

COVER PAGE

Commercial Aquaponics Case Study #1: Economic Analysis of Lily Pad Farms AEC 2015-03

This case study is the first of a series of three different case studies that will analyze the economics behind three different commercial aquaponics systems. Each case study will be released in this draft form to make the information available. These case studies will simply summarize the economics behind different commercial aquaponics production systems. The final report for this project will include the summary information from these three case studies, an overall analysis of the respective systems, and a summary of data collected through a worldwide survey of the commercial aquaponics industry.

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This project was funded by Southern Sustainable Agriculture Research & Education (SARE) through a Graduate Student Grant under the award number 3048110880.

This publication has not been reviewed by an official departmental committee. The ideas presented and the positions taken are solely those of the author(s) and do not represent the official position of the Department of Agricultural Economics, the College of Agriculture, Food and Environment or The University of Kentucky. Questions should be directed to the author(s).

Introduction to Lily Pad Farms

Adam and Susan Harwood are the proud owners of Lily Pad Farm in San Marcos, TX. Their farm sits on roughly two acres of land, surrounded by cattle ranches, out in the beautiful countryside. Their farm consists of three greenhouses that contain commercial aquaponic production systems, which are modeled after the University of the Virgin Island's (UVI) system. However, Lily Pad Farm's system is different from the UVI system in a few different ways.



Lily Pad Farm has succeeded because of the hard work, diverse skill sets, experiences, and knowledge of the owners, Adam and Susan Harwood. They have both been researching aquaponics for quite some time and have put years of planning into building their farm. Adam has also worked in aquaculture for a long time, and Susan has been right along side of him for much of this. The proprietors of this farm deeply understand how to keep fish happy and healthy, which is what they claim is the key to successful aquaponic production. If the fish are thriving in the system, then the plants will experience what Adam calls "abnormal growth"; which essentially means they will grow like crazy. The Harwoods have graciously agreed to share their unique experiences for the purpose of this project.

The following pages of this first case study will explain the configuration of Lily Pad Farm's aquaponic production system and provide some background information, estimate construction costs and operating costs, provide estimated production figures and associated revenue streams, and pull all the info together into income statements. All of this data and information is specific to the experiences of this particular farm. Individuals seeking to replicate this enterprise may experience differing costs, production figures, and other issues. The following information is meant to be used as a road map to guide aquaponic producers down the right path towards planning a successful commercial aquaponics enterprise. However, this information is specific to one enterprise and has been estimated using the memory of the proprietors and the information they have collected.

Aquaponic System Configuration & Background Info

Greenhouses

Lily Pad Farm now has three greenhouses that are 100 ft. long by 30 ft. wide, and they sit on pads that are 105 ft. long by 35 ft. wide. The basic components of the greenhouses are the pads the greenhouse



sit on, end walls, structural supports, and plastic film covers. The end walls each have a door and are primarily constructed of wood. The structural support is primarily made out of metal poles and it is covered with a plastic film.

Aquaponic Systems

Each Aquaponic system is an altered model of the UVI deep water raft system. Each system consists of two fish rearing tanks, one cone-bottom solid separator, two filter fabric net tanks, one degassing chamber, and two hydroponic growing beds. The rearing tanks have a 12 ft. diameter and they are stocked with around 1,450 tilapia per tank. Water flows from the fish tanks via a surface drain and then through the solid separator, filter fabric net tanks, and degassing chamber in order to separate solid waste from the nutrient rich water. Solid waste is removed from the system by pumping it out of the solid separator periodically, which ensures the water stays habitable for the fish. This clean, nutrient rich

water then flows through the hydroponic growing beds, which are 8 feet wide by 72 feet long by 16 inches deep. Each of these hydroponic beds contains 18 rafts that have a total of 48 holes each for planting produce. The plants in the system are placed in three inch net cups, containing coconut coir and a small amount of vermiculite, which are then placed directly into the grow bed. Once water flows through the grow bed, it falls into a six inch drain and travels through PVC pipe located under the beds, via gravity, back to a 30 GPM low-flow motor that lifts the water and returns it to the rearing tanks.



