Organic substitution accumulates more nitrogen in soil while maintaining unchanged nitrogen use efficiency in rice-fava bean rotation system

Panlei Wang[1], Bin Wang[2], Anqiang Chen[3], Xi Sun[3], Caiyan Du[3], Hongye Zhu[3], Yanhua Pan[3], and Li Tang[1]

[1]Yunnan Agricultural University
[2]Chinese Academy of Agricultural Sciences Institute of Environment and Sustainable Development in Agriculture
[3]Yunnan Academy of Agricultural Sciences

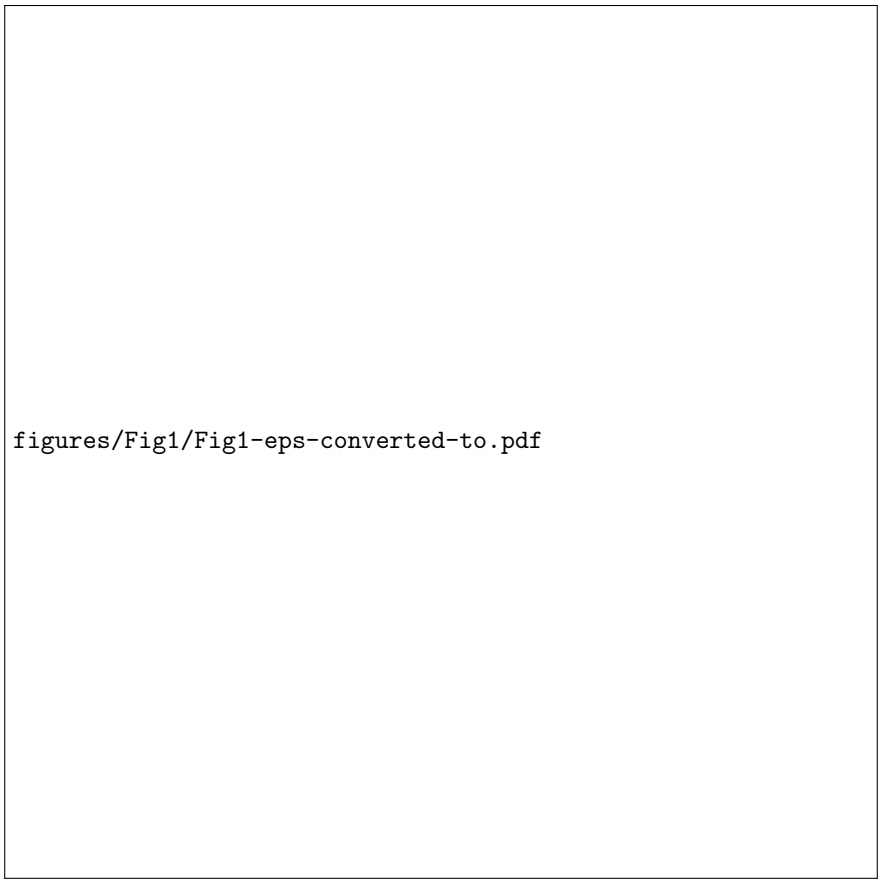
May 16, 2022

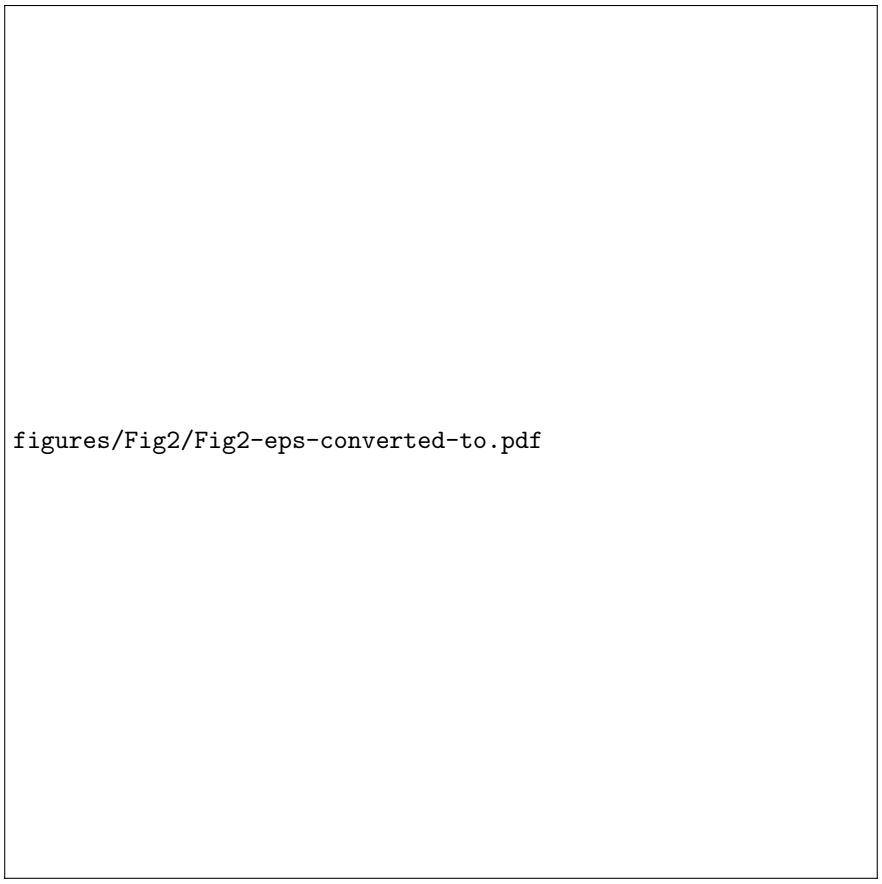
Abstract

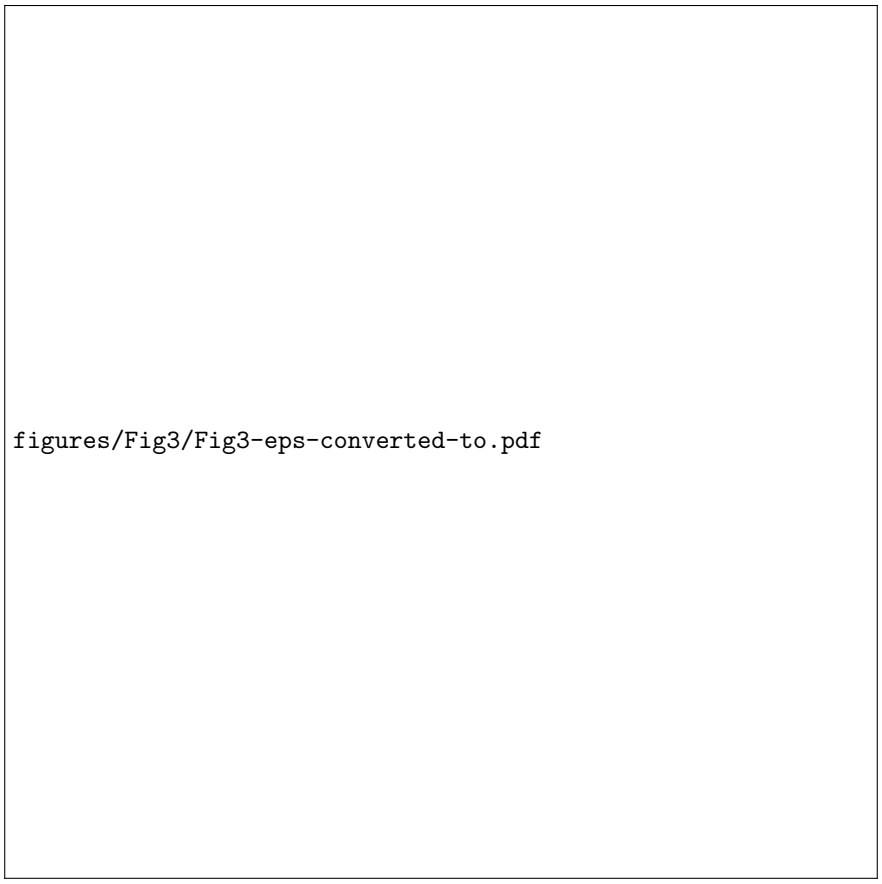
Organic substitution management (OSM) is critical for soil conservation and nitrogen efficiency. However, assessment of soil N pool and system NUE under paddy-upland rotation systems after OSM introduction is still lacking, especially given the system's alternating wetting-drying soil environment and double cropping. Here, the response of soil nitrogen and crop nitrogen use efficiency to OSM was evaluated in 2018, 2019 and 2020, basing on a long-term rice-fava bean rotation experiment started in 2015. Soil nitrogen, soil enzymes and microbial functions were also used to identify the key factors influencing nitrogen use in response to OSM. The results showed that in comparison to chemical fertilization, OSM increased the soil total nitrogen in both cropping seasons, with increases of 13.1% for the rice season and 16.3% for the fava bean season, respectively. However, nitrogen use efficiency (NUE) showed season-specific responses to OSM. OSM decreased NUE by 18.2% in the rice season but decreased by 8.0% in the fava bean season. Based on the SEM analysis results, we suggest that the opposite response of NRE and NUE to OSM across the studied seasons was mainly attributed to the difference in crop nitrogen requirements and soil hydrological conditions. In conclusion, in paddy-upland rotation areas where have increasing demand for food and chemical fertilizers are currently abused, the use of OSM has potential to curb regional soil degradation due to its high capacity of improving soil quality while ensuring no yield reduction.

