Use of SWAT for optimizing irrigation strategies for sugarcane production on the Island of Maui, Hawaii.

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Hawaiian Commercial & Sugar Company

- Sugarcane - 184.3 km^2
- Average yield: 159.9 t ha^{-1}
- Irrigation: 760,000 m^3 d^{-1} (drip irrigation)

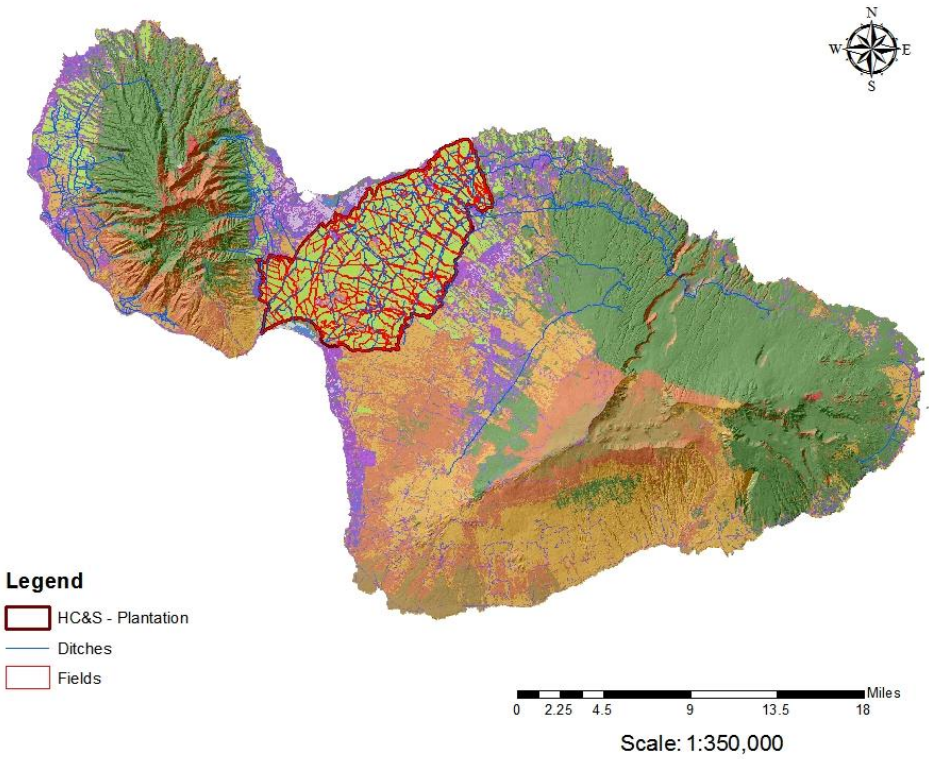
Maui / HC&S

Introduction

Introduction

Maui, HI

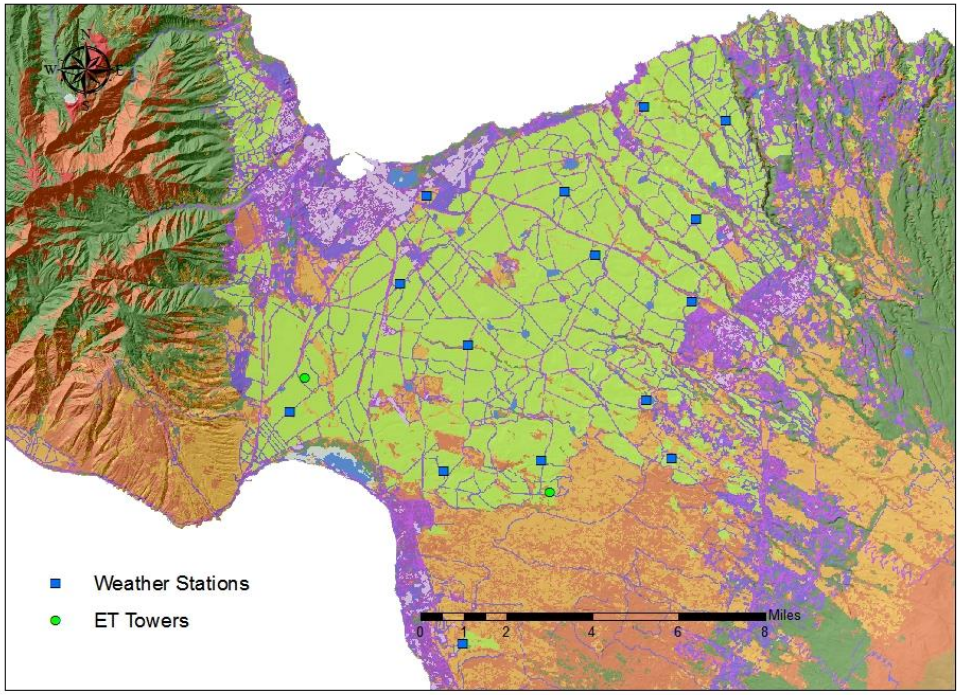
- Climatic characteristics
- Water diversion & transport
- Water usage concerns