The aeration system is powered by a 1.5 HP blower that sends air through a metal heat diffuser before transferring into PVC pipe. The metal heat diffuser allows the heat in the air from the blower to dissipate before entering the PVC pipe. The PVC pipe follows the length of both hydroponic beds on the ground, and an additional PVC loop with valves is located along the edge of the hydroponic beds. The loop that runs along the edge of the beds distributes air throughout the bed; utilizing 6 in. glass airstones that are staggered throughout the grow bed. The PVC pipe on the ground travels directly to the fish tanks. This looped PVC system ensures that airflow to the tanks won't be disturbed if there is an issue with airflow in the hydroponic beds. Airflow to the beds can simply be shut off with valves, as maintenance is performed, and air will continue to flow to the fish tanks. This is vital to ensure the survival of the fish.



Lily Pad Farm also has an innovative way to raise fingerlings in their aquaponic system. Adam built his own fingerling crib that floats in one of his rearing tanks. This crib is a simple, but ingenious instrument that is built with PVC pipe, floating foam noodles, and netting. This crib is stocked with 1,450 fingerlings every 37 days, in order to sustain the farm's staggered fish harvesting schedule. These fingerlings are then added to rearing tanks once they reach the appropriate size.

Adam Harwood says that the key to successful aquaponics is clean aquaculture practices, and not necessarily hydroponic gardening. He believes that once practitioners master the aquaculture skills required for aquaponic production, the result is "abnormal", or wildly successful, hydroponic plant production. He believes in following SRAC Publication No. 454 "Recirculating Aquaculture Tank Production Systems: Aquaponics – Integrating Fish and Plant Culture" to the letter.



However, the aquaponic system design and flow at Lily Pad Farm is different from the UVI design in SRAC 454 in that it is a smaller, slightly altered version of that system. Instead of four fish tanks and six hydroponic beds, Lily Pad Farm has two fish tanks and two hydroponic beds in each system. They have larger diameter fish tanks with higher stocking rates and shorter, wider hydroponic beds. All of the plants in the grow beds on Lily Pad farm are also set in three inch net cups compared to the UVI system, which uses both two and three inch cups. Adam believes larger net cups allow his plants to establish a large root system, which can help them grow faster. Lily Pad Farm also has more airstones in their system powered by a single blower.

Aquaponic System Construction, Timeline, & Costs

Timeline

The original aquaponic system was built by Adam and Susan, volunteers, and acquaintances between January and May of 2010. Due to the proprietors being heavily involved in the construction process, the

first greenhouse and aquaponic system were built with significantly lower costs. By October of 2010, Lily Pad Farm began harvesting an average of 440 plants per week. Within 7 months of stocking the first tank, they were able to begin harvesting tilapia for the first time. Within the first year of operating the original commercial aquaponic system, Lily Pad Farm was able to harvest 440 plants 32 times and 1,000 tilapia four times. In the 11th month of operation, Lily Pad Farm began construction of the other two greenhouses and commercial aquaponic systems. After 6 to 7 months of building and acclimating the new systems, Lily Pad Farms had all three greenhouses and aquaponic systems constructed and ready for production. However, since the construction of the second and third systems had to be contracted out, they were more expensive to build.

Greenhouse Construction Costs

Each greenhouse has two end walls that were built at an estimated cost of \$500 each. The structural support costs about \$3,000 to build, and the plastic film cover was purchased for about \$990. The pad for the first greenhouse was constructed for roughly \$1,800, but the other two additional pads that were contracted out were built for a total of \$5,200. These figures include all labor and construction required to complete the pads. This entails digging, filling, and installing electrical wiring and plumbing. The cost to construct the first greenhouse was only about \$7,400 because the proprietors have unique abilities to perform many of the tasks necessary for greenhouse construction. The other two greenhouses were built using outside labor, which made the total construction cost for them equal about \$11,000 each. Figures for the total cost of greenhouse construction can be seen in Figure 1 below.

