

Performance of Rice Systems, Irrigation and Organic Carbon Storage

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Three-year (2007/2008–2009/2010) field experiment was conducted at the Directorate of Water Management Research Farm under Deras command in Odisha, India to assess the crop yield, irrigation water use efficiency (WUE), sustainable yield index (SYI), land utilization index (LUI) and changes in soil organic carbon (SOC) for dominant rice systems, viz. rice-maize-rice, rice-cowpea-rice, rice-sunflower-rice, rice-tomato-okra and rice-fallow-rice. Results revealed that crop yield, in terms of total system productivity (TSP) increased by 273, 113, 106 and 58% in rice-tomato-okra, rice-sunflower-rice, rice-maize-rice and rice-cowpea-rice, respectively, when compared to rice-fallow-rice. Irrigation WUE was 49–414% greater in rice-based diversified systems than the existing rice-fallow-rice (2.98 kg ha⁻¹ mm⁻¹). The SYI ranged from 0.65 to 0.75 indicating greater sustainability of the systems. Three crops in a sequence resulted in greater LUI and production efficiency compared to rice-fallow-rice. The gross economic return and benefit-cost ratio was in the order: rice-tomato-okra > rice-maize-rice > rice-sunflower-rice > rice-cowpea-rice > rice-fallow-rice. The SOC storage ranged from 40.55 Mg ha⁻¹ in rice-fallow-rice to 46.23 Mg ha⁻¹ in rice-maize-rice system. The other systems had also very close values of SOC storage with the rice-maize-rice system; there was a positive change of SOC (7.20 to 12.52 Mg ha⁻¹) for every system, with highest in rice-maize-rice system and the lowest in rice-fallow-rice. It is concluded that the appropriate rice-based system would be rice-tomato-okra followed by rice-maize-rice, rice-sunflower-rice and rice-cowpea-rice. Rice-fallow-rice is not advisable because of its lower productivity, lower LUI and economic return.