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"Bridging the gap between increasing knowledge and decreasing resources"

It's a Matter of Strategic Knowledge: Adaptation Measures Increase Agricultural Systems Resiliency Against Climate Change

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Abstract

Agricultural production is of major interest in a world that will require doubling the food production in the next 40 years without significantly increasing the area dedicated for crops. Besides this, climate change and variation are considered major threats to the long-term resilience of agricultural systems. Studies related to climate change are usually done for individual sites and cultivars. Although the information generated is significant, it cannot be extrapolated to large and complex regions. To obtain more precise assessments about the impact of climate change and respective adaptation strategies, field experiments and simulations – using DSSAT (CERES-Maize model) – were done for maize in the Santa Catarina State (>580000 ha cultivated, 3,69 million tons), Southern Brazil. The objectives are to assess, at field and regional level, i) the impact of climate scenarios on maize production and ii) to quantify the buffer effect of strategies such as planting date and cultivar. The fields identification was done using satellite imagery coupled with in-field assessments and census data, allowing satisfactory spatial refinement. This information was attached to soil maps (1:250000 scale) and weather information for running simulations and validating CERES-Maize. Several regional circulation models (RCM) were tested in order to identify the ones that best represent past yields in target regions. An ensemble of four RCMs (LMDZ+IPSL+RCA2+RCA3) was selected based on the ability to mimic the 1990–2010 yields. After validation of the crop model, RCMs and regionalisation, simulations for 2012–2040 were run using i) actual agronomic management and ii) combinations of cultivar and planting date as adaptation strategies. Depending on the field location, the impact on maize yields ranged from -60 % to +20 %. The overall impact without adaptation strategies resulted in a reduction of the 13,49 % in maize production (from 3,69 to 3,19 million tons). When adaptation measures are employed, local yields changes ranged from -12 % to +40 %, and overall production increases by 15 % (to 3,87 million tons). The results indicate that coupling best cultivar and planting date at local level are a strategic knowledge that not only buffers the eventual deleterious impacts of climate scenarios, but also increases overall maize production.

Keywords: Adaptation strategies, adapted cultivar, landraces, local knowledge, maize production, planting date

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