**Objective/Goals**
The rate of growth of plants will vary depending on the effectiveness of substrate to facilitate the absorption nutrients & water. My objective is to measure & compare plant growth in 4 different substrates: Coconut Fiber/Perlite, Hydroponic Beads, an Aquaponic system, & soil, and demonstrate more effective, energy-efficient ways of growing produce using sustainable environmentally-friendly resources. These growth substrates will be more ecologically effective alternatives to support Third World & urbanized countries alike.

**Methods/Materials**
The experiment consists of 4 sets of containers (w/ 3 containers per set), each w/ different growth substrates, to measure & determine the greatest plant growth. The 4 substrates are a Coconut Fiber/Perlite substrate, Hydroponic Beads/Water substrate, an Aquaponic system, and Soil. Plants were grown & observed in each set of containers for approx 6 wks & the plant growth was compared to show which was the most effective growth substrate.

**Results**
The substrate with Coconut Fiber/Perlite yielded the most growth; the Hydroponic Bead substrate followed; the Aquaponic system was 3rd; the soil substrate was lowest yielding. These results demonstrate alternate substrates are more effective for nutrient absorption than soil. The two most cost-effective & energy-efficient substrates were the Aquaponic system & the Coconut Fiber/Perlite which are inexpensive & made from recycled materials.

**Conclusions/Discussion**
Soil is the least efficient medium to grow plants. Nutrient absorption is lowest & the energy required to produce is high. Although Hydroponic Beads are a very efficient & effective growth medium, the energy required to produce the ceramic hydroponic beads is very high, making this a very effective growth medium but a higher carbon footprint. Aquaponics is a very effective & efficient growth medium w/ a very low carbon footprint. It relies on a symbiotic relationship between the fish consumption of plant decay & the discharge of nitrogen which then provides the plant w/ nutrients. Coconut Fiber/Perlite substrate is a very efficient & effective growth medium. The energy footprint is very low as it is also a recycling of readily available organic materials.

**Summary Statement**
My project's goal was to find out alternate plant substrates, which not only yield the highest growth in plants, but are also more cost-effective, energy efficient and environmentally friendly to sustain growing populations and urbanization

**Help Received**
Father assisted in the substrate set-up for the project; Mentor provided substrate materials ; Mother helped with project board layout ; Father assisted in final typing and applications.