Supporting Information for "Substantial differences in crop yield sensitivities between models call for functionality-based model evaluation"

Christoph Müller[1], Jonas Jägermeyr[2,3,1], James A. Franke[4], Alex C. Ruane[2], Juraj Balkovic[5], Philippe Ciais[6], Marie Dury[7], Pete Falloon[8], Christian Folberth[5], Tobias Hank[9], Munir Hoffmannn[10], Cesar Izaurralde[11], Ingrid Jacquemin[7], Nikolay Khabarov[12], Wenfeng Liu[13,14], Stefan Olin[15], Thomas A. M. Pugh[15,16], Xuhui Wang[17], Karina Williams[8,18], Florian Zabel[9], Joshua W. Elliott[19],

[1]Potsdam Institute for Climate Impact Research, Member of the Leibniz Association, Potsdam, 14412, Germany

[2]NASA Goddard Institute for Space Studies

[3]Columbia Climate School Center for Climate Systems Research

[4]University of Chicago Department of Geophysical Sciences

[5]Biodiversity and Natural Resources Program, International Institute for Applied Systems Analysis, Laxenburg, Austria

[6]Laboratoire des Sciences du Climat et de l'Environnement, CEA-CNRS-UVSQ, 91191 Gif-sur-Yvette, France

[8]Met Officce Hadley Centre, Exeter, United Kingdom

[7]Unité de Modélisation du Climat et des Cycles Biogéochimiques, UR SPHERES, Institut d'Astrophysique et de Géophysique, University of Liège, Belgium

[9]Department of Geography, Ludwig-Maximilians-Universität, Munich, Germany

[10]Tropical Plant Production and Agricultural Systems Modelling (TROPAGS), Georg-August-University Goettingen, Grisebachstraße 6, 37077 Goettingen, Germany

[11]Department of Geographical Sciences, University of Maryland, College Park, MD, USA

[12]Advancing Systems Analysis Program, International Institute for Applied Systems Analysis, Laxenburg, Austria

[13]Center for Agricultural Water Research in China, College of Water Resources and Civil Engineering, China Agricultural University, Beijing, China

[14]National Field Scientific Observation and Research Station on Efficient Water Use of Oasis Agriculture in Wuwei of Gansu Province, Wuwei 733000, China

[15]Department of Physical Geography and Ecosystem Science, Lund University, Lund, Sweden

[16]School of Geography, Earth & Environmental Science, University of Birmingham, Edgbaston, Birmingham, B15 2TT, United Kingdom

[17]Sino-French Institute for Earth System Science, College of Urban and Environmental Sciences, Peking University, Beijing, China

[18]Global Systems Institute, University of Exeter, Exeter, UK

[19]DARPA, Washington DC, USA

Contents of this file

Introduction

This file contains supplementary figures, Additional figures show results for other crops than the one shown in the main text or additional information, such as the cluster dendrograms.

Additional figures

$$R_T = \frac{\sum_{i=1}^{nW} \max(y_i) - min(y_i)}{nW}$$

$$R_W = \frac{\sum_{i=1}^{nT} \max(y_i) - min(y_i)}{nT}$$

$$RR_{T,W} = {}^{R_T}/_{(R_W+R_T)}$$

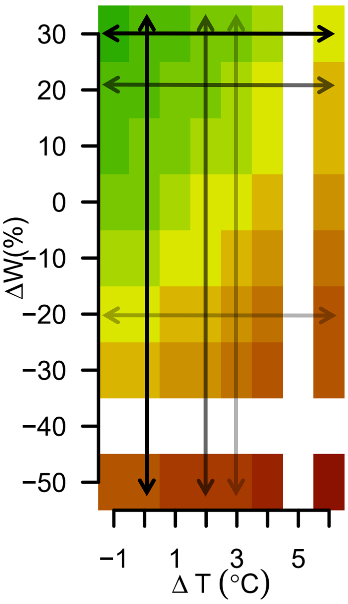

Figure S1. Schematic of the computation of response ratios.

Crop Yield Response Types YRT

dendrograms

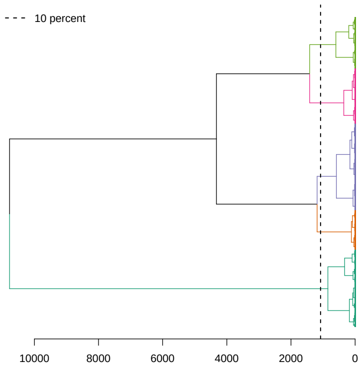

Figure S2. Dendrogram of CTW-YRT clusters for maize (ignoring the N dimension), which corresponds to Figures 3 and 4. The dashed vertical lines shows the 10% of overall variance (x-axis) threshold used to define the number of clusters.

