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"Agricultural development within the rural-urban continuum"

Different Maize Cultivars Overcome Climate Change Deleterious Effects at Regional Level – Hybrid and Community-Developed Cultivar

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Abstract

Maize is one of the world's most important cereals, cultivated in a wide range of environments, and for various purposes. Understanding climate change and its impacts on crops is crucial to determine anthropogenic responses. Simulations of climate change impact in agricultural systems using crop models are often run for individual sites with a single cultivar. This approach, besides generating important information, limits its benefits of the results, especially regarding regionalisation and use of distinct crop cultivars (particularly locally developed cultivars). The objectives of this work are to assess i) the impacts of climate scenarios on maize production in Santa Catarina State, Brazil and the ii) effect of contrasting maize cultivars (commercial hybrid AS1548 and open-pollinated MPA01, selected through participatory processes with peasants) and five planting dates as adaptation strategy. The location of agricultural land use (>800 thousand ha) was mapped using satellite images and GIS, allowing the coupling of soil (1:250000 scale) and weather information for the crop modelling procedure CERES-Maize. Seven climate scenarios from regional circulation models (RCM) were tested. Simulations of impact on yield were done with an ensemble of four RCMs (LMDZ+IPSL+RCA2+RCA3) that was able to mimic the past 30 years of observed yield. Results showed that the identification and allocation of agricultural areas permitted the crop model to accurately simulate present yields and match census data of production. Once crop model, RCMs and regionalisation processes were validated, simulations for 2012–2040 using different cultivars and planting dates were run. Simulations for 2012–2040 without adaptation strategies (actual management) showed reductions of 13.5 % in regional maize production. When using the best cultivar for each area (AS1548 or MPA01), total production was 6 % higher than present level; when using both adaptation strategies – cultivar and best planting date – total production increased by 15 %. This analysis showed that cultivar and planting date are feasible adaptation strategies to mitigate effects of climate changes, and crop models can be successfully used for regional assessments. Furthermore, results indicate at refined level the best cultivar and planting date. Finally, it confirms that local cultivars are too a feasible alternative to cope with climate change effects.

Keywords: Adaptation strategies, corn, impacts of climate change, landraces

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