STAR Water-Energy-Crop Analysis for Optimal Land Management & Irrigation

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BAEN 480 - Capstone Project

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Introduction

The South Texas Advancement Resources (STAR) mission is to promote research, education and training in sustainable farming, ranching and land management. This region of South Texas is not historically known for producing a large cash crop, the main agricultural product in this area has been cattle. Our main contact with STAR is Bill Raney in Aguilares, Texas. Mr. Raney has provided data from soil tests from the indicated pasture, well water reports from wells in the surrounding area, and a topographic map of the tract and surrounding area. Our faculty advisor, Dr. Dana Porter at the Texas A&M AgriLife Research and Extension Center in Lubbock has assisted us with the technical aspects of this project.

Crop Selection

Criteria used to select vegetables to be grown in high tunnels:

1. Vegetable that are known to do well in high tunnels.
2. Vegetables that can have their water needs met by the available water in the area.

Criteria used to select the field crops:

1. Crops that are commonly grown in Texas, so that we know there is an available market for them.
2. Crops that can have their water needs met by the available water in the area.
3. Crops that do well in rotation of each other and can improve soil quality over time.

The Blaney-Criddle method was used for calculating the evapotranspiration of the plants. This allowed us to narrow our crop selection and design a system that will meet the water needs of the crops.

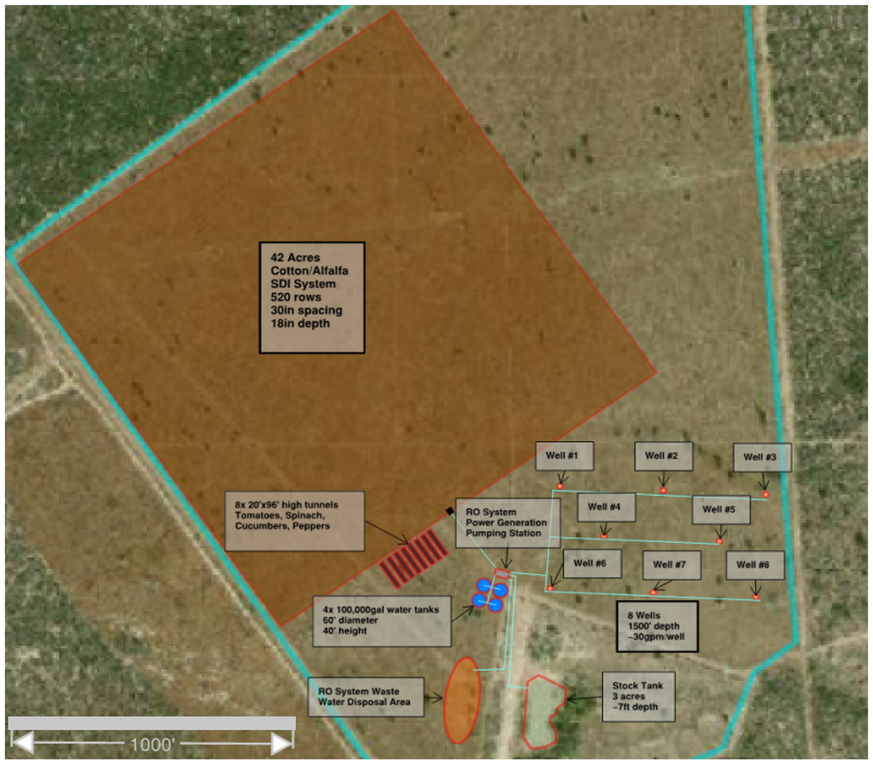
Irrigation Selection/Design

The designed irrigation will be a sub-surface drip irrigation (SDI) system supplied by Eco-Drip. This system will apply small amounts of water and fertilizer efficiently and uniformly across the specified area. Water and fertilizer are delivered directly to the crop root zone, eliminating runoff, evaporation, and drift. Our SDI system will use a 30” row spacing, 20” emitter spacing and a 15mm thick wall drip line placed 14” below the surface. Eco-Drip claims their SDI systems, when compared to center pivots, are 25-40% more efficient, have 25 year lifespans, require little maintenance and can fit any shape field. Our SDI system will be controlled by Eco-Drip’s EC III Pro, which is a state of the art irrigation management control system that allows us to manage the most acreage with the least amount of water and obtain the highest yield possible.

Design Objectives

Our team was given the task of developing a replicable model for sustainable agriculture in South Texas, specifically the area between Aguilares, TX and Laredo, TX that will provide an alternative to the traditional land uses for the ranchers and local communities in this area. The system should be able to make efficient use of available water, and irrigate a 100 acre tract that contains suitable crops for the region. This model needs to provide a positive rate of return in 5 years.

Water is available onsite from a three acre stock-pond and it is possible to drill water wells to supplement our water needs. Using the land and water available, we selected crops, selected and designed irrigation method/system which included additional water storage and additional water wells.



Economics

Section 1: Vegetable Production in High Tunnels

Initial investment: $93,726

Annual Expenses: $4,663

Yearly Revenue: $5,000

Section 2: Field Crop Production

Initial investment: $433,054

Annual Expenses: $10,000

Yearly Revenue: $23,000 (Cotton) / $30,000 (Alfala)

(Estimated using USDA-NASS Texas Monthly Crop Production reports and adjusting for a decreased yield)