Session 2.3 Biophysical Impacts of Climate Change

Oral Presentation

Title: **What would happen to wheat production in cotton-wheat cropping zone of Punjab under mid century scenario?**

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Abstract: Wheat is the staple food and contributes nearly 70% of the calorie needs of an average Pakistani. The cotton-wheat belt in the south comprises of 1.36 million ha and grows 45% of the wheat produced in the province. Cotton crops particularly cause serious delays in sowing of wheat. Cotton's growth cycle and favorable price structure may push wheat planting into late December or early January. Down scaling results under RCP8.5 and CCSM4 model (with cool/dry characteristics) suggest a 2.5 °C rise in the maximum and minimum temperatures with 9% decrease in the precipitation amount in the 2040-2069 projected period over the region. The projected increase in temperature and the corresponding decrease in the precipitation regime give clues regarding devastation in the agricultural yield in the 2040-2069 projection period over the region. Well calibrated and validated models DSSAT and APSIM were used to simulate wheat yield at farmers field and found that both models simulated wheat yield well with <10% error. Both the model were run with base line 1980-2010 and then with future generated data with 5 GCMs. Results showed that there will be reduction in wheat yield under future scenarios of RCP8.5 and 4.5. This reduction level is different in different district. However, this reduction about 1% in the current yield.

Key words: APSIM, CERES-Wheat, GCMs, Climate change, RCP 8.5, RCP 4.5

Oral Presentation

Title: **Climate change impacts on crop yield in Koutiala, Mali**

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Abstract: An integrated modelling framework is used to simulate crop productivity for current and future climate scenarios. Two crop models, Decision Support Systems for Agro-Technological Transfer (DSSAT) and the Agricultural Productions Systems sIMulator (APSIM), were calibrated and evaluated for the study site in Koutiala, Mali, simulating yields of maize, millet, and peanut for 123 households. These crop models are fed by weather data from baseline climate (1980-2009) from observed weather and futur

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Title: **Sensitivity of current spring barley production system to climate change**

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Abstract: Climate change will have significant impact on cultivated barley areas in Scotland, modifying the capability of land and thus the potential areas over which cropping activities may be conducted. In this study we evaluate the impact of climate change on simulated barley yield using 4 Global Circulation Models (GCMs), 2RCP (45 and 85), and 2 crop simulation models. The models were calibrated using benchmark variety trials and evaluated on field trial data collected at an experimental farm for spring barley. The models were run on the cultivated barley areas using geospatial datasets of climate land-use/crop management, and soils. Crop models calibration and evaluation showed little variability between models, and their ability to replicated experimental data. Overall, climate change will not have a significant negative impact on spring barley because the increase in temperature at such high latitude is within the optimal range for the cultivar. Future yield is forecasted to increase between 5 to 9% under RCP45 and RCP85, respectively.

Oral Presentation

Title: **Wheat Yield Potential in Europe Under Climate Change Explored by Adaptation Response Surfaces**

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Abstract: Uncertainty about climate change increases the complexity of addressing adaptation and optimizing risk management at regional level. Approaches for managing this uncertainty, simulating and communicating climate impacts and adaptation opportunities are required.

Here, we applied an ensemble of 8 crop models to identify suitable adaptation options for rainfed winter wheat at Lleida, NE Spain, and analyze the results by constructing adaptation response surfaces. These are plotted surfaces showing the response of an adaptation option compared to the non-adapted simulation in an impact variable (e.g. yield changes) for a range of systematic changes in temperature and precipitation. The general methodology was adapted from Pirttioja et al. (2015). The adaptation options explored were changes in sowing dates, cultivar phenology, supplementary irrigation and combinations of these. A "full irrigation" scenario also served as a reference for identifying yield potentials and associated water requirements.

The results indicated that adaptation strategies may help to reduce detrimental effects of climate change. Combined adaptations performed better than single adaptation options. The best results were obtained when a non-vernalizing cultivar was sown 2 weeks earlier and given 40 mm of supplementary irrigation at anthesis. However, some rainfed only options also shown potential for mitigating climate change impacts.

Our analysis evaluated if the explored adaptations fulfill the biophysical requirements to become practical adaptative solutions. This study exemplified how adaptation options and their responses can be analyzed, evaluated and communicated in a context of high regional uncertainty for current and future conditions and for short to long-term perspectives.