Figure 1

<u>Greenhouse A</u>		<u>Greenhouse B & C</u>	
pad	\$ 1,800	pad	\$ 5,200
structure	\$ 3,000	structure	\$ 6,000
end walls	\$ 1,000	end walls	\$ 2,000
electrician	\$ 400	electric & water	\$ 4,675
other labor	\$ 200	transformer & pole	\$ 2,150
plastic film	\$ 991	plastic film	\$ 1,982
Total Cost	\$ 7,391	Total Cost	\$ 22,007 (\$11,003.50 each)

Aquaponic System Total Construction Costs

The following figures are estimates of the costs associated with all materials and equipment required to build the aquaponic systems and to make them operational. Therefore, all costs associated with building, stocking, and filling the system to make it operational are included in these figures. Some of the following information had to be estimated, which means that some numbers have the potential to vary from actual expenditures. However, these figures are simply meant to guide producers down the proper path to planning their own aquaponic enterprise. As I have previously stated, the proprietors of Lily Pad Farms have many unique skills that have facilitated their success, and purchase negotiation is certainly one of those skills. Adam took advantage of these skills when purchasing equipment for his farm, which means some of the costs you will see in this report could vary significantly from what other individuals may typically experience. Furthermore, you will see noticeable differences between the costs to construct System A versus Systems B and C. Once again, this is due to the proprietors being involved in the construction process of the first system.

Aquaponic systems typically require many miscellaneous costs that producers might not figure into their business plans. Not only do producers have to build the system and stock it with fish and vegetables, but

they will also be subjected to what Adam calls the “and, and, & and” of aquaponics. Aquaponic systems need to be stocked with enough seeds for transplanting, fingerlings, net cups, germination tables and trays, coconut coir, vermiculite, fish feed, iron, and much more. These commonly overlooked expenditures make up the “and, and, & and” of aquaponics. Some of these hidden expenses are added up under the heading *miscellaneous expenses*. These miscellaneous expenses include a shed, tools, racks, hoses, cords, brushes, nets, containers, tables, and chairs. All of the estimated costs for building System A can be seen in Figure 2 below, and all estimated costs for building Systems B and C can be seen in Figure 3 below:

Figure 2: Construction Costs for Aquaponic System A

<u>Item</u>	<u>Quantity</u>	<u>New Cost Each (\$)</u>	<u>New Cost Total (\$)</u>
Fish Production Component			
Rearing tanks	2	\$1,440.00	\$2,880.00
Clarifiers	1	\$500.00	\$500.00
Net tanks	3	\$1,000.00	\$3,000.00
Fingerlings (1400 in a box)	2	\$389.00	\$778.00
Piping- water (ft.)	250	\$1.50	\$375.00
Piping- air (ft.)	420	\$1.50	\$630.00
Shade Cloth	1	\$530.00	\$530.00
Valves		\$500.00	\$500.00
Fiberglass water holding tank (275 gal)	1	\$625.00	\$625.00
Blower	1	\$1,450.00	\$1,450.00
Metal Heat Diffuser	1	\$80.00	\$80.00
Filter netting	4	\$30.00	\$120.00
Crib for baby fish	1	\$155.00	\$155.00
Circulating pump	1	\$240.00	\$240.00
Airstones	78	\$13.54	\$1,056.00
Water for Initial Fill (Gallons)	16000	\$0.005	\$80.00
Vinyl tubing (ft.)	500	\$0.05	\$25.00
		Total	\$ 13,024.00
Produce Production Component			
Hydroponic Bed	2	\$1,012.00	\$2,024.00
Cups	1728	\$0.0875	\$151.20
LDPE liner	2	\$431.00	\$862.00
Polystyrene rafts	36	\$21.20	\$763.20
Germinating Tables	3	\$20.00	\$60.00
Germinating Trays (100 Pack)	1	\$140.00	\$140.00
Gravel (yards)	32	\$28.13	\$900.00
Pond Underlayment (Sq. Ft.)	1500	\$0.22	\$330.00
Greenhouse	1	\$7,391.00	\$7,391.00
Seeds & Transplants	100	\$3.00	\$300.00
Miscellaneous Expense			\$3,140.00