Model setup

Methods

- SWAT model
- Landuse:
  - 701 Sugarcane
- Soils data:
  - SSURGO
- HC&S Climate data:
  - 16 Weather stations
  - 40 Rain gauges
- Simulation period 2003-2013
  - 1 year spin up
- Crop parameters
- Irrigation DB
- Penman-Monteith method



- Climatic variables
  - Precipitation (mm)
  - Temperature (C)
  - Solar Radiation (MJm^{-2})
  - Wind Velocity (m/s)
  - Relative Humidity (%)
- Time period 1997-2013
- Data processing:
  - Historical extreme events
  - Missing data

HC&S Climatic DB

Methods

Runoff	2.8
Evapotranspiration	1604.9
Lateral flow	19.2
Percolation	325.4
Soil Water Content	-8.4
Precipitation	65.0
Irrigation	1895.8
PET	1851.9

Water budget (mm)

Results

To perform a sensitivity assessment of sugarcane yields to various irrigation schemes.

Objective

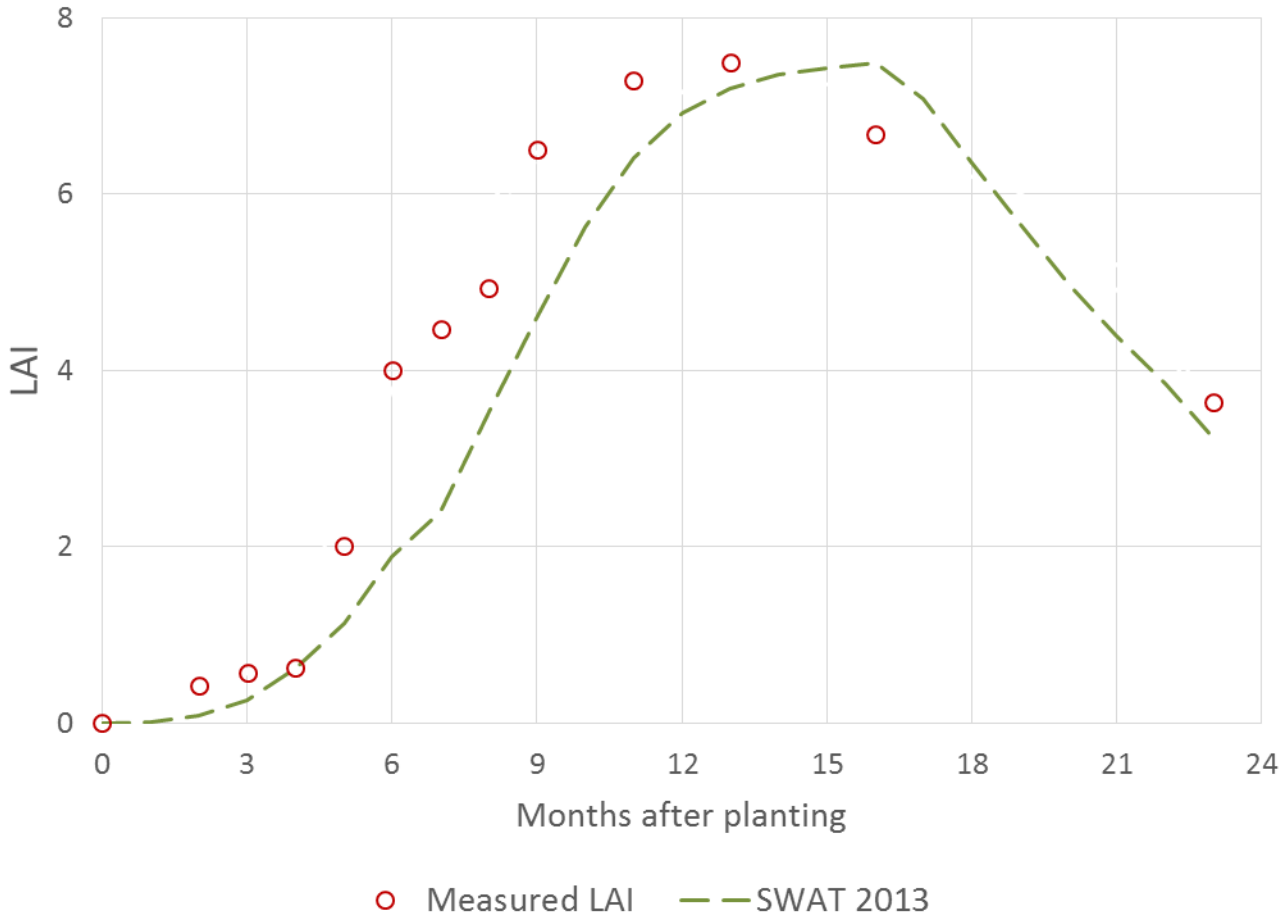
Introduction

- Treatments:
  - Historical Irrigation dataset (100%)
  - Treatments (+25, -25, -50, -75%)
  - Automatic irrigation
- Response variables:
  - Crop yield
  - WUE

