

Agricultural integrated climate change impact assessments- do we need to account for incremental crop management adaptations?

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Evaluating climate change impacts on agriculture and land use must simultaneously consider changes in climate, technology, prices and trade. Studies by Nelson et al. (2014) and Hertel et al. (2010) have shown the sensitivity of macro-economic and poverty outcomes to the climate impact on crop yields, respectively. However, previous economic studies have not explicitly controlled for assumptions about adaptations in crop management such as optimizing sowing dates and varieties, which farmers are expected to do as average temperatures gradually warm. This study presents the results of an integrated modelling exercise investigating the impact to climate change and different crop management adaptation cases (no adaptation, optimal adaptation and non-optimal „actual“ adaptation) on a number of indicators for European agriculture. A process based crop modelling framework, SIMPLACE, was used to model the adaptations and climate impacts on six crops to 2050 for three SRES scenarios, while historical yield trends were extrapolated for each scenario to give relative yield changes due to technology progress (Ewert et al., 2005). The economic agricultural sector model CAPRI was used to simulate changes in land use, supply, demand, and prices. Finally, the environmental model INTEGRATOR was used to assess agricultural emissions based on changes in crop yields and land use, simulated with the CAPRI.

With no adaptations, crop yield changes for grain maize and potato were negative for scenarios A1B and B2, while the relative changes in winter wheat, barley, canola and sugar beet were positive for all scenarios. Use of either adaptation case led to positive yield changes for all crops, with the resulting adaptation highly variable across Europe and crops. Technology changes were always positive and resulted in larger changes in crop yields than any climate change or adaptation combination. Results indicate that the method of specifying adaptations had a very large influence on projected yields of approx 15% points, with the relative uncertainty decreasing for the landuse, economic and emissions indicators (Zimmermann et al., 2017). Challenges in specifying crop management in integrated assessments are discussed.

References

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