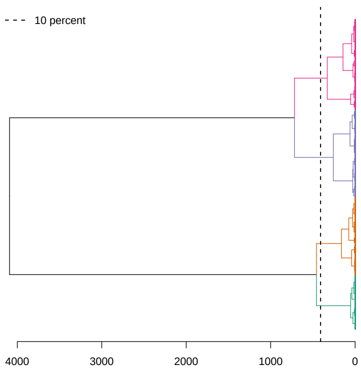

Figure S3. Same as Figure S2, but for rice.

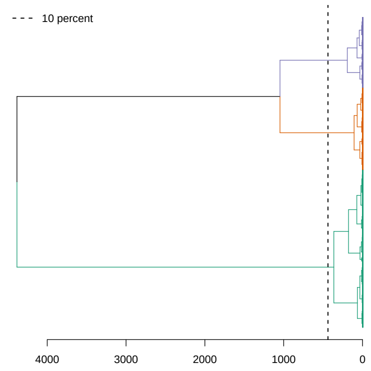

Figure S4. Same as Figure S2, but for soybean.

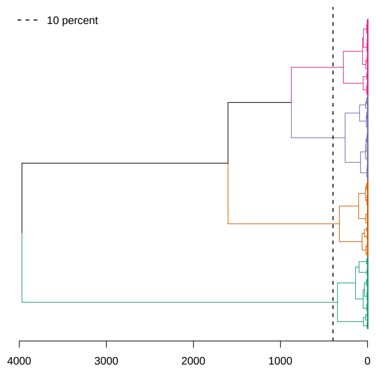

Figure S5. Same as Figure S2, but for spring wheat.

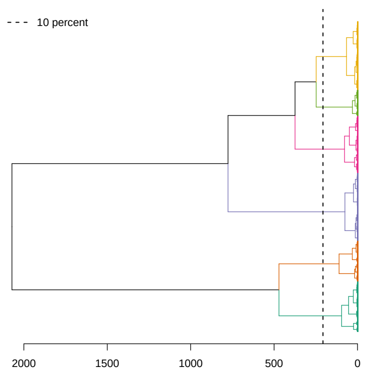

Figure S6. Same as Figure S2, but for winter wheat.

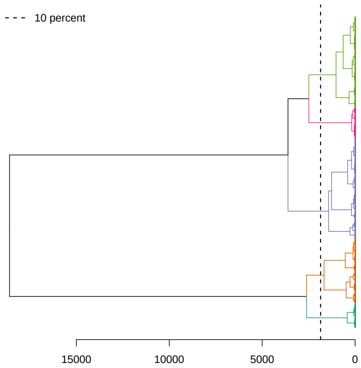

Figure S7. Same as Figure S2, but for all four CTWN dimensions, i.e. including the N dimension, but omitting the GGCMs CARAIB and JULES that did not supply data along the N dimension.

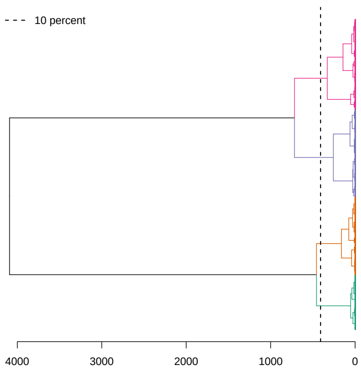

Figure S8. Same as Figure S7, but for rice.

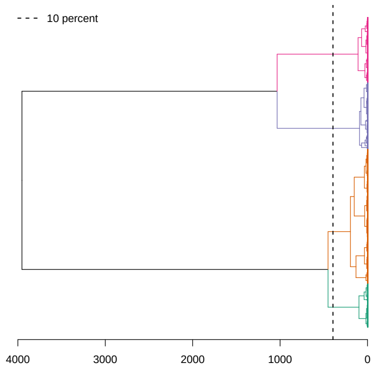

Figure S9. Same as Figure S7, but for soybean.

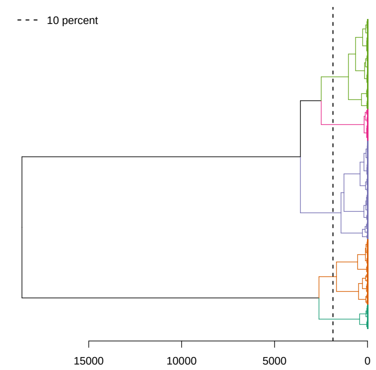

Figure S10. Same as Figure S7, but for spring wheat.

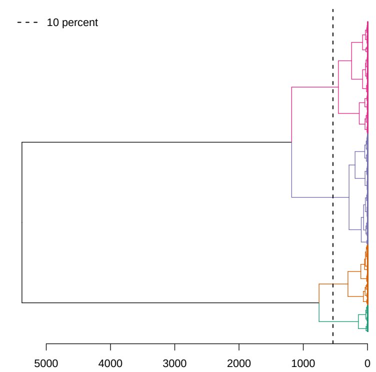

Figure S11. Same as Figure S7, but for winter wheat.