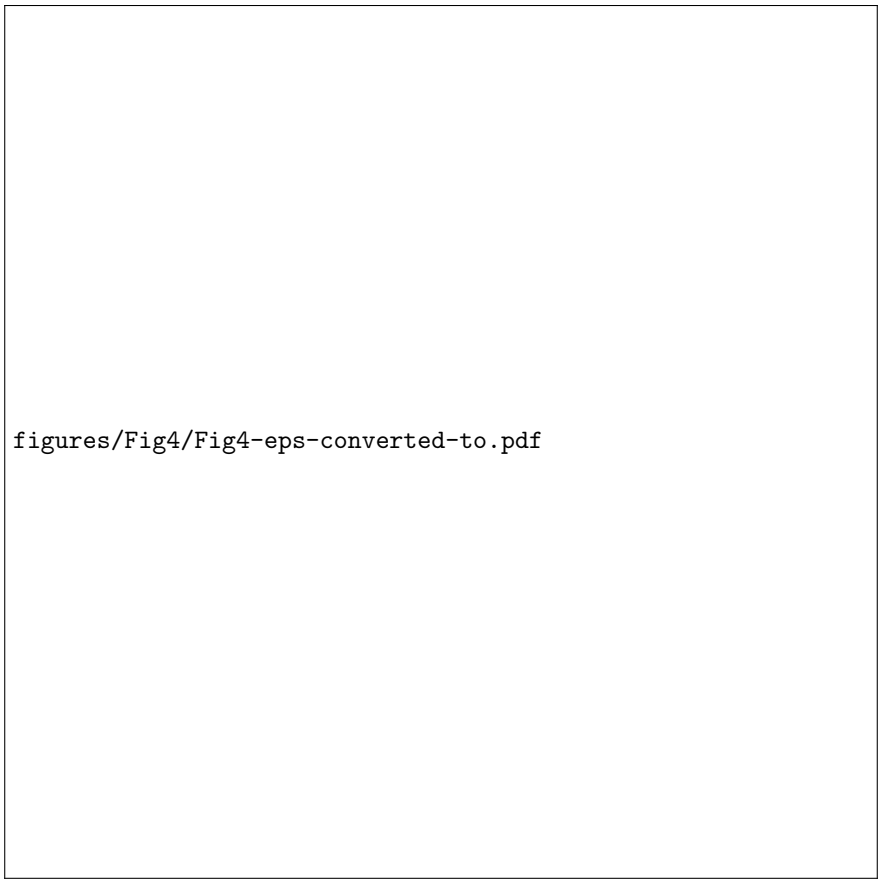
Hosted file

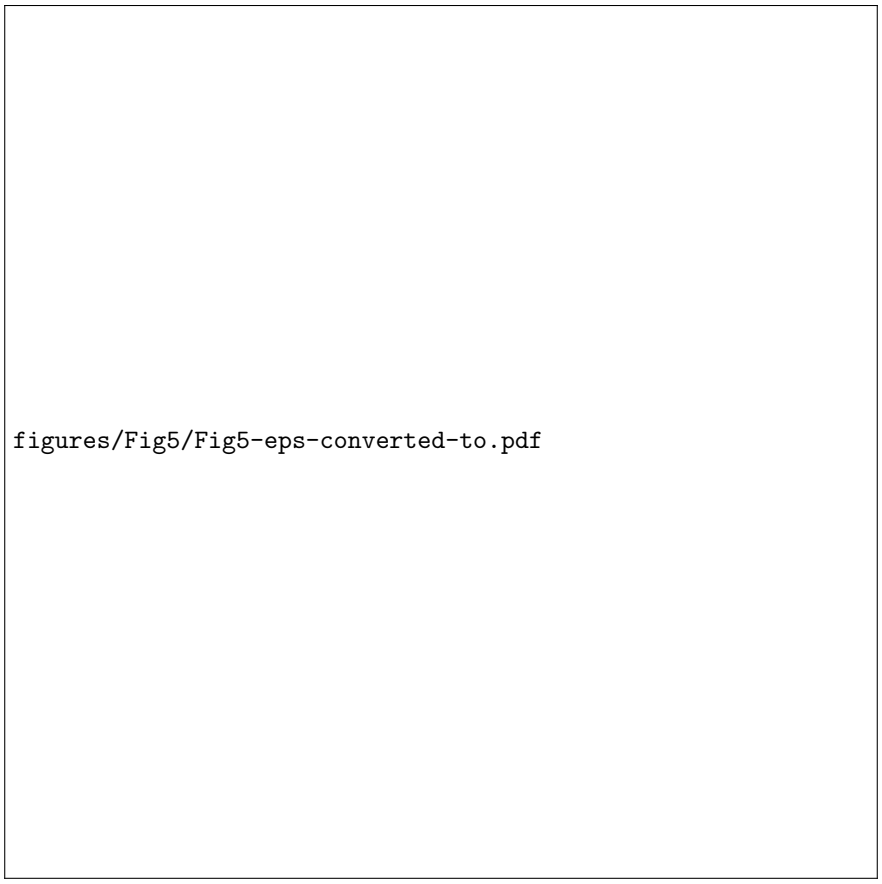
`Manuscript.docx` available at https://authorea.com/users/482887/articles/569274-organic-substitution-accumulates-more-nitrogen-in-soil-while-maintaining-unchanged-nitrogen-use-efficiency-in-rice-fava-bean-rotation-system

