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WeARE Research Area

Determining crop parameters for ALMANAC to predict the growth of summer squash vegetable under different growing conditions

Background

Vegetables make up a significant percentage of human diet and nutrition, being a major source of vitamins, minerals, and fibers. However, vegetable production is very water intensive. With around 70% of potable water being used for irrigation, it is important to explore ways of increasing water use efficiency so that future demand does not further environmental impact. About 11 thousand tons of squash was produced in the year 2014 worldwide, and with the continual increase in population size, this number is expected to rise drastically. Finding the optimal watering regime for squash under different soil conditions can help decreasing potable water usage and increasing water use efficiency. This study focuses on the production of *Cucurbita pepo L. var. ovifera*, commonly referred to as yellow straightneck squash.

Objectives

1. Monitor and measure the growth of summer squash until optimum yield
2. Compile measurements to find trends
3. Calculate parameters for future growth simulation with the ALMANAC model

Methodology

The study was conducted at the Grassland Soil and Water Laboratory, Temple, Texas. The lab is at an elevation of 719 feet asl and has a Houston black clay soil. The squash was grown from seed and allowed to establish for two weeks in a greenhouse to minimize attrition. Plastic tarp was placed to deter weed growth. The squash was then transplanted at 0.8 by 1.25 meter spacing. Biomass harvesting began 2.5 weeks after transplanting, and was continued once every week until optimal fruit yield was attained. For every harvesting event, three random samples of individual squash plants were measured for height, light interception, leaf area index (LAI), fresh weight, stem, leaves, and reproductive parts weight. The samples were then allowed to dry in an oven at 70°C to constant weight, whereupon dry weights were recorded.



Results

The harvest index was calculated based on the averages of the final repro weights (repro is short for reproductive parts and refers to the seeds, flowers and fruits of a plant) divided by the total biomass at final harvest. Moisture content was calculated by comparing the fresh and dry weight averages. The radiation use efficiently (RUE) was determined using the amount of light intercepted by the squash and the corresponding biomass in a meter squared area. Historical records of light intensity during the study period were used to calculate the photosynthetically active radiation (PAR).

Days vs LAI

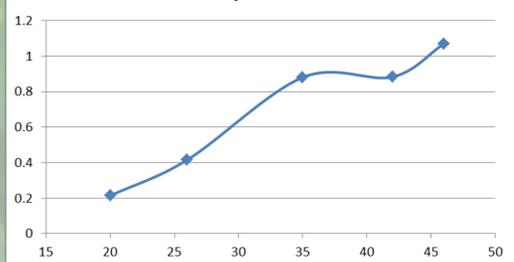
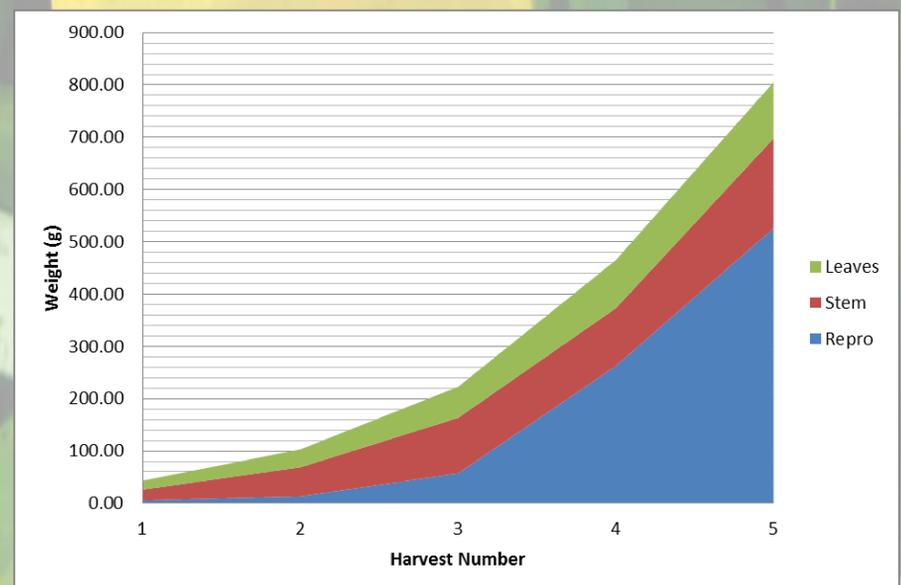
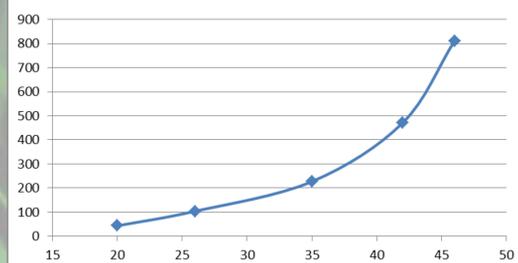


Fig. 1
How the Leaf Area Index changed over time in days after transplantation

Fig. 2
The changes in weight of each part of the squash at each harvest number

Fig. 3
The fresh weight (g) compared to the number of days after transplantation

Days vs Weight



Max Height	51 cm
Moisture Content (Harvest)	91%
Harvest Index	65%
RUE	1.67

The Next Step

The determined crop parameters can be used to describe how squash grows in the given conditions. However ultimately, we want to predict how squash will grow under any conditions and use this information to improve water use efficiency. This can be done by incorporating the crop parameters into a plant growth simulation model such as ALMANAC and simulating squash water use.

Acknowledgments

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