Experiment
Methods

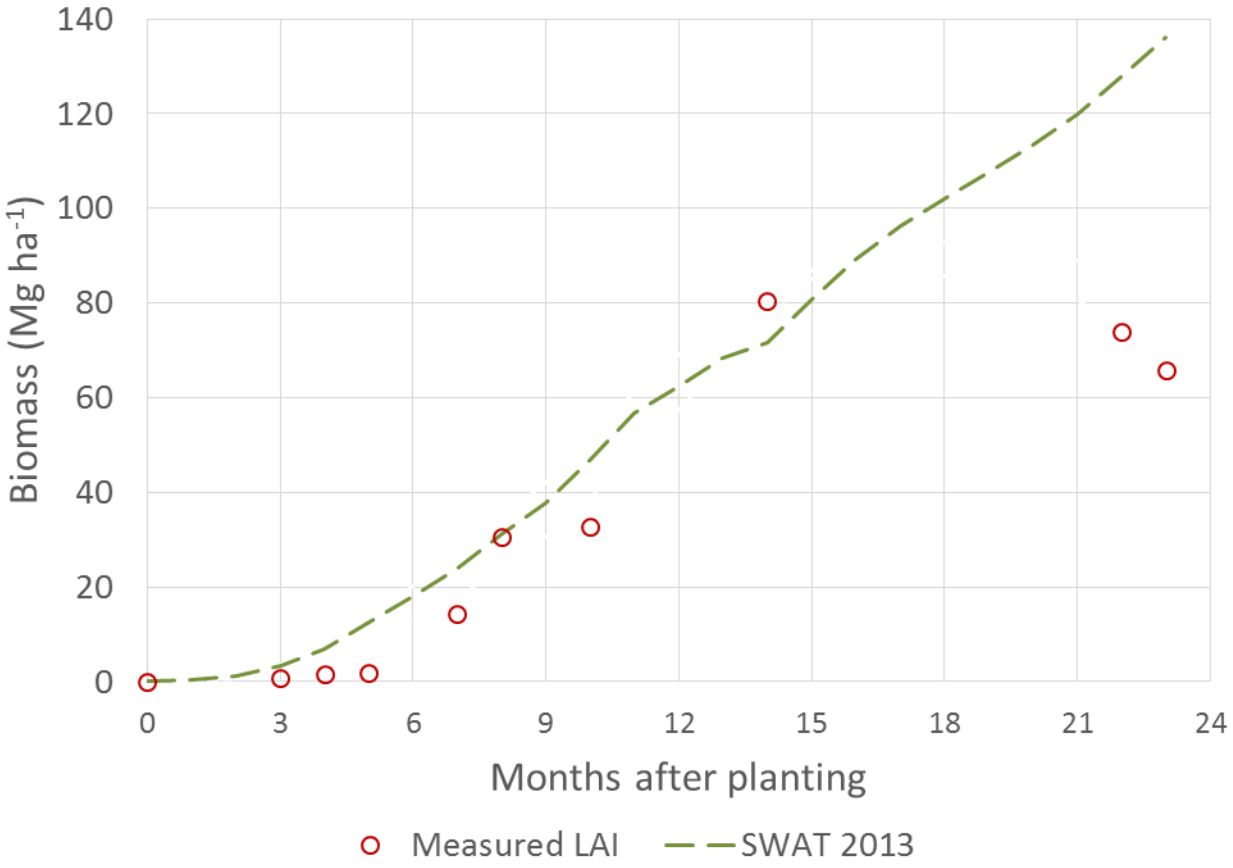
Crop Yield

Results



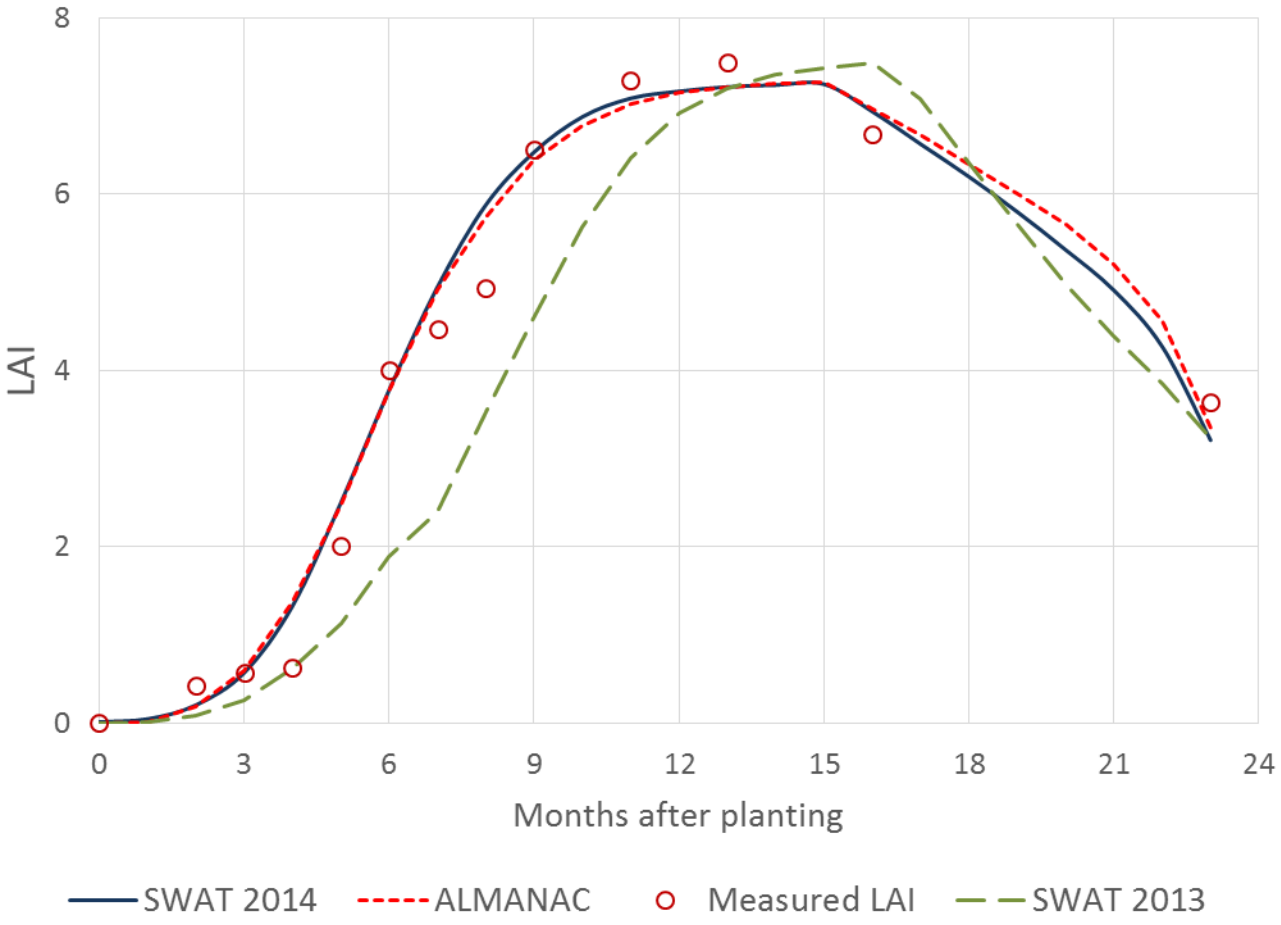
LAI (Obs : Sim)

Results



Crop growth (Obs : Sim)

