CARIWIG Case Study Report

The impact of future climate change on sweet potato production

***Dale Rankine**, ***Michael Taylor, and ***Tannecia Stephenson*

*CIMH, Barbados
UWI, Mona (CSGM)-Jamaica

UWI

CARIWIG

Aim and objectives

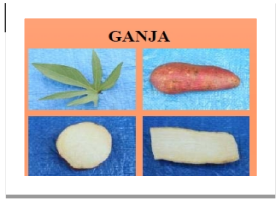
The aim: To assess the impact of future climate change on field grown sweet potato production.

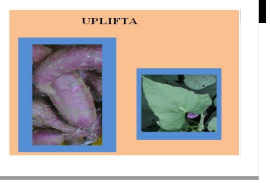
The objective: to determine the percentage change in **yield**, **biomass, reference evapotranspiration (ETo)** and **water productivity** across three varieties of sweet potato for ***2041-2070*** relative to ***1981-2010***

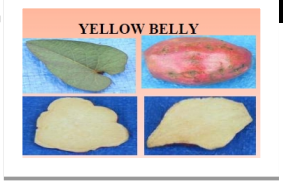
Downscaling from GCM (**HadCM3Q0**) was done so that:

- Output from the CARIWIG weather generator was used, as
- Input to the FAO AquaCrop model.

The three varieties exa**G** **lift** **low Belly**.







UWI

CARIWIG

Which tools were used? How & why?

- The FAO AquaCrop Model is a user-friendly crop-water productivity model that simulates yield response to water of herbaceous crops and is particularly suited to address conditions where water is a key limiting factor in crop production.

- The **CARIWIG Weather Generator** used to generate daily series of rainfall, maximum and minimum temperature and vapour pressure for two periods: **1981-2010** and **2041-2070** (A1B-HadCM3Q0).

- Data for the **1981-2010** period were generated from observed rainfall and maximum and minimum temperature from Worthy Park in Jamaica.

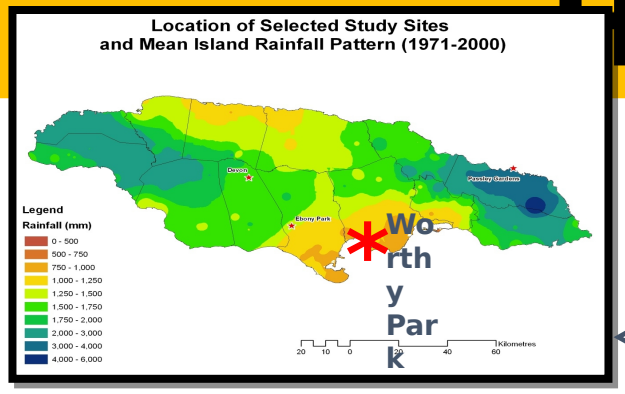
- The FAO ETo Calculator : was used to calculate Reference Evapotranspiration (ETo) for both periods.

- **CARIWIG Wx Generator Outputs: rainfall, temperature, relative humidity, vapour pressure and ETo (from FAO Calculator) were used as input to the "calibrated" AquaCrop Model; (% difference in Mean values between present vs future period calculated)**

UWI

CARIWIG

Which tools were used? How & why?



Randomised Complete Blocks (RCBs)

Worthy Park Data

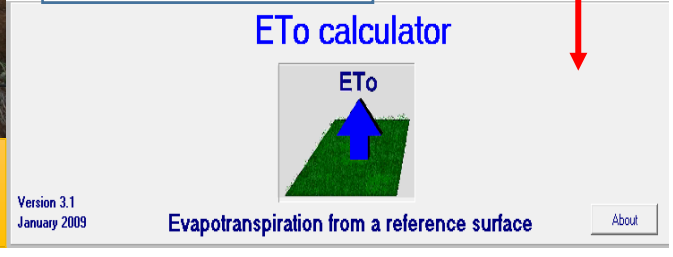
GCM

WX Generator

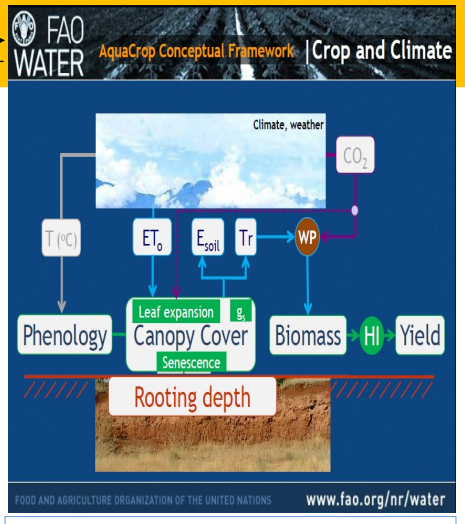
CC Data

Parameters:

- Rainfall
- Temperature
- Relative Humidity
- ET_0



Canopy cover, Biomass (above & Below)



AquaCrop Model Explained

- Biomass=WP x ΣTr [Biomass]
- *ET=E +Tr*
- WP normalised for ET and CO_2
- Y=B x HI [Yield]
- **Robust, Accurate yet simple**

UWI

CARIWIG

The findings

Rainfall (mm)			Maximum Temperature (˚C)			Minimum Temperature (˚C)			Vapour Pressure			Relative Humidity (%)		
Min	Mean	Mx	Min	Mean	Mx	Min	Mean	Mx	Min	Mean	Mx	Min	Mean	Mx
-0.75	-0.32	0.04	1.8	1.9	2.0	1.6	1.7	1.8	2.4	2.6	2.7	0.6	0.9	1.2

Change	Biomass (t/ha)			Yield (t/ha)			Evapotranspiration (mm/day)			Water Productivity ($kgm^{-2}mm^{-1}$)		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Absolute	3.68	4.37	5.06	1.9	2.3	2.8	-113.7	-90.5	-186.6	0.6	1.0	1.5
Percentage	30.0	34.4	40.0	28.5	32.9	40.0	-20.1	-15.4	-24.6	57.0	77.7	108

UWI

CARIWIG

Implications for policy & planning

- The results suggest that sweet potato may be a potential 'climate change' adaptation crop particularly with respect to:
  * Its moderate drought tolerance
  * Relatively low agronomical inputs required for development of the tuber.

- More, the crop can be grown on marginal lands, is highly adaptable to multiple agro-ecological conditions and is not exposed to destructive winds of tropical cyclones.

- Sweet potato may be thus viewed as a resilient and reliable food source even in times of adverse weather.

- The potential to mainstream crop modelling in routine operations of the Agricultural sector in the Caribbean should be pursued.

UWI

CARIWIG

Feedback on the tools

The weather generator provides the ability to produce series of daily data at present and future periods.

- Tool is quite advantageous to investigating a number of climate scenarios; interfaces well with FAO AquaCrop Model.
- Additionally the weather generator output showed good skill in representing mean and extreme variability.

There was some challenge working across 100 ensemble members for each scenario.

UWI

CARIWIG

What more could be done?

Future work could involve:

- Quantifying improvements in production resulting from the optimisation process using the application of weather generated data.
- Application of the Weather Generator to multiple sites across the Caribbean and for other crops.
- Development of techniques to select random and representative means from data generated by the Weather Generator
- Specifically, 3000 years need effective filtering mechanism.
- Potential to be the "Best or **B.E.S.T."**-However defined!!

UWI

CARIWIG