3rd INTER-REGIONAL CIGR CONFERENCE ON LAND AND WATER CHALLENGES:

"TOOLS FOR DEVELOPMENT"

Instituto Nacional de Investigación Agropecuaria
URUGUAY

Assessment Of AquaCrop Model in Potato Crop in Uruguay

F. Montoya; F. Vilaró; C. García

INTRODUCTION

- Potato crop (*Solanum tuberosum* L.) is the most important horticultural crop in Uruguay

- The South of Uruguay is the main production region (80% of the growing area and production total)

- The high level of precipitation in Uruguay does not guarantee a good quantity and quality production.

- Use of tools for irrigation water management is very important to get it.

AquaCrop → -When
- How much

- AquaCrop model needs to be evaluated previously.

- Objective: Assessment of potato crop yield in AquaCrop under different irrigation treatments.

MATERIALS AND METHODS

- Location of the experimental desing

Basin of Pavon-Cufre river. San José Department (URUGUAY)

-Coordenates:

Latitude: 34°29´ South

Longitude: 56°42´ West

-Growing seasons:

2010-2011

2011-2012

-Climate

Template. High precipitation (1200 mm/year)

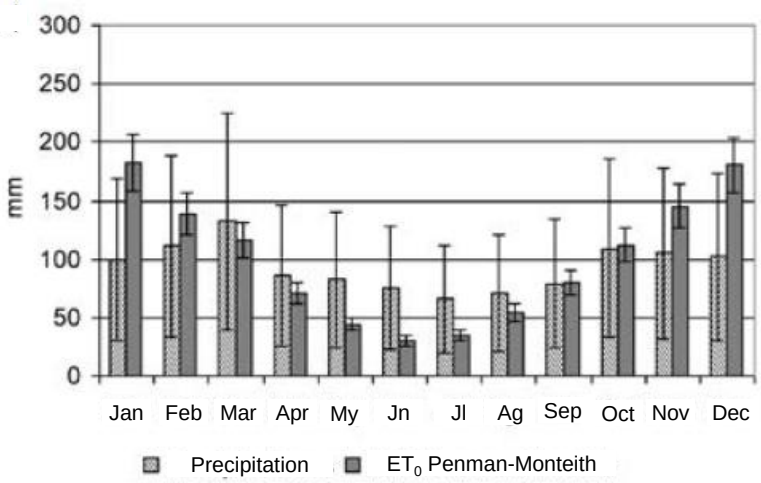
-Soil

Albolls soil.

Thickness soil: 0.8 m.

Texture: clay loam

High organic matter content (5%)



MATERIALS AND METHODS

Crop management

- Potato crop cultivar: Chieftain. Cultivation techniques according to maximize crop yield and quality.

- Crop cycle: From October (sowing: 25th in 2010, and 27th in 2011) to February (ripening of tuber stage: 26th in 2011 and 25th in 2012).

Experimental design

- Experimental plot was a commercial potato area (4.5 ha).
- Drip irrigation system. Irrigation depth: 8 mm h^{-1}.
- Four water regimes with four replicates (2011-2012):
    - Rainfed and three irrigation treatments which were a percent (50%, 100% and 150%) of the water requirement of the crop according to FAO methodology.
- 2010-2011 cropping season, two irrigation treatments (150% and 100%) with four replicates.

- A completely randomized block design was used.

MATERIALS AND METHODS

Irrigation management. Control of soil water

- Schedule for irrigation: simplified water balance in the root zone (effective rooting depth: 0.5 m; FAO 56 methodology).
- Kc for the reference irrigation treatment (FAO 56; 0.5, 1.15 and 0.75).
- Soil water potential measured with Watermark™ sensors. Soil depth: 0.15, 0.30, 0.45 and 0.60 m.

Crop growth

- It was determinated at harvest date.
- Experimental plots were harvested at ripening of tubers stage.
- Harvest area: 40 m^2.
- After manual harvest of each plot, fresh matter content of potato tuber was deteminated

MATERIALS AND METHODS

AquaCrop model. Parameterization and evaluation

- Previously, AquaCrop model was parameterizated with an specific experimental trail with potato in Spain (Agria cultivar). The same conservative and nonconservative data were used for this work.

-Fresh matter content of potato tuber was transformed in dry matter content considering a 78% of moisture in potato tuber.

