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Using DSSAT to examine the interannual weather variation in forage maize productivity in Asturias and Galicia (Spain)

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INTRODUCTION

Process-based crop models are excellent tools for quantifying the effects of management, genetics, soil and weather on growth, development, and yields (Addiscott and Wagenet, 1985). Oliveira et al. (2023) initiated the adaptation of the CSM-CERES-Maize model of software platform Decision Support System for Agrotechnology Transfer (DSSAT) (Hoogenboom et al., 2019) for forage maize and, to simulate growth and development of three forage maize cultivars for three sites and three years in Asturias, Spain.
The objective of the present study was to use the CSM-CERES-Maize model in combination with the seasonal analysis of DSSAT to quantify the influence of interannual weather variation on forage maize production in Asturias and Galicia.

MATERIALS AND METHODS

With the aim of examining the interannual variation in whole plant dry matter production, the model was executed with long-term historical meteorological data for 23 years from 2000 to 2022 with three cultivars (SE1-200, SE2-300, SE3-400) for three sites of Asturias and with three cultivars (XU1-200, XU2-300, XU3-400) for four sites in Galicia.
The genetic coefficients of the cultivars used in the simulation were obtained according to Oliveira et al. (2003).


Asturias-Barcia (05-07)


Asturias-Villaviciosa (02-08)


Asturias-Grado (26-07)

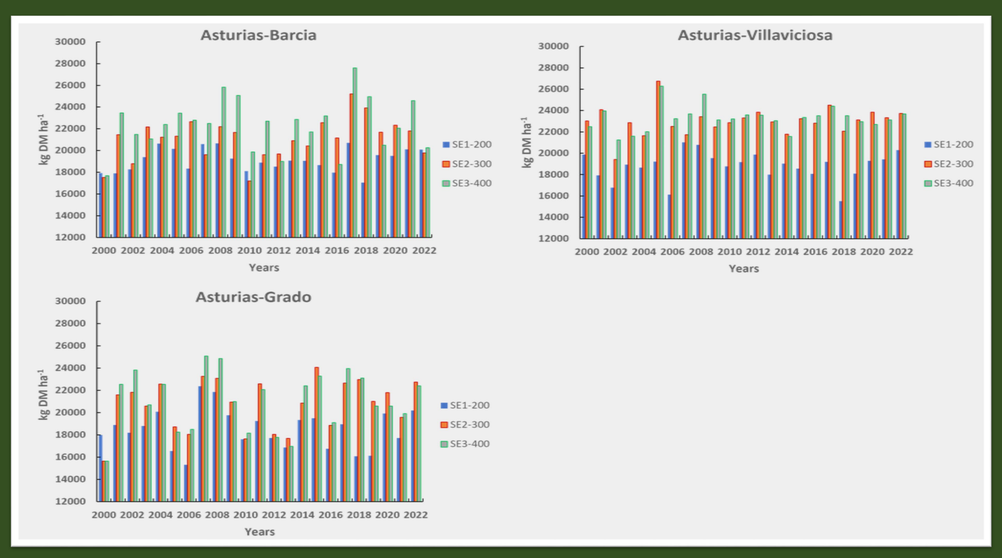

Galicia-Ribadeo (09-09)


Galicia-Ordes (09-07)


Galicia-Deza (21-07)


Galicia-Sarria (02-08)

RESULTS



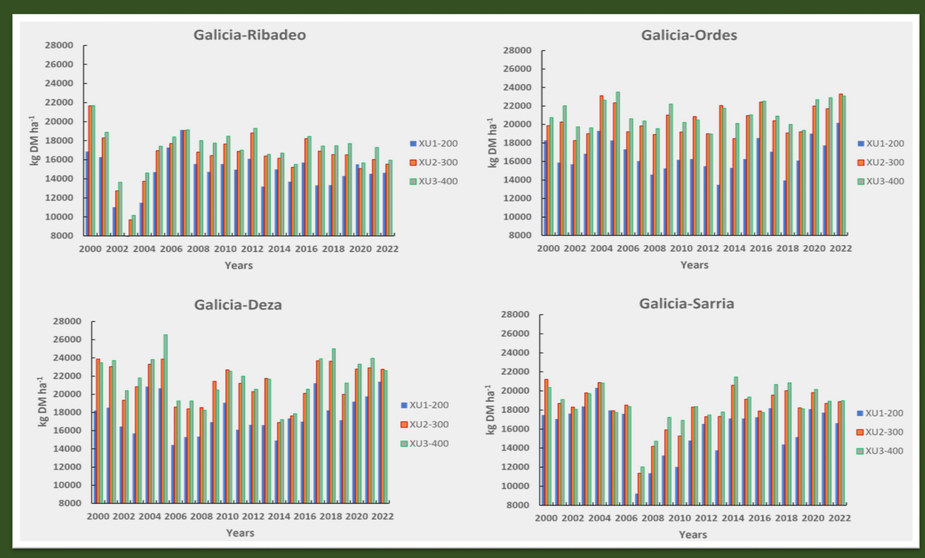


Figure 1. Comparison of whole plant dry matter production (kg DM ha^{-1}) simulated using 23 years of meteorological data in the seven locations for the six cultivars studied

For all locations, the highest yield was achieved with the cultivars that had the longest growth cycle (SE3-400 and XU3-400) during the growing season. The average daily weather conditions for maximum temperatures ranged from 21.3 to 26.0 °C, for minimum temperatures it ranged from 9.8 to 15.8 °C, and for total solar radiation it ranged from 15.8 to 23.0 MJ m^{-2} day^{-1}; total rainfall during the growing season ranged from 109.5 to 313 mm.

DISCUSSION

The CSM-CERES-Maize model was adapted to simulate forage maize yields by calibrating the genetic parameters of six cultivars in three locations and three years in Asturias, and four locations and three years in Galicia. The calibration, together with the use of historical meteorological data (2000-2022) from the study sites, allowed simulation of the whole plant dry matter production of the six cultivars during the 23-year period. A specific model for forage maize is expected to be included in the DSSAT platform. Use of the new model should help to optimize management practices and harvest decisions in forage maize.

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