Clusters per GGCM

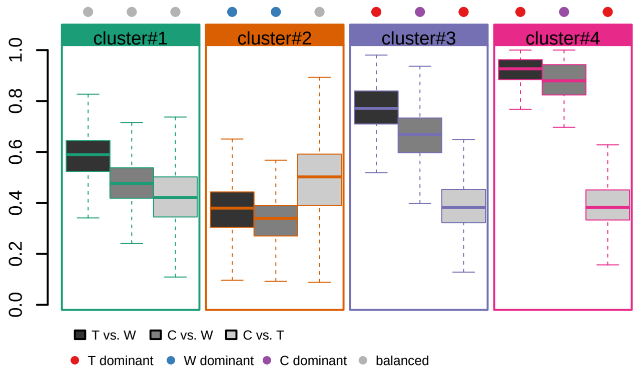

Figure S12. As Figure 3, but for rice.

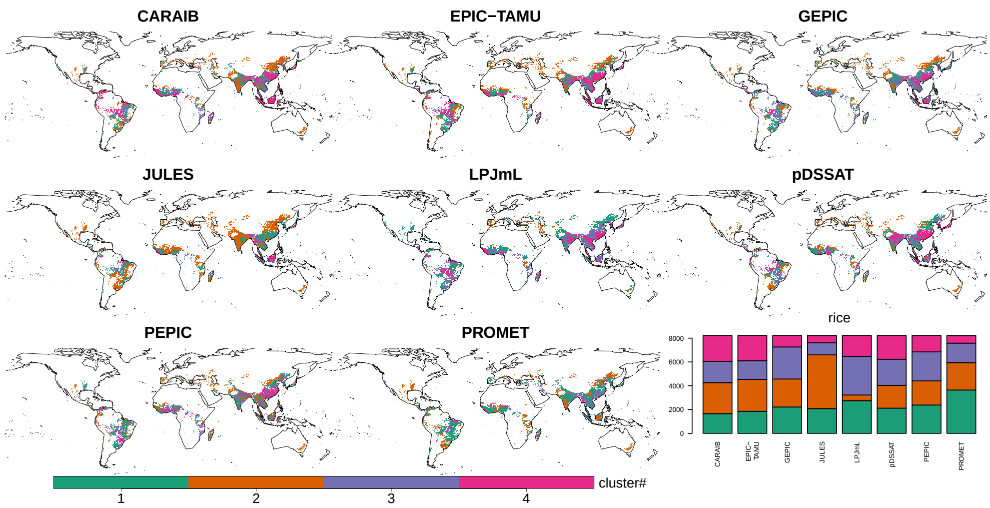

Figure S13. As Figure 4, but for rice.

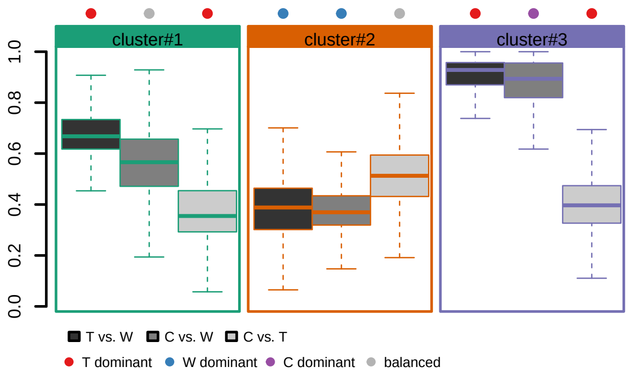

Figure S14. As Figure 3, but for soybean.

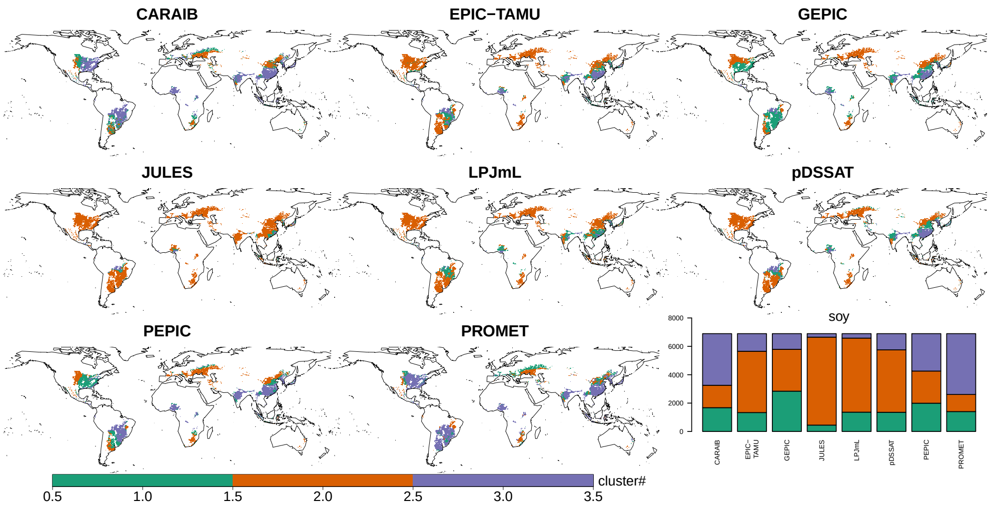

Figure S15. As Figure 4, but for soybean.