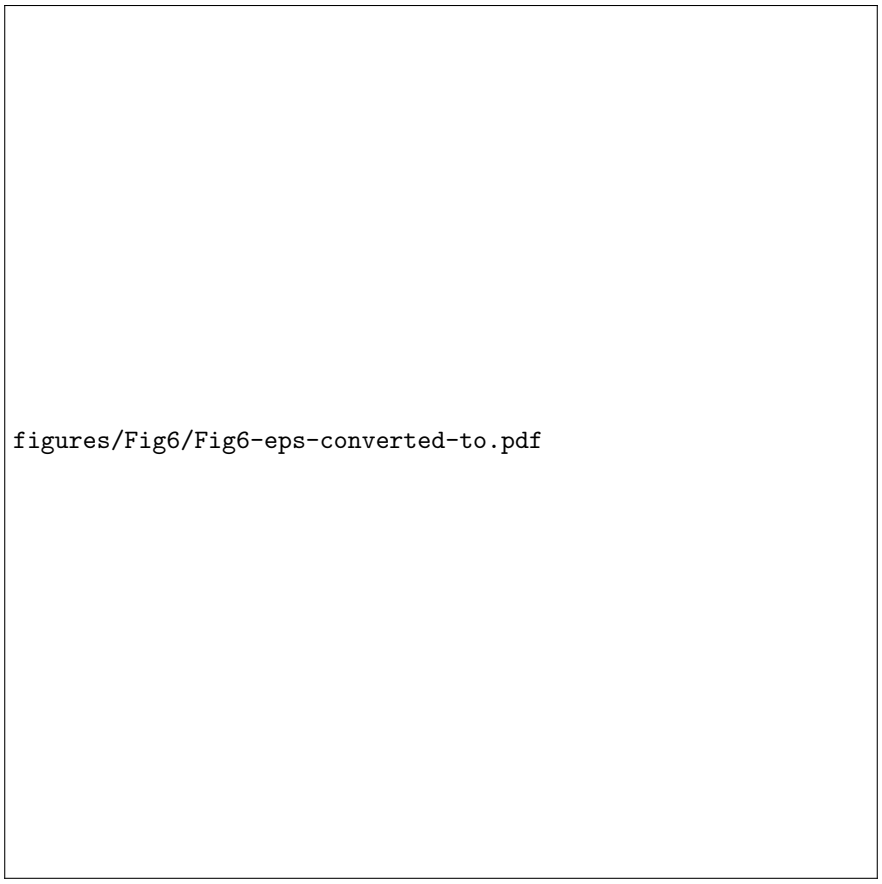












Hosted file

Table.docx available at https://authorea.com/users/482887/articles/569274-organic-substitution-accumulates-more-nitrogen-in-soil-while-maintaining-unchanged-nitrogen-use-efficiency-in-rice-fava-bean-rotation-system