-Stadistical indicators (goodness of fit):

-Root mean square errors

$$\mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(S_i - M_i)^2}$$

Index of agreement (d) of Willmott

$$d = 1 - \frac{\sum_{i=1}^{n}(S_i - M_i)^2}{\sum_{i=1}^{n}\left(\left|S_i - \overline{M}\right| + \left|M_i - \overline{M}\right|\right)^2}$$

RESULTS AND DISCUSSION

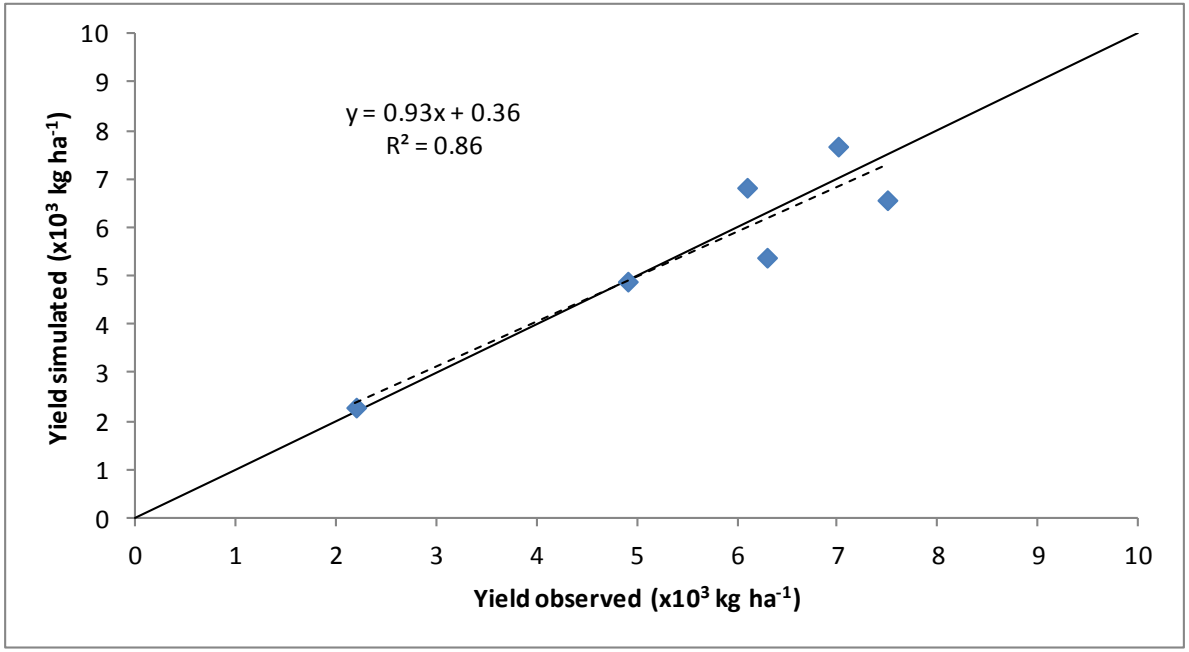
- The first simulation by AquaCrop for all treatments showed high crop yields (50% upper than observed data).

-We observed that Chieftain cultivar is more sensitive to water loggin than the Agria cultivar used in Spain.

Change of the nonconservative parameter one (Aeration stress): from -5% to -15%

Cropping season	Water regime	Observed yield ($x10^3$ kg ha^{-1})	Simulated yield ($x10^3$ kg ha^{-1})	Desviation (%)
2010-2011	100%	6.294	5.382	-14.5
	150%	4.905	4.887	-0.4
2011-2012	Rainfed	2.195	2.284	4.0
	50%	6.095	6.827	12.0
	100%	7.004	7.678	9.6
	150%	7.495	6.569	-12.4

RESULTS AND DISCUSSION



RMSE: 0.67 $x10^3$ kg ha^{-1}

Index of agreement d: 0.96

CONCLUSIONS

- Weakness: it has not enough crop growth data to check the good suitable of the model. We are working with soil moisture data to compare with simulated data.

- The preliminar assessment of the AquaCrop model has showed to be successful to potato crop under Uruguayan conditions.

- AquaCrop model is a suitable tool to make the schedule irrigation and the management of the water resources.

THANK YOU