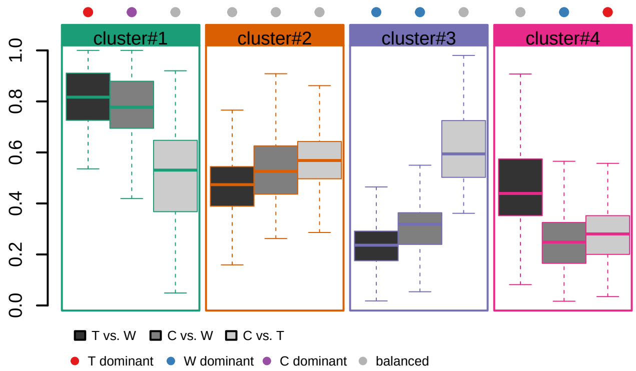

Figure S16. As Figure 3, but for spring wheat.

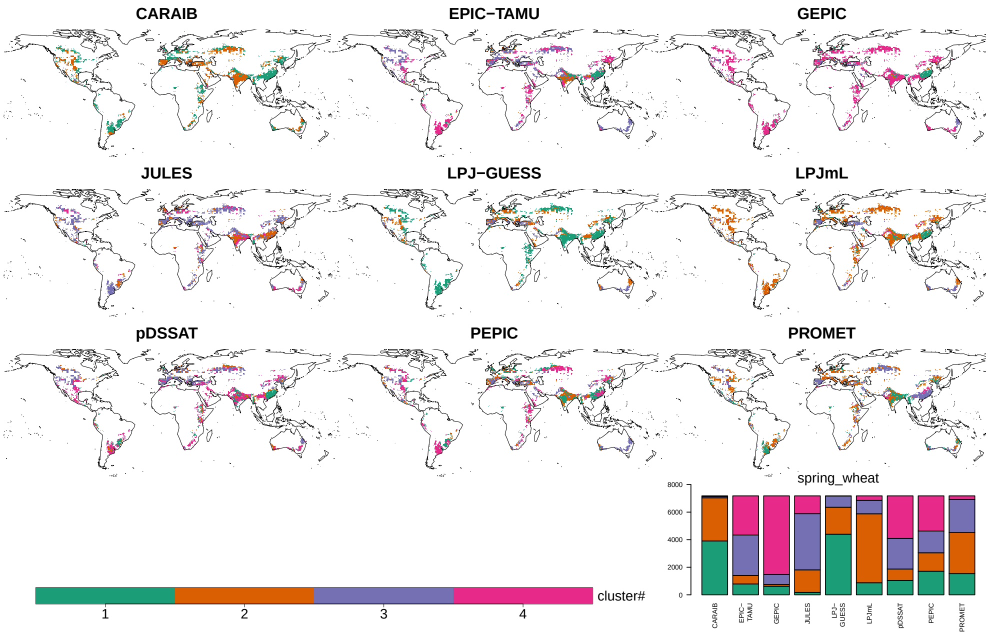

Figure S17. As Figure 4, but for spring wheat.

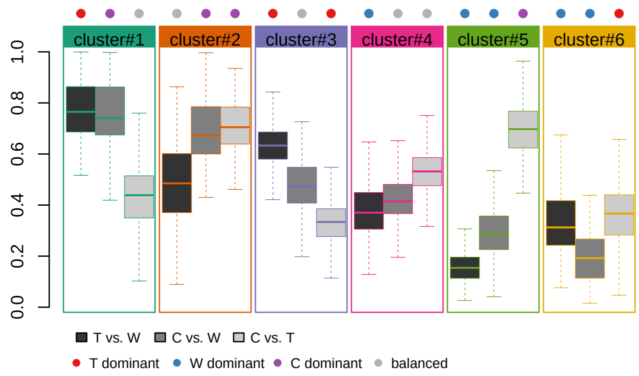

Figure S18. As Figure 3, but for winter wheat.