Total	<u>\$ 16,061.40</u>
Aquaponic System Total	<u>\$ 29,085.40</u>

Figure 3: Construction Costs for Aquaponic Systems B & C

<u>Item</u>	<u>Quantity</u>	<u>New Cost Each (\$)</u>	<u>New Cost Total (\$)</u>
Fish Production Component			
Rearing tanks	4	\$4,350.00	\$17,400.00
Clarifiers	2	\$700.00	\$1,400.00
Net tanks	6	\$700.00	\$4,200.00
Fingerlings	4	\$389.00	\$1,556.00
Piping- water (ft.)	580	\$1.50	\$870.00
Piping- air (ft.)	1000	\$1.50	\$1,500.00
Shade Cloth	2	\$1,200.00	\$2,400.00
Valves			\$1,200.00
Fiberglass water holding tank (275 gal)	0	\$0.00	\$0.00
Blower	3	\$1,450.00	\$4,350.00
Metal Heat Diffuser	2	\$80.00	\$160.00
Filter netting	8	\$30.00	\$240.00
Crib for fingerlings	0	\$0.00	\$0.00
Circulating pump	3	\$240.00	\$720.00
Airstones	156	\$13.54	\$2,112.24
Water for Initial Fill (Gallons)	32000	\$0.01	\$160.00
Vinyl tubing (ft.)	1000	\$0.05	\$50.00
Total			<u>\$ 38,318.24</u>
Produce Production Component			
Hydroponic Bed	4	\$1,012.00	\$4,048.00
cups	3456	\$0.09	\$302.40
LDPE liner	4	\$431.00	\$1,724.00
Polystyrene rafts	72	\$21.20	\$1,526.40
labor & Construction			\$25,000.00
Germinating Tables	6	\$20.00	\$120.00
Germinating Trays (100 Pack)	2	\$140.00	\$280.00
Gravel (yards)	64	\$28.13	\$1,800.00
Pond Underlayment (Sq. Ft.)	1500	\$0.22	\$330.00
Greenhouse	2	\$11,103.50	\$22,207.00
Seeds & Transplants	200	\$3.00	\$600.00
Miscellaneous Expense			\$6,280.00
Total			<u>\$ 64,217.80</u>

System Total	\$ 102,536.04
Average Cost/System	\$ 51,268.02

Aquaponic System Variable Costs

The total variable costs associated with operating all three aquaponics systems increased significantly compared to the costs associated with operating one system. Certain variable costs obviously had to increase to support the additional systems. For example, variable costs associated with fish feed, plant inputs, heating, and labor had to increase. However, once the systems were in working order the same rotational production schedule was followed. This means that some costs remain unchanged. The Harwoods began harvesting a larger amount of plants each month, but the same amount of fish because they have a staggered fish production schedule that allows them to harvest around 1,000 fish per month. The variable costs for the systems have been broken down in Figures 4 and 5 below.

Figure 4: Variable Costs for Aquaponic System A

Fish Variable Costs

	<u>Units</u>	<u>Cost/Unit</u>	<u>Quantity</u>	<u>Monthly Cost</u>	<u>Annual Cost</u>
Fingerlings		\$0.28	1,450	\$406	\$4,872
Feed (fingerlings)	Bag	\$100	2	\$200	\$2,400
Feed (adult)	Per lb harvested	\$0.51	333	\$170	\$2,040
Harvesting/Processing		\$130	1	\$130	\$1,560
Bags & Labels		\$0.56	400	\$224	\$2,688
			Fish VC	\$ 1,130.00	\$ 13,560.00

Vegetable Variable Costs

	<u>Units</u>	<u>Cost/Unit</u>	<u>Quantity</u>	<u>Monthly Cost</u>	<u>Annual Cost</u>
Seedling transplants		\$0.04	1,600	\$64	\$768
Coconut Coir	Bags	\$13.53	7	\$94.71	\$1,136.52
Coarse Vermiculite	Bags	\$24	1	\$24	\$288
3" Net Pot		\$0.09	900	\$78.75	\$945
			Vegie VC	\$ 261.46	\$ 3,137.52

