



Agriculture and Climate Change- Adapting Crops to Increased Uncertainty (AGRI 2015)

Assessing Economic Impacts Of Climate Change And Adaptation In Indo-Gangetic Basin

Harbir Singh^{a*}, Nataraja Subash^a, Babooji Gangwar^a, Roberto Valdivia^b, John Antle^b,
Guillermo Baigorria^c

^a ICAR-Indian Institute of Farming Systems Research, Modipuram-250110, India

^b Oregon State University, Corvallis, OR 97331, United States

^c University of Nebraska-Lincoln, 1400 R St, Lincoln, NE 68588, United States

Abstract

The Indo-Gangetic Basin (IGB) is characterised by cereal-based farming systems where livestock is an integral part of farm economy. Majority of the population derives their livelihood from agriculture sector which is dominated by small land holdings (<2 ha). Cereal crops (mainly rice and wheat) are crucial to ensuring the food security in the region, but sustaining their productivity has become a major challenge due to climate variability and uncertainty. This paper uses an integrated climate-crop-economic modelling framework (using AgMIP protocols) to make an integrated assessment of climate change and adaptation strategy for rice-wheat growing farms of Meerut district (India) in the IGB. This framework enables integration of location- and farm-specific climate and crop modelling output for assessing economic impact on the farming systems using trade-off analysis (TOA-MD) model. The assessment clearly shows likely impact of climate change on agricultural production systems, and how adaptation strategies can reduce climate change vulnerabilities. Sensitivity analysis shows that under current production system, rice mean yield declines 8–23% while wheat yield declines by 17–29% under five climate scenarios. Though decline in mean net farm returns and per capita income appears small, a large proportion of farm population (53–79%) remains vulnerable to climate change. Assessment of future agricultural systems (2050s) shows that though the mean net farm returns and per capita income decline by 3–9% and 2–6%, respectively, under different climate scenarios, a large proportion of farms (39–64%) incur losses due to climate change. The adaptation strategy for existing farming system shows positive impacts on crop yield, farm returns and per capita income. However, a comprehensive assessment of more sites for climate change impacts on future agricultural production systems would be useful in devising appropriate adaptation strategy to improve the livelihoods and food security in the IGB region.

* Corresponding author. Tel.: +91-121-288-8711; fax: +91-121-288-8546.
E-mail address: hs.pdfsr@yahoo.com

© 2015 The Authors. Published by Elsevier B.V This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organizing committee of the Agriculture and Climate Change - Adapting Crops to Increased Uncertainty (AGRI 2015)

Keywords: Integrated assessment; climate change; TOA-MD; economic impact; adaptation strategy

References

1. Chaturvedi et al., 2012. Multi-model climate change projections for India under representative concentration pathways. *Current Science* 103(7):791-802.
2. IPCC, 2013. Climate Change 2013: The Physical Science Basis. Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, (Eds.) Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. Cambridge University Press, Cambridge, UK and New York, USA, 1535 pp.
3. Pathak, et al., 2003. Climatic potential of on-farm yield trends of rice and wheat in the Indo-Gangetic Plains. *Field Crops Research* 80, 223–234.