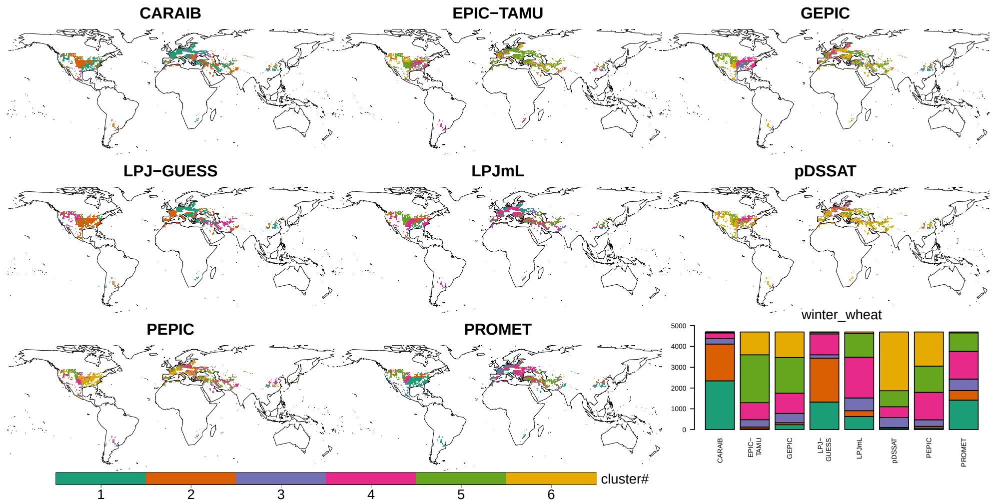

Figure S19. As Figure 4, but for winter wheat.

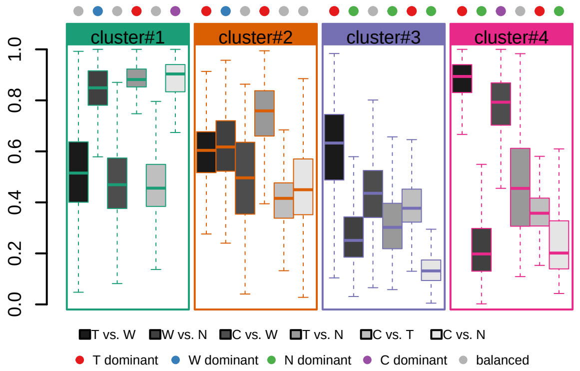

Figure S20. As Figure 5, but for rice.

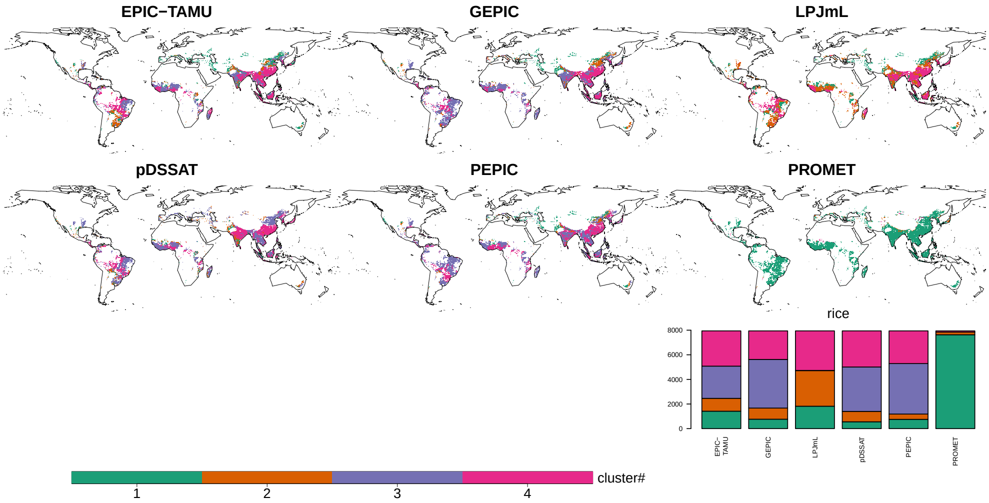

Figure S21. As Figure 6, but for rice.

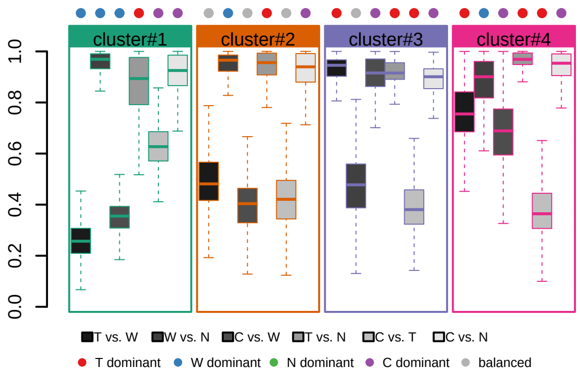

Figure S22. As Figure 5, but for soybean.

