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"Resilience of agricultural systems against crises"

ASsessing ThE Risk of Water Saving Ground Cover RICe Production Systems on Regional Soil Carbon and Nitrogen Stocks (ASTERICS)

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Abstract

In China rice production is increasingly challenged by the growing demand of its rising population and the increasing demand for water by the industry/ private sector. The latter is resulting in shortages in irrigation water for lowland rice (>90 % of total area) as well as to a decline in water quality. Therefore, China enforced its search for expanding and to intensify rice cultivation in regions which were formerly of only marginal importance. One of the most promising techniques to overcome problems in water shortage as well as in temperature limitations of rice production is the so-called Ground Cover Rice Production System (GCRPS). Here, lowland rice varieties are used and the soil is kept moist between irrigation periods by covering materials, thus reducing water demand by 50 up to 90 %. Keeping a soil constantly moist but not waterlogged is likely to accelerate mineralisation of soil carbon (C) stocks – with negative impacts for soil fertility and nutrient retention- and potentially decrease crop nitrogen (N) use efficiency due to increased losses of fertiliser N to the atmosphere or hydrosphere. In our study we determined the effects of GCRPS on soil carbon stocks, $d^{13}C$ and $\delta^{15}N$ signals and mineralisation activity of the soil by sampling chrono-sequences of land use as well as a large number of adjacent pairs (50+) of traditional lowland and GCRPS rice production in Hubei province. Results on changes of soil $\delta^{15}N$ signals but also SOC concentrations shows, that introduction of GCRPS has already resulted in detectable and significant changes in soil C and N cycling with so far largely unexplored consequences for biosphere-atmosphere exchange. But against expectation rice production via the GCPRS technique resulted in increased soil C and N stocks, increased N use efficiencies and increased yields. Possibly mechanisms how GCRPS is positively affecting C and N cycling in rice systems will be discussed.

Keywords: Environmental sustainability, ground cover technique, soil C/N stocks, rice

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