UNCERTAINTIES IN WHEAT PRODUCTION DUE TO CLIMATIC CHANGE SCENARIOS IN ARGENTINA

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• Introduction

Argentina is the most important wheat producer in South America, with an annual average production around 15 millions of tons. Two important wheat production zones: Buenos Aires and Entre Ríos, have a wheat production area of 670,000 and 180,000 ha respectively, and together are responsible for almost 18% of the Argentina production of wheat (*Triticum aestivum*).

• Objective

The objective of this research was to analyze the potential effects of climatic change in the wheat production of these important wheat producer regions.

• Methodology

Field experiments were carried out and used to calibrate and validate the CERES-Wheat model for the Argentine conditions. Fig. 1 shows the main wheat areas.

- After calibrating the model and crop varieties, the model simulated crop yields using previously characterized Vertisols, Alfisols, Mollisols soils in the study area.
- As climatic input, IPCC scenarios of climate change were adapted to the area. Weather generators were used to produce the daily realizations based on the projected IPCC scenarios used as inputs in the model.
- As result, average increases of temperature in the range of 0.5°C, together with increases in rainfall ranging from 2 to 5 percent of the total annual rainfall amount slightly affected wheat production in the area.
- However, possible changes in rainfall distribution that were introduced in the simulation by using multiple weather generated data were the major source of uncertainty.

• Study area:

Formed by regions I, II, III, IV, V where simulated scenarios were applied. Each region had its own weather and soil database.

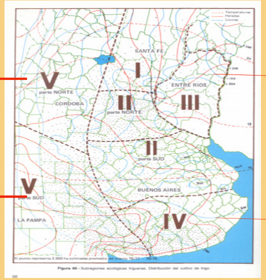


***Fig.1** : Map of the five most important areas of wheat production located in central Argentina. Pictures show typical wheat fields in the argentinean wheat belt.*

• Climate data:

Rainfall, maximum and minimum temperature data-sets were available for wheat regions I to V, from 1977 to 2007.

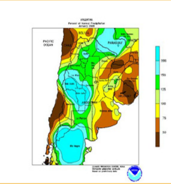


Fig.2 Rainfall pattern in the study area.

• Soil data:

Soil data information needed by the DSSAT model were available from soil profile descriptions, which included physical/chemical analysis available for every wheat region. Table 1 shows information only for the top soil.

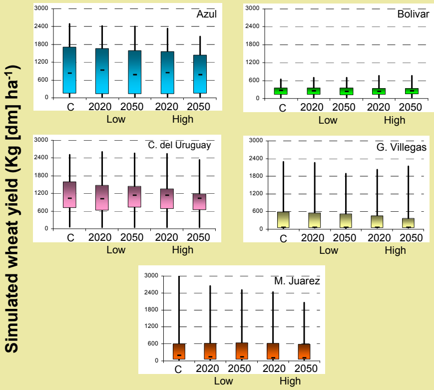
Table 1: Soil classification and additional information from the topsoil of five representative soil profiles across the wheat regions.

Wheat regions	Classification	Texture	Depth (cm)	Field capacity (%)	Wilting point (%)	pH
I	Hapludol	Sandy loam	205	12	8	7.3
II	Argiudol	Loam	120	30	12	6.2
III	Hapludol	Clay loam	85	32	17	6.3
IV	Argiudol	Silty loam	160	35	18	6.4
V	Argiudol	Silty clay	200	42	24	7.4

***Table 2:** Climatic change scenarios. T = temperature, R = rainfall.*

	C. del Uruguay		G. Villegas		Bolivar		Azul		M. Juarez	
	T	R	T	R	T	R	T	R	T	R
2020 Low	+ 0.55	0%	+ 0.50	0%	+ 0.45	0%	+ 0.40	0%	+ 0.70	0%
2020 High	+ 1.25	+ 5%	+ 1.20	0%	+ 1.10	+ 5%	+ 1.00	0%	+ 1.50	0%
2050 Low	+ 0.90	+ 3%	+ 0.80	0%	+ 0.70	0%	+ 0.70	0%	+ 1.00	0%
2050 High	+ 2.30	+ 6%	+ 2.20	+ 7%	+ 1.90	+ 11%	+ 2.00	+ 5%	+ 2.80	0%

• Results



C = Current conditions; Low = lowest projection; High = highest projection

The application of IPCC scenarios of temperature and rainfall for 2020 and 2050 (lower and higher impact scenarios) on wheat production in the wheat regions of Argentina did not show a major change.

The simulated wheat yields were statistically non-significant at α=0.05 for any of the regions; however, there is a decreasing trend in the highest percentiles, meaning that during those years with higher yields will be lower than under the current climate.

• Conclusions

- Simulated results of wheat production showed non-significant wheat yields under any IPCC simulated scenario.
- DSSAT demonstrated being a powerful tool to simulate the effect of climate change in crop production.

• References

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