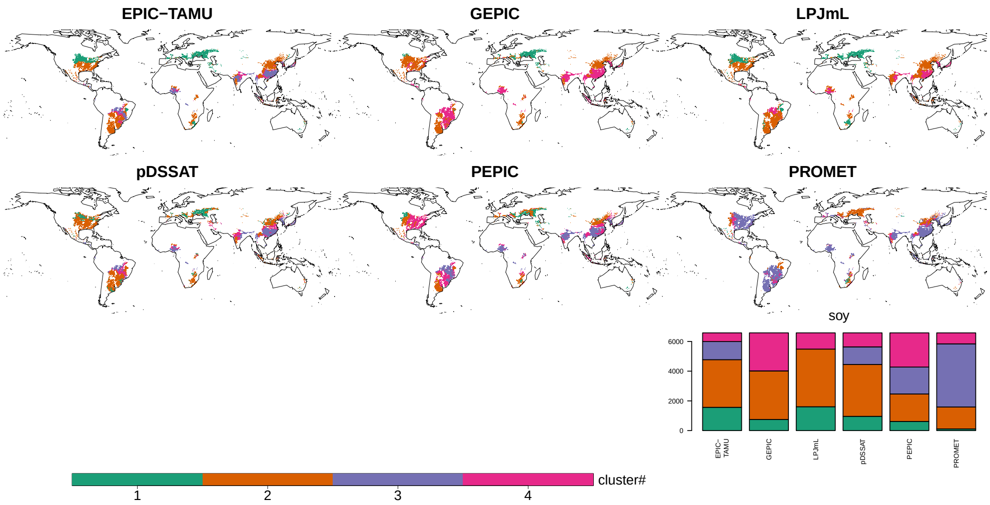

Figure S23. As Figure 6, but for soybean.

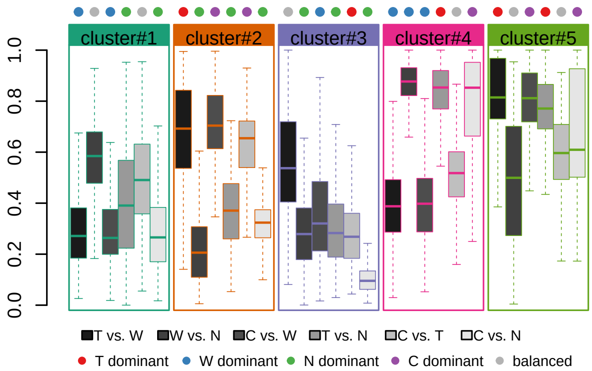

Figure S24. As Figure 5, but for spring wheat.

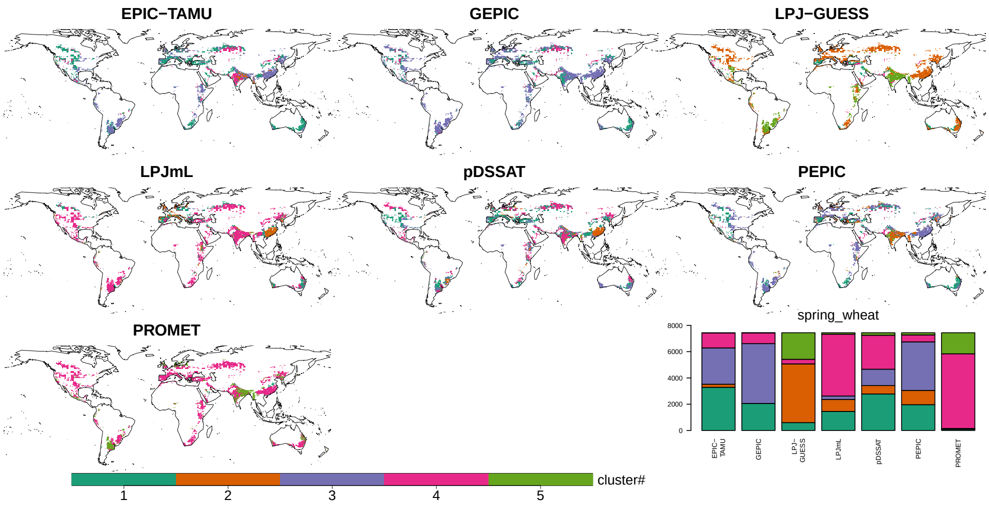

Figure S25. As Figure 6, but for spring wheat.

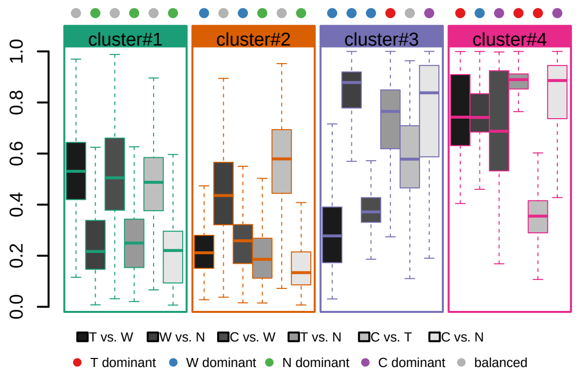

Figure S26. As Figure 5, but for winter wheat.

