



FACCE-MACSUR

Modelling long term effects of cropping and managements systems on soil organic matter, C/N dynamics and crop growth

Petr Hlavinka^{1*}, Jørgen E. Olesen², Kurt Christian Kersebaum³, Miroslav Trnka¹, Eva Pohankova¹, Tommaso Stella³, Roberto Ferrise⁴, Marco Moriondo⁵, Gerrit Hoogenboom⁶, Vakhtang Shelia⁶, Claas Nendel³, Markéta Wimmerová¹, Alex Topaj⁷, Sergey Medvedev⁷, Domenico Ventrella⁸, Margarita Ruiz-Ramos⁹, Alfredo Rodríguez Sánchez⁹, Jozef Takáč¹⁰, Ravi H. Patil², Isik Öztürk², Munir Hoffman¹¹, Anne Gobin¹², Reimund P. Rötter¹¹

¹ Mendel University of Brno, Zemedelska 1, 613 00 Brno, Czech Republic

² University of Aarhus, Blichers Alle 20, 8830, Tjele, Denmark

³ Leibniz Centre for Agricultural Landscape Research (ZALF), Eberswalder Str. 84, 15374 Müncheberg, Germany

⁴ University of Florence, Piazzale delle Cascine 18, 50144 Firenze, Italy

⁵ Institute of Biometeorology of the National Research Council (CNR-IBIMET), 50145 Firenze, Italy

⁶ University of Florida, Gainesville, FL, USA

⁷ Agrophysical Research Institute, Grahzdansky pr. 14, St.-Petersburg, Russia

⁸ Consiglio per la Ricerca in Agricoltura e L'analisi Dell'economia Agraria, Unità di Ricerca per i Sistemi Colturali degli Ambienti Caldo-Aridi, I-70125 Bari, Italy

⁹ Universidad Politécnica de Madrid, ETSIAAB, 28040 Madrid, Spain

¹⁰ Soil Science and Conservation Research Institute, Gagarinova 10, 827 13 Bratislava, Slovak Republic

¹¹ Crop Production Systems in the Tropics, Georg-August-Universität Göttingen, Grisebachstr. 6, 37077, Göttingen, Germany

¹² Flemish Institute for Technological Research (Vito NV), B-2400 Mol, Belgium

* petr_hlavinka@centrum.cz

Instrument:	Joint Programming Initiative
Topic:	Agriculture, Food Security, and Climate Change
Project:	Modelling European Agriculture with Climate Change for Food Security (FACCE-MACSUR2)
Start date of project:	1 June 2015
Duration:	24 months
Theme, Work Package:	CropM 1
Deliverable reference num.:	D-C1.3
Deliverable lead partner:	University Aarhus
Due date of deliverable:	month 24
Submission date:	2017-06-09
Confidential till:	2017-12-31 (only the abstract may be published)

Revision	Changes	Date
1.0	First Release	2017-05-31

Abstract/Executive summary

While simulation of cropping systems over a few years might reflect well the short term effects of management and cultivation, long term effects on soil properties and their consequences for crop growth and matter fluxes are not captured. Especially the effect on soil carbon sequestration/depletion is addressed by this task. Simulations of an ensemble of crop models are performed as transient runs over a period of 120 year using observed weather from three stations in Czech Republic (1961-2010) and transient long time climate change scenarios (2011-2080) from five GCM of the CMIP5 ensemble to assess the effect of different cropping and management systems on carbon sequestration, matter fluxes and crop production in an integrative way. Two cropping systems are regarded comprising two times winter wheat, silage maize, spring barley and oilseed rape. Crop rotations differ regarding their organic input from crop residues, nitrogen fertilization and implementation of catch crops. Models are applied for two soil types with different water holding capacity. Cultivation and nutrient management is adapted using management rules related to weather and soil conditions. Data of phenology and crop yield from the region of the regarded crops were provided to calibrate the models for crops of the rotations. Twelve models were calibrated in this first step. For the transient long term runs results of four models were submitted so far. Outputs are crop yields, nitrogen uptake, soil water and mineral nitrogen contents, as well as water and nitrogen fluxes to the atmosphere and groundwater. Changes in the carbon stocks and the consequences for nitrogen mineralisation, N fertilization and emissions also considered.

Table of Contents

Abstract/Executive summary	1
Table of Contents	1
Introduction.....	2
Methods.....	2
Results	4
Discussion	5
References	7