

Crop yield and soil organic matter after long-term straw return to soil in China

Jinzhou Wang · Xiujuan Wang · Minggang Xu · Gu Feng ·
Wenju Zhang · Chang'ai Lu

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Abstract Straw has been commonly incorporated to maintain soil fertility and crop productivity in China, but effects of long-term straw incorporation on crop yield, soil organic carbon (SOC) and total nitrogen (TN) have not been thoroughly evaluated. Thus, this study analyzed data collected in long-term (>10-year) trials across the major agricultural zones of China. Across the trials, relative to straw removal, straw return significantly increased crop yield, SOC and TN (by 7.0, 10.1 and 11.0 %, respectively). In some trials with winter wheat in northern China, straw return

reduced yield by 0.6–7.1 %. The effects of straw return on SOC and TN were not significantly affected by experimental duration, land use type and cropping system, but positively and linearly related to the inputs of straw-C and -N, respectively. Interestingly, SOC and TN responses to straw return were decoupled in upland and upland-paddy soils in China, but not in paddy soils. Mean values of straw-C sequestration efficiency (7.7, 10.3 and 9.4 %, under corn, wheat and rice, respectively) indicate that 100 % straw return could increase SOC by 281.7 Tg C in 18 years (the mean experimental period of the considered studies) in China. Our analyses demonstrate that straw return is an effective practice for sustaining crop productivity and soil fertility in large parts of China, but site-specific factors should be considered.

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J. Wang · M. Xu (✉) · W. Zhang · C. Lu
Ministry of Agriculture Key Laboratory of Crop Nutrition and Fertilization, Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing 100081, China
e-mail: mgxu@caas.ac.cn

J. Wang · G. Feng
College of Resources and Environmental Sciences, China Agricultural University, Beijing 100094, China

J. Wang · X. Wang
Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD 20740, USA

X. Wang
College of Global Change and Earth System Science, Beijing Normal University, Beijing 100875, China

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Introduction

As natural supplements containing valuable nutrients and organic carbon (C), crop straws are often incorporated into soils in sustainable agriculture (Lal 2009). The practice has some disadvantages, e.g., straw can interfere with crop planting, harbor pathogens or insect pests, and immobilize nutrients from soil and