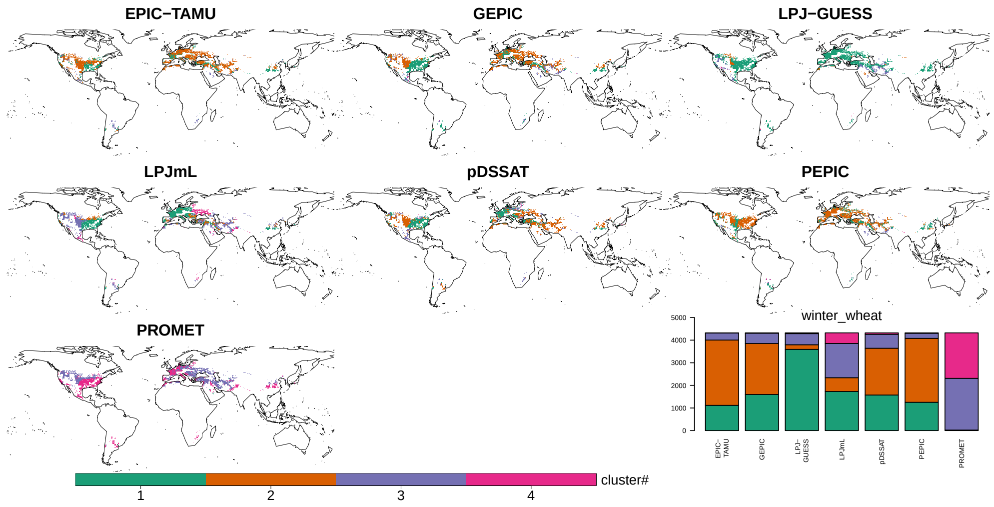

Figure S27. As Figure 6, but for winter wheat.

functional relationships

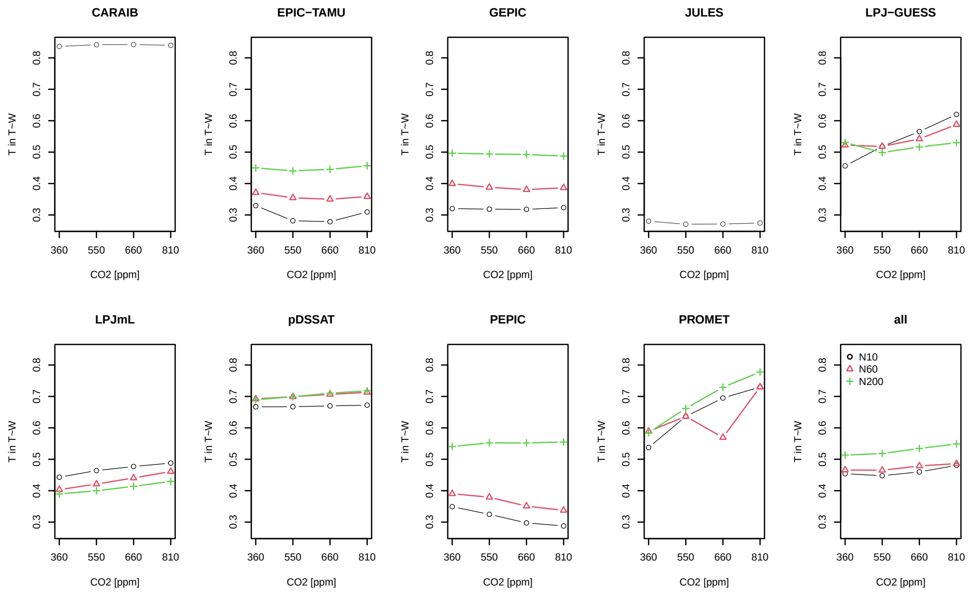

Figure S28. Same as Figure 7 but for maize.

