AquaSeng: A Panax Ginseng and Talapia Producer through Aquaponics
Institution: Appalachian State University
Team Members: Dennis Alcorn and Eric McTeir
Faculty Advisor: Dr. Heather Dixon-Fowler

Social Problem Addressed:
AquaSeng addresses three threats to the environment:

- Our oceans are being overfished and according to some estimates 85-95% of fish caught commercially are accidentally harvested by trawlers. Only about 10% of fish killed in this process are actually eaten.

- Farm raised fish results in negative environmental impact with an average salmon farm producing as much waste as a town of 65,000 and much of it ending up in the waterways. In traditional aquaculture systems, the fish are usually heavily stocked leading to polluted water with high concentrations of ammonia.

- Agriculture accounts for 80% of water consumption in the U.S. at a time when over one billion people lack access to clean drinking water worldwide and water sources are being polluted and depleted.

Solution:
Aquaponics is the combination of aquaculture and hydroponics. In aquaponics, plants and fish grow together in one integrated system. The fish waste provides a food source for the growing plants and the plants provide a natural filter for the water in which the fish live. The majority of the waste produced by fish is in the form of ammonia, secreted through the gills and in urine. The remainder of the waste, excreted as fecal matter, undergoes a process called mineralization which occurs when heterotrophic bacteria consume fish waste, decaying plant matter and uneaten food, converting all three to ammonia and other compounds. In excessive quantities, ammonia is toxic to plants and fish. Nitrifying bacteria, which naturally live in the soil, water and air, convert ammonia first to nitrates and then to nitrates, which plants consume to grow. This creates a sustainable ecosystem where both plants and fish can thrive.

Aquaponics is the answer to a fish farmer’s problem of disposing of nutrient rich water and a hydroponic grower’s need for nutrient rich water. The only inputs to an aquaponic system are fish food and small amounts of water to replace the water lost by evaporation and transpiration from the plants. Aquaponics systems use 90% less water than soil-based growing and are also able to be USDA Organic Certified, thus doubling the value of crops produced.

Each of the three greenhouses will have the dimensions 10 meters x 90 meters, for a total area under each greenhouse roof of 900 square meters. Three more greenhouses of the same size will be built out of cash flows. Inside each greenhouse, an integrated system combines aeroponics, deep water culture (on both polystyrene and bamboo rafts) with a gravel bed. Each greenhouse is divided in half by a 6-meter wide, concrete fish tank, each stocked with 400 pounds of fish. 65% of the greenhouse will be devoted to growing ginseng eight months of the year, and strawberries the remaining four months, when the ginseng is put into cold storage. The other 35% of the greenhouse space will be dedicated to seasonal fruits and vegetables. The seasonal fruits and vegetables will provide plant diversity, a natural protection from common plant diseases.
Market Analysis:

Our aquaponic system produces USDA organic-certified Panax ginseng and tilapia. Panax ginseng is a slow-growing plant with fleshy roots, which after 1-2 years can be sold for approximately $1500. The most valuable parts of ginseng are the roots because they contain the most concentrated amount of beneficial compounds. Panax ginseng grows in the northern hemisphere, typically in northern China and Korea, in shady, cold locations, on mountainous slopes. Extended periods of sunlight can damage a ginseng plant. Ginseng is best suited to thrive in a mountainous region due to the cool climate. The Appalachian Mountains are one of the few regions in the South where ginseng grows wild. These growing conditions match perfectly to the climate surrounding Boone, NC where our aquaponics system will be located.

In Western culture, ginseng is used primarily as a source of energy. It is marketed as a key ingredient in energy drinks but has a very small market as an independent product. Large sales potential is available in the Eastern cultures, specifically in China. In this region, ginseng has been used for thousands of years as a health product and medicinal herb. The wide range of uses and far reaching history of ginseng use in China clearly offers a large customer base and proves to be the best location for ginseng sales.

Tilapia is a fresh water fish that grows quickly and has firm white meat when filleted. Tilapia are commonly raised in aquaponics because they are very hardy and can tolerate a wide variety of water quality conditions. The ability to buy fresh fish on a daily basis without excess transport fees and advance ordering would be a competitive advantage for local restaurants and hotels in Western NC. Although we will sell tilapia to local restaurants, the majority of our revenues will come from ginseng sales. Since talapia sales make up a small portion of revenues, excess tilapia, vegetables, and fruits will be donated to the Hospitality House, a homeless shelter, in Boone, NC, whose budget has been significantly reduced in recent years, as well as homeless shelters in surrounding counties.

Financial Plan and Sustainability:

Using aquaponics deep-water culture, ginseng has a three-year growth cycle, rather than the five to six years it takes to grow in the ground. Aquaseng will also produce ginseng seed and young plants, which are currently very expensive and almost impossible to acquire. This is a smart business move, and gives Aquaseng one more stream of income.

Ginseng has high medical and cultural significance in China. The demand for quality ginseng products always far outstrips supply. The ginseng operation alone is projected to gross $150,000 per year, beginning in the third year, and continuing every year thereafter. The strawberries are projected to gross $75,000 per year, beginning in the first year. Operating costs, including labor, electricity, water, fish food, packaging, farmer’s market dues, planting medium, seeds, additives, and fuel, are projected to be $65-85,000 per year for the entire operation, including ginseng, strawberries, tilapia, and seasonal fruits and vegetables. The projected total cost of construction is $300,000. The greenhouse fish tanks will be heated with solar-panel-heated hot water in pipes that run underneath the fish tanks.

Impact Summary:

Aquaseng will provide farmers markets, local restaurants, the Hospitality House, and surrounding county homeless shelters with fresh, locally produced tilapia, fruits, and vegetables. The majority of cash flows will come from ginseng sales, allowing the remainder of the produce and fish to be sold at competitive prices or donated.
Resources:

Aquaponics Association  http://aquaponicsassociation.org
Backyard Aquaponics  http://backyardaquaponics.com
The Aquaponic Source  http://theaquaponicsource.com
Friendly Aquaponics  http://www.friendlyaquaponics.com/