Results



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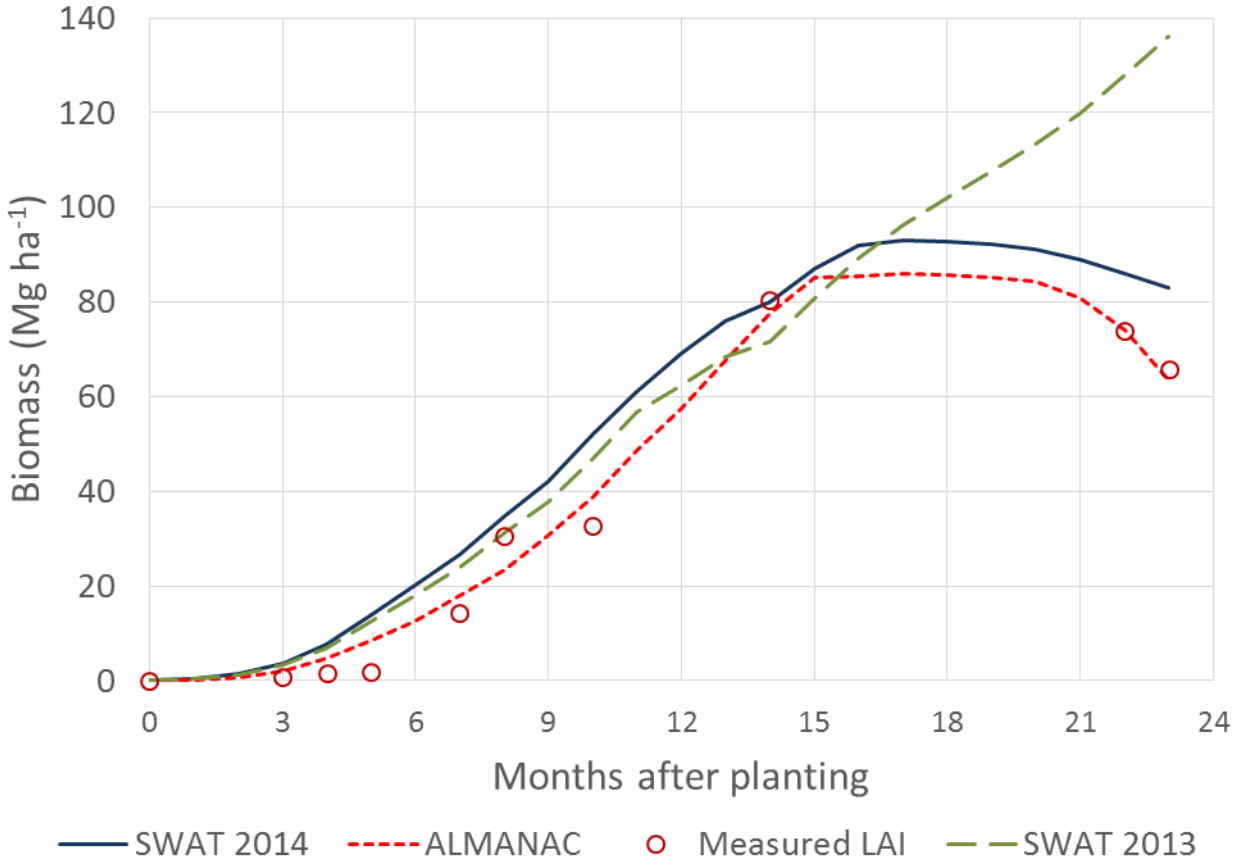