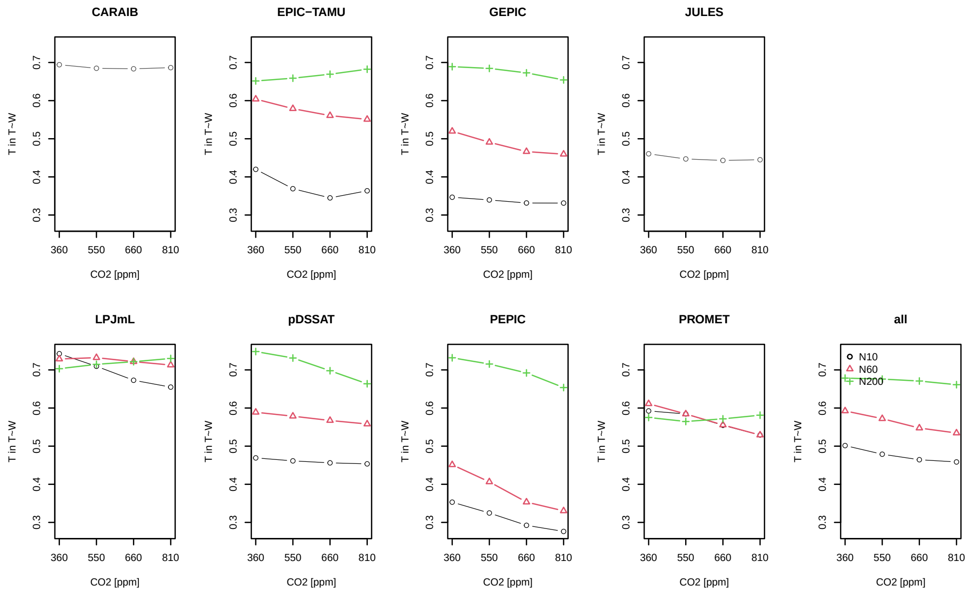

Figure S29. Same as Figure 7 but for rice.

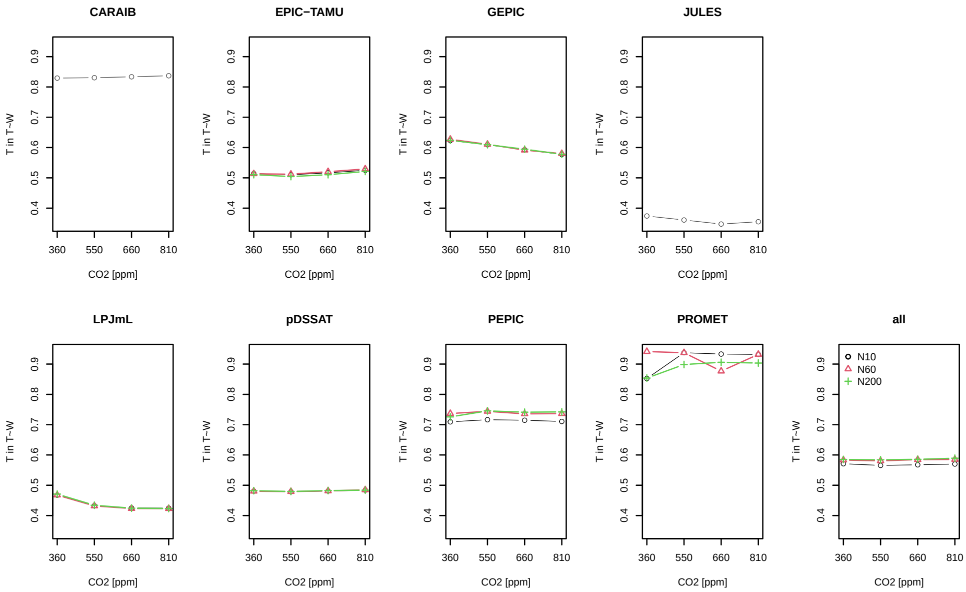

Figure S30. Same as Figure 7 but for soybean.

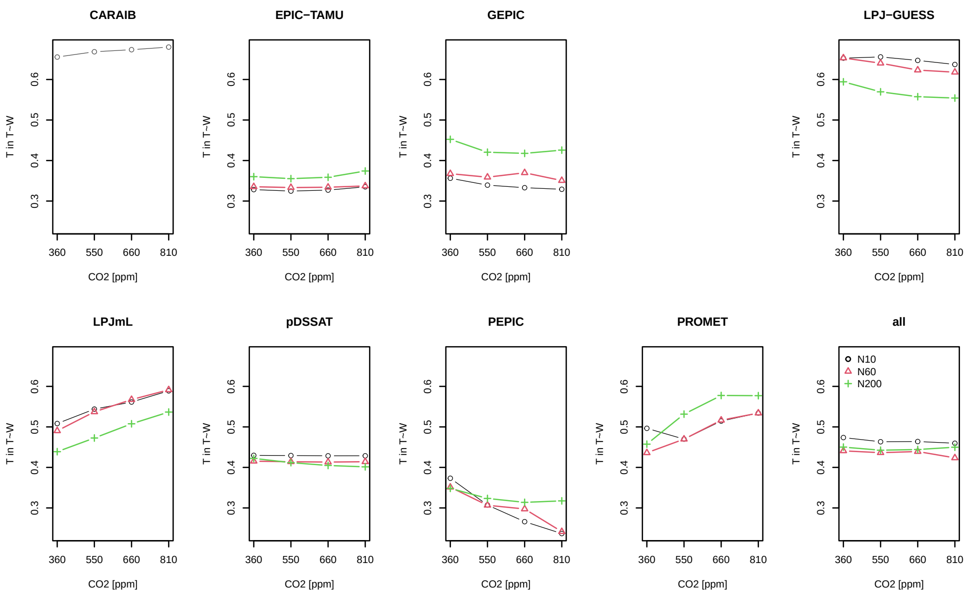

Figure S31. Same as Figure 7 but for winter wheat.