Other Variable Costs

	<u>Units</u>	<u>Cost/Unit</u>	<u>Quantity</u>	<u>Monthly Cost</u>	<u>Annual Cost</u>
Insurance				\$173.33	\$2,079.96
Test Kits		\$15	1	\$15	\$180
Heating - Propane	Gal	\$2.50	56	\$140.63	\$1,687.50
Iron	5 Lb Bag	\$60	1	\$60	\$720
Labor				\$900	\$10,800
Maintenance				\$46.30	\$555.56
Transportation - Gas				\$476.67	\$5,720
Electrical	KWh			\$400	\$4,800
Packaging - Bags	Box of 1,000	\$11	2	\$22	\$264
Book Keeping				\$75	\$900
Phone & internet				\$91.67	\$1,100

Water		\$80	\$960
Other VC	\$	2,480.58	\$ 29,767.02
Total VC	\$	3,872.04	\$ 46,464.54

Figure 5: Variable Costs for Aquaponic Systems A, B, & C

Fish Variable Costs

	<u>Units</u>	<u>Cost/Unit</u>	<u>Quantity</u>	<u>Monthly Cost</u>	<u>Annual Cost</u>
Fingerlings		\$0.28	1,450	\$406	\$4,872
Feed (fingerlings)	Bag	\$100	2	\$200	\$2,400
Feed (adult)	Per lb harvested	\$0.51	1500	\$765	\$9,180
Harvesting/Processing		\$130	1	\$130	\$1,560
Bags & Labels		\$0.56	400	\$224	\$2,688
			Fish VC	\$ 1,725.00	\$ 20,700.00

Vegetable Variable Costs

	<u>Units</u>	<u>Cost/Unit</u>	<u>Quantity</u>	<u>Monthly Cost</u>	<u>Annual Cost</u>
Seedling transplants		\$0.04	5,400	\$216	\$2,592
Coconut Coir	Bags	\$13.53	21	\$284.13	\$3,409.56
Coarse Vermiculite	Bags	\$24	2	\$48	\$576
3" Net Pot		\$0.09	3,600	\$315.00	\$3,780
			Vegie VC	\$ 863.13	\$ 10,357.56

Other Variable Costs

	<u>Units</u>	<u>Cost/Unit</u>	<u>Quantity</u>	<u>Monthly Cost</u>	<u>Annual Cost</u>
Insurance				\$173.33	\$2,079.96
Test Kits		\$15	3	\$45	\$540
Heating - Propane	Gal	\$2.50	169	\$421.88	\$5,062.50
Iron	Case - 5 gallon	\$100	1	\$100	\$1,200
Labor				\$3,600	\$43,200
Maintenance				\$200.00	\$2,400.00
Transportation - Gas				\$476.67	\$5,720
Electrical	KWh			\$600	\$7,200
Packaging - Bags	Box of 1,000	\$11	5	\$55	\$660
Book Keeping				\$208	\$2,500
Phone & internet				\$91.67	\$1,100
Water				\$100	\$1,200
			Other VC	\$ 6,071.87	\$ 72,862.46
			Total VC	\$ 8,660.00	\$ 103,920.02

As you can see above, the variable costs associated with operating all three systems are about 123.7% more per year. It costs about \$4,788 more per month to run all three systems in the second year. Many things contribute to the increase in variable cost, but the most significant increases in costs can be attributed to adult fish feed, heating, labor, and plant germination (seedling transplants, coconut coir, vermiculite, and net pots). Variable costs increase slightly again in year three because more adult fish

feed is required with the extra months of fish production. Lily Pad Farm still harvests the same number of fingerlings per month, which means the variable cost for feeding fingerlings remains the same. This also means that the harvesting / processing costs and the bags / labels costs also remain unchanged.

Aquaponic System Revenue



In the first year of production, Lily Pad Farm was able to harvest a total of about 440 plants 32 times and 1,000 fish four times. They sold each plant live for \$4 and each fish for \$6. Therefore, they were able to capture about \$80,320 in revenue in the first year. Once the other two aquaponic systems were in full production, Lily Pad Farm had the potential to nearly triple plant production.