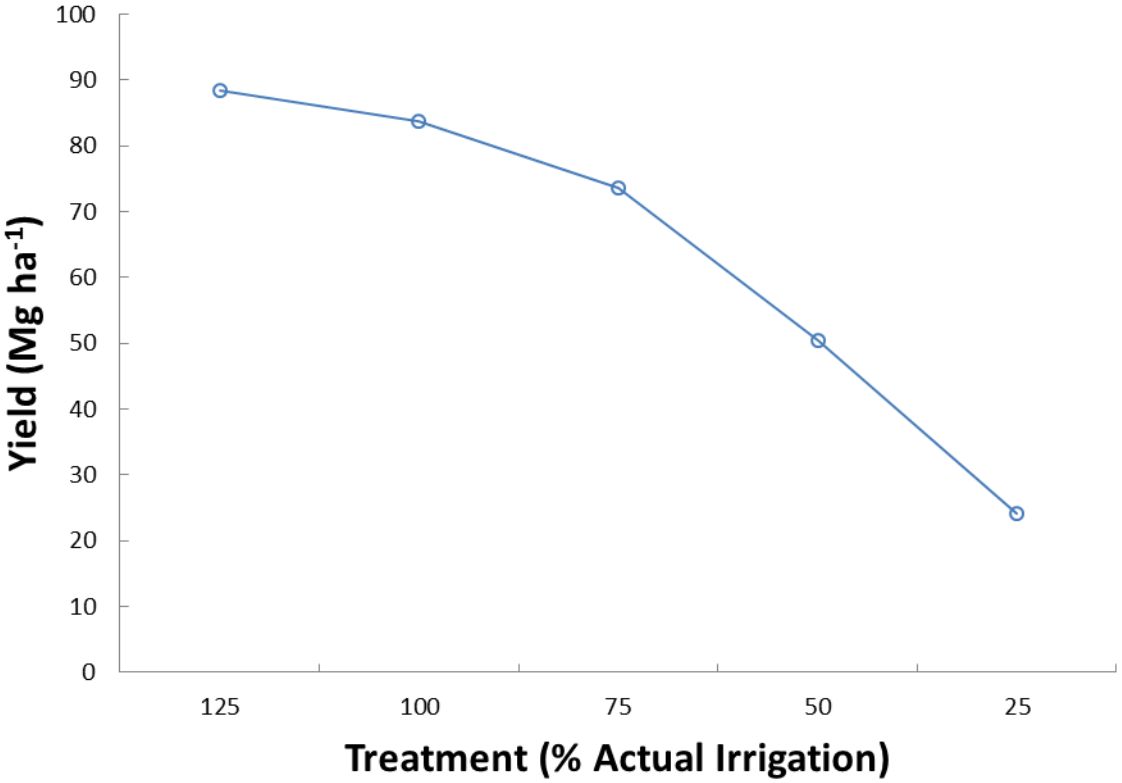


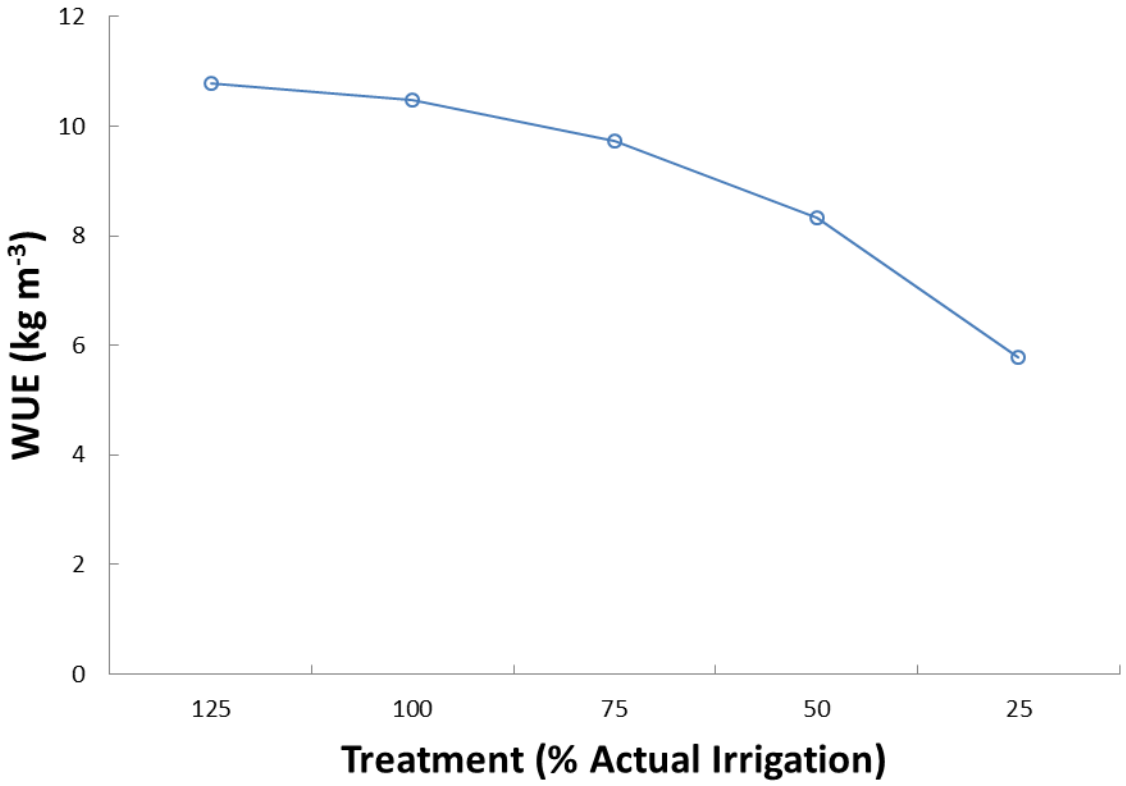
Crop growth (Obs : Sim)

