.

MATERIALS:



Whiner Beer Company spent grain



Purina Aquamax Grower commercial fish feed

METHODS:

This process began by removing the tilapia from each tank to count and take their total weight per tank. There was a total of 87 fish, which we redistributed evenly among the four tanks - tank 4 had one less

fish. We then calculated an average weight (pounds per fish) for each of the tanks. For the duration of the experiment, tank 1 would be fed only commercial feed as the control, tank 4 only spent grain, and tanks 2 and 3 would trade off both feeds. The fish were fed 1% of their body mass dry feed, 1x/day, six days/week, for one month. It was determined that wet grain straight from the brewery was 75% water by weight. Adjusting the feed amount accordingly meant 4x the amount of wet grain would be needed to equal the same dry weight of commercial feed. After one month of this feeding regimen, we re-weighed the fish to determine how much weight they had gained.

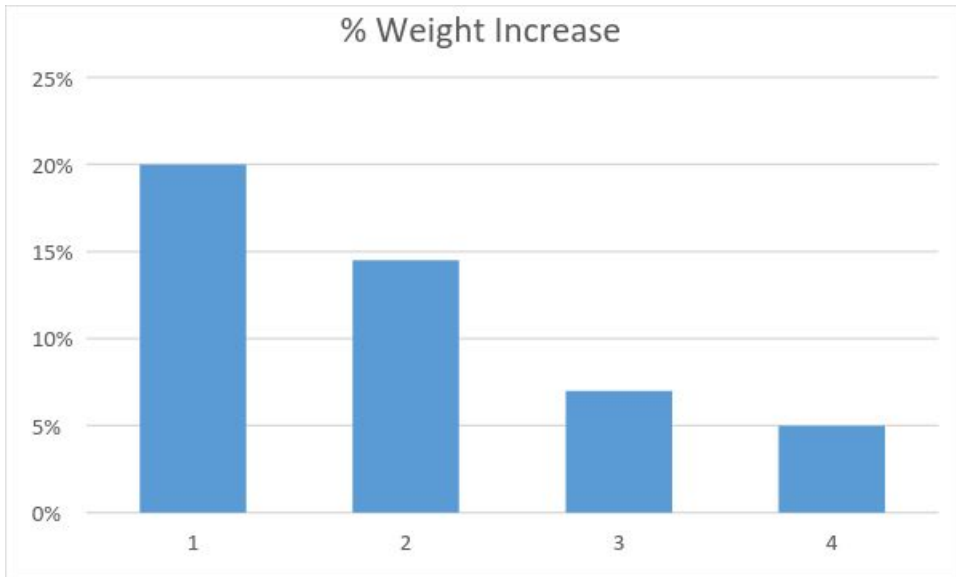
Commercial vs Spent Grain Feeding Schedule (oz)				
Day of week	Tank #			
	1	2	3	4
Monday	3.3	4.1	4.5	17.8
Tuesday	3.3	4.1	18	17.8
Wednesday	3.3	16.4	18	17.8
Thursday	3.3	16.4	18	17.8
Friday	3.3	4.1	18	17.8
Saturday	3.3	4.1	4.5	17.8
Sunday	0	0	0	0
Commercial Feed %	100%	66%	33%	0%

Table 1. Breakdown of feed (in ounces) each tank received on a given day **Note:** 16 oz wet grain = 4 oz dry grain. Grain amounts are in green.

RESULTS:



Graph 1. Initial average weight (blue) vs. final average weight (red) after one month.



Graph 2. Percent weight gain for each tank over the one month test period.

CONCLUSION:

Through this experiment we discovered that spent brewers grain would not be a viable option as the tilapia's only diet. However, since the tilapia in tank 4 did gain weight, spent grain could be used as part of their weekly diet. At Plant Chicago, the tilapia are used solely of educational purposes in the aquaponic farm. Therefore, it is not necessary for the fish to grow at commercial scale rates. Tank 2, which was fed commercial feed 66% of the time and grain 33% had the ideal weight increase for our needs. Therefore, we have decided to adapt this feeding schedule for all of the tanks. By including spent grain into the tilapia's regular diet a couple of days a week, Plant Chicago will be able to save a third of the cost over using only commercial feed. That's almost \$200/year just for those 87 fish! Employing the ideas of a circular economy, diverting one business's waste as another business's fish food was a success!