Figure 6: Estimated Total Revenue Year 1 (One System)

<u>Item</u>	<u># Harvests</u>	<u>Price/Unit</u>	<u>Quantity</u>	<u>Avg. Monthly Rev.</u>	<u>Annual Rev.</u>
Produce	32	\$4	440	\$4,693	\$56,320
Tilapia	4	\$6	1000	\$2,000	\$24,000
				\$ 6,693	\$ 80,320
Total Revenue					<u><u>\$ 80,320</u></u>



In the second year of production, this farm experienced some unfortunate events. Similar to other ways of farming, aquaponics is vulnerable to the surrounding environment. Lily Pad Farm began the year with a complete crop failure due to high winds, which meant they were also unable to harvest fish for a few months. After this, they experienced another complete crop failure due to heat, and then they had a harsh winter that dramatically impacted plant production. Lily Pad Farm was only able to sell an average of 229 plants 16 times due to the crop failures experienced. Lily Pad farm was then able to harvest an average of 963 plants 32 times, but had the potential to produce 1,200 plants each week. This low average yield is due to crop failure and harsh winter weather. Fish were harvested in batches of 1,000 a total of nine times throughout this year. The average price they received for selling whole-live plants was \$3, and they still received \$6 from the sale of each fish. Therefore, Lily Pad farm likely experienced \$157,428 in total revenue in their second year of production. All of these figures can be seen in Figure 7 below.

Figure 7: Estimated Total Revenue Year 2 (All 3 Systems)

<u>Item</u>	<u># Harvests</u>	<u>Price/Unit</u>	<u>Quantity</u>	<u>Avg. Monthly Rev.</u>	<u>Annual Rev.</u>
Produce	16	\$3	229	\$915	\$10,980
Produce	32	\$3	963	\$7,704	\$92,448
				\$8,615	\$103,428
Tilapia	9	\$6	1000	\$4,500	\$54,000
				\$ 4,500.00	\$ 54,000.00
Total Revenue					<u><u>\$ 157,428</u></u>

Lily Pad Farm is only able to reach full production capacity in their aquaponics systems around 38 to 48 weeks per year. In the third year of production, Lily Pad Farm harvested an average of about 1,300 plants per week for 40 weeks, and 1,000 fish per month for 11 months. Therefore, it is estimated that they earned about \$248,000 in total revenue in year three. The revenue estimations for Lily Pad Farm in year three, and moving forward into the future, can be seen in Figure 8 below.

Figure 8: Estimated Total Revenue Year 3 (All 3 Systems)

<u>Item</u>	<u># Harvests</u>	<u>Price/Unit</u>	<u>Quantity</u>	<u>Avg. Monthly Rev.</u>	<u>Annual Rev.</u>
Produce	40	\$3.50	1300	\$15,167	\$182,000
				\$15,167	\$182,000
Tilapia	11	\$6	1000	\$5,500	\$66,000
				\$ 5,500.00	\$ 66,000.00
Total Revenue					<u><u>\$ 248,000</u></u>

Lily Pad Farms 5 Year Forecast

Using all of the information displayed above, five years worth of pro forma income statements have been estimated. This information was then used to calculate the Net Present Value (NPV) and Internal Rate of Return (IRR) for this operation. NPV is the sum of the present values of cash flows experienced in a project over a period of time. IRR is the rate of return that makes the NPV of cash flows equal to zero. NPV and IRR are often used to determine the attractiveness of an investment or business venture. A conservative approach was taken to estimate NPV and IRR. Typically, NPV is estimated over the lifetime of a project and includes figures for asset depreciation. However, NPV was estimated for just five years worth of time and it was assumed assets would have no value at the end of the project. Therefore, the true NPV and IRR of this project would be higher because the aquaponics systems will likely still be operational well beyond five years. The NPV of this operation has been estimated to equal \$128,072, assuming a tax rate of 30% on net income and an interest rate of 8%. The IRR for this operation was then estimated to be 41.8%.