Results



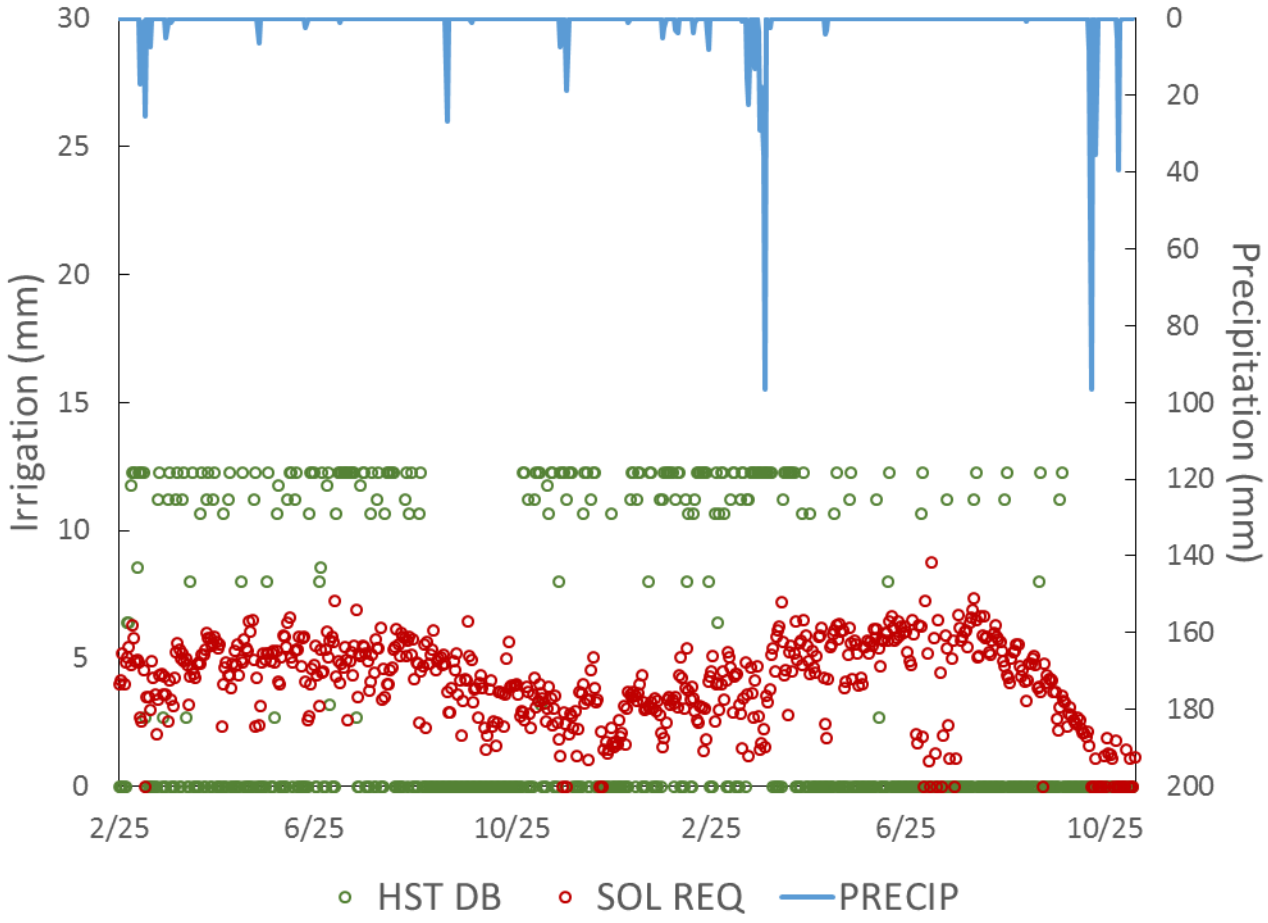
Crop Yield

Results



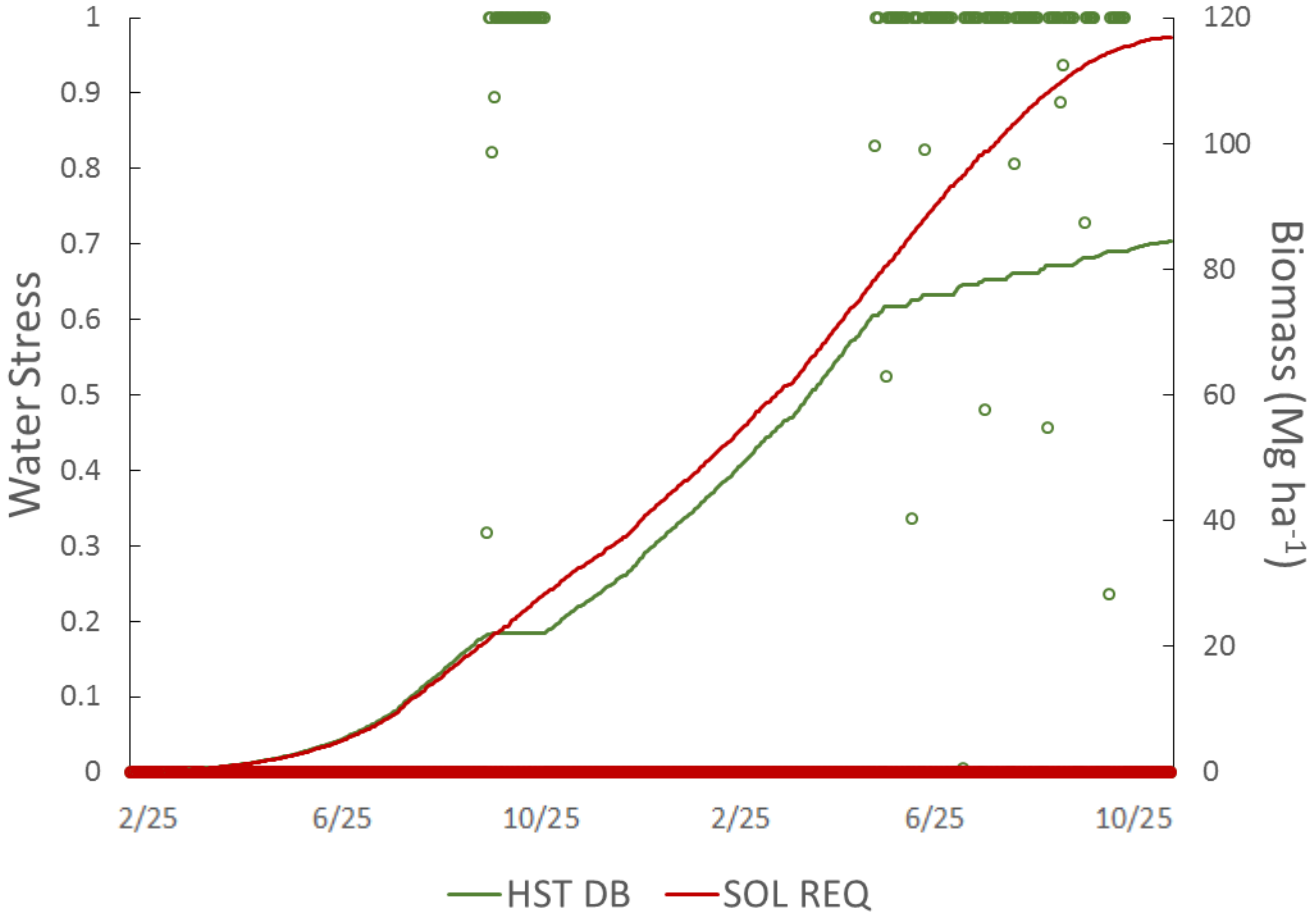
Water Use Efficiency

Results



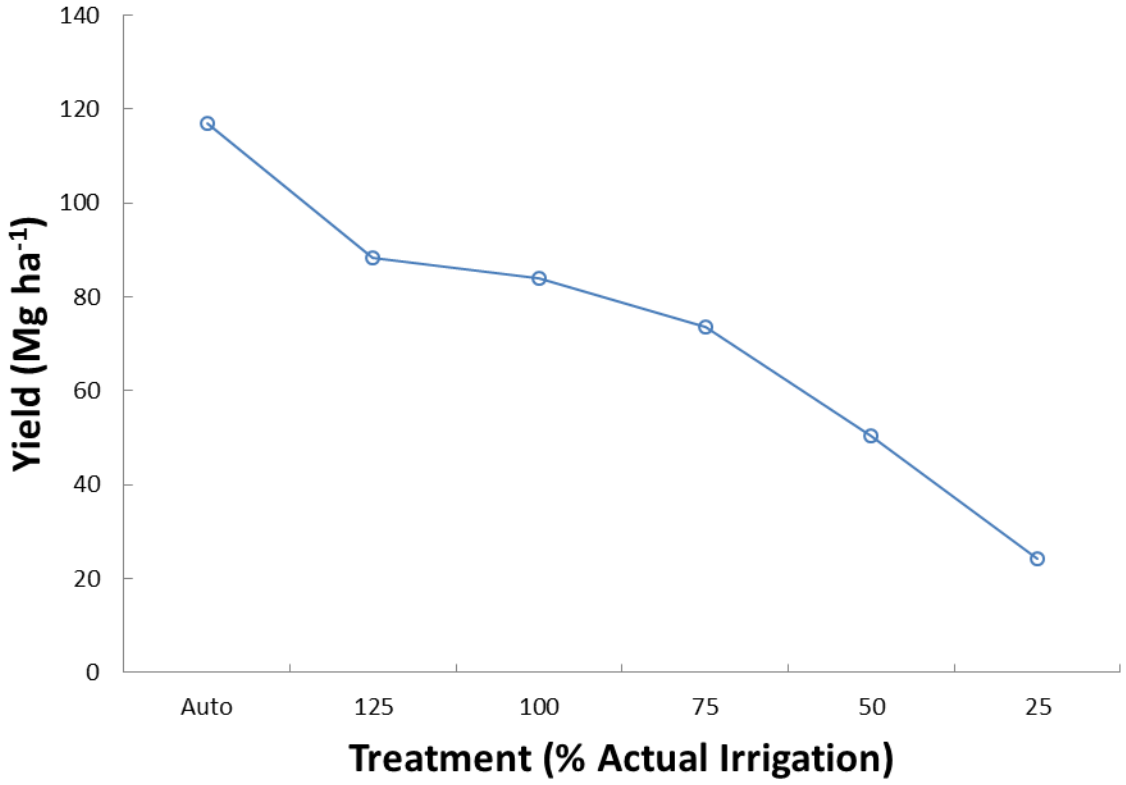
Auto Irrigation

Results

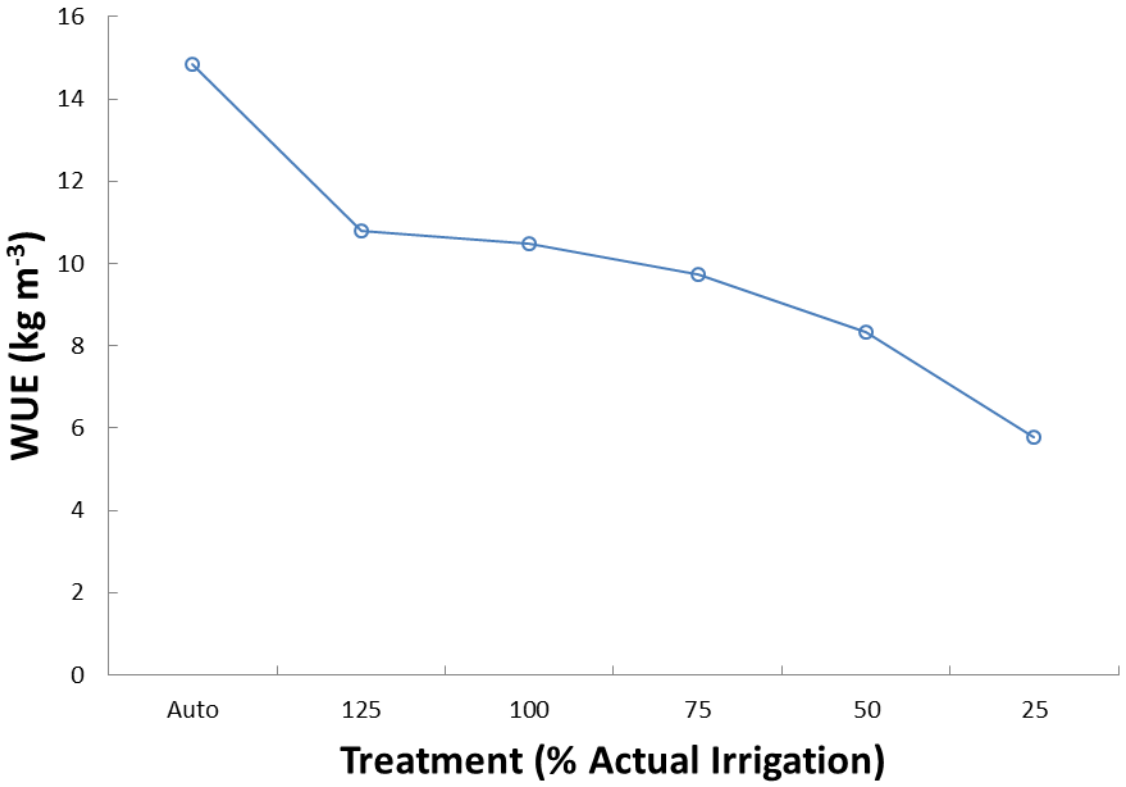


Auto Irrigation

Results



Crop Yield
Results



Water Use Efficiency

Results

- Lessons learned
  - SWAT can adequately estimate sugarcane growth under different water management
  - Sugarcane yield and growth rate highly sensitive to water reductions.
  - Timing of irrigation is as important as volume applied
- Future work
  - WUE analysis entire plantation
  - Plant/Crop algorithm
  - Alternative biofuel crops

Lessons learned & Future work

Conclusions

Soil & Water Assessment Tool | SWAT

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