Science of the Total Environment 609 (2017) 1640–1649

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Cropping systems affect paddy soil organic carbon and total nitrogen stocks (in rice-garlic and rice-fava systems) in temperate region of southern China

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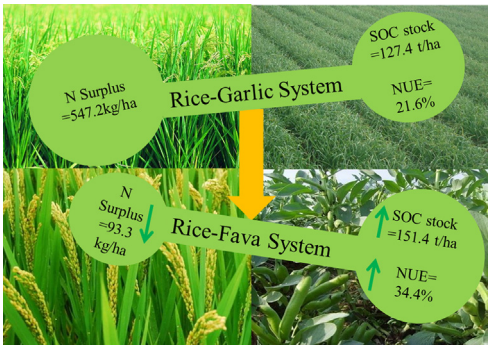
HIGHLIGHTS

- Impacts of cropping systems on paddy SOC and TN stocks were evaluated.
- Paddy SOC sequestration increased after rice-garlic system was changed to rice-fava.
- Rice-fava system reduced soil N surplus and the risk of N loss compared to rice-garlic.
- Rice-fava system was a better option for the environment in temperate regions compared to rice-garlic.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 10 May 2017
Received in revised form 15 June 2017
Accepted 26 June 2017
Available online xxxx

Keywords:
Nitrogen balance
Paddy soil
Rice-fava system
Rice-garlic system
Soil organic carbon stock
Total nitrogen stock

ABSTRACT

The accumulation of soil organic carbon (SOC) in agricultural soils is critical to food security and climate change. However, there is still limited information on the dynamic trend of SOC sequestration following changes in cropping systems. Paddy soils, typical of temperate region of southern China, have a large potential for carbon (C) sequestration and nitrogen (N) fixation. It is of great importance to study the impacts of changes in cropping systems on stocks of SOC and total nitrogen (TN) in paddy soils. A six-year field experiment was conducted to clarify the dynamics of SOC and TN stocks in the paddy topsoil (0–20 cm) when crop rotation of rice (*Oryza sativa* L.) -garlic (*Allium sativum*) (RG) was changed to rice-fava (*Vicia faba* L.) (RF), and to examine how the dynamics were affected by two N management strategies. The results showed that SOC stocks increased by 24.9% in the no N (control) treatment and by 18.9% in the treatment applied with conventional rate of N (CON), when RG was changed to RF. Correspondingly, TN stocks increased by 8.5% in the control but decreased by 2.6% in the CON. Compared with RG, RF was more conducive to increase the contents of soil microbial biomass C and N. Moreover, changing the cropping system from RG to RF increased the year-round N use efficiency from 21.6% to 34.4% and reduced soil N surplus in the CON treatment from 547 kg/ha to 93 kg/ha. In conclusion, changes in the cropping system from RG to RF could markedly increase SOC stocks, improve N utilization, reduce soil N surplus, and thus

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http://dx.doi.org/10.1016/j.scitotenv.2017.06.226