Figure 9: 5 Year Projected Income Statements

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
Revenue					
Produce	\$ 56,320.00	\$103,428	\$182,000	\$182,000	\$182,000
Tilapia	\$ 24,000	\$ 54,000	\$ 66,000	\$ 66,000	\$ 66,000
Total Revenue	\$ 80,320.00	\$157,428	\$248,000	\$248,000	\$248,000
Fixed Costs					
System Construction	\$ 29,085	\$ 102,536.04	\$0	\$0	\$0
Land & Rent	\$7,742	\$7,742	\$7,742	\$7,742	\$7,742
Total FC	\$ 36,827	\$ 110,278.04	\$7,742.00	\$7,742.00	\$7,742.00
Variable Costs - Fish					
Fingerlings	\$4,872	\$4,872	\$4,872	\$4,872	\$4,872
Feed (fingerlings)	\$2,400	\$2,400	\$2,400	\$2,400	\$2,400
Feed (adult)	\$2,040	\$9,180	\$11,220	\$11,220	\$11,220

Harvesting/Processing	\$1,560	\$1,560	\$1,560	\$1,560	\$1,560
Bags & Labels	\$2,688	\$2,688	\$2,688	\$2,688	\$2,688
Total VC - Fish	\$ 13,560	\$ 20,700	\$ 22,740	\$ 22,740	\$ 22,740
Variable Costs - Produce					
Seedling transplants	\$768	\$2,592	\$2,592	\$2,592	\$2,592
Coconut Coir	\$1,137	\$3,410	\$3,410	\$3,410	\$3,410
Coarse Vermiculite	\$288	\$576	\$576	\$576	\$576
3" Net Pot	\$945	\$3,780	\$3,780	\$3,780	\$3,780
Total VC - Produce	\$3,138	\$10,358	\$10,358	\$10,358	\$10,358
Variable Costs - Other					
Insurance	\$2,080	\$2,080	\$2,080	\$2,080	\$2,080
Test Kits	\$180	\$540	\$540	\$540	\$540
Heating	\$1,688	\$5,063	\$5,063	\$5,063	\$5,063
Iron	\$720	\$1,200	\$1,200	\$1,200	\$1,200
Labor	\$10,800	\$43,200	\$43,200	\$43,200	\$43,200
Maintenance	\$556	\$2,400	\$2,400	\$2,400	\$2,400
Transportation - gas	\$5,720	\$5,720	\$5,720	\$5,720	\$5,720
Electrical	\$4,800	\$7,200	\$7,200	\$7,200	\$7,200
Packaging - Bags	\$264	\$660	\$660	\$660	\$660
Book Keeping	\$900	\$2,500	\$2,500	\$2,500	\$2,500
Phone & internet	\$1,100	\$1,100	\$1,100	\$1,100	\$1,100
Water	\$960	\$1,200	\$1,200	\$1,200	\$1,200
Total VC - Other	\$29,767	\$72,862	\$72,862	\$72,862	\$72,862
Total VC	\$ 46,464.54	\$ 103,920.02	\$ 105,960.02	\$ 105,960.02	\$ 105,960.02
Net Income	\$ (2,971.94)	\$ (56,770.06)	\$ 134,297.98	\$ 134,297.98	\$ 134,297.98

The Harwoods are adamant that commercial aquaponics farms need to be built and not bought. This means they believe creating a sustainable business requires starting small and growing as you learn. According to Adam Harwood, having a small family farm and living where they work has also been vital to their success. The costs associated with operating this family farm include many household expenses such as rent, utilities, and property tax. Therefore, living where they work saves the Harwood family a significant amount of money.

In conclusion, the Harwoods truly believe that starting small in aquaponics and building your way up is the key to success. They also believe this principle can be made evident by the numerous high-publicity failures of expensive and extravagant commercial aquaponics start-ups over the years. As you can see by looking at the financial figures for this farm, there are significant start-up and operating costs associated with commercial aquaponic enterprises. When an individual/entity makes a large up-front investment into building an aquaponics system, especially one that isn't tested or proven, they will begin their already arduous business venture with large monthly loan payments; which may not ever allow the business to become sustainable. It takes time to build these systems, for them build up proper nutrient levels, and for plants and fish to mature before harvesting can begin. Therefore, no revenue will be generated for quite some time. This can cause serious cash flow issues because when a business continues to incur operating expenses without generating revenue, it can be a death sentence. All of these issues, and the inherent risks involved in agricultural production, need to be considered; and all potential issues should be factored into the financial plan for a commercial aquaponics business.