

## Rice Yield and N Use Efficiency in a Long-Term Rice-Pastures-Crops Rotations Experiment in Uruguay

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### ABSTRACT

In Uruguay, rice frequently rotate with perennial pastures (mix of grasses and legumes) for livestock production. This allows sustain high yields, preserve natural resources, diversify incomes and minimize the use of agrochemicals. We evaluated the productivity and the partial factor productivity of N (PFPN: kg grain/kg N applied) in six no-tillage rice-pasture-other crops rotations (seasons 2016-2019) in a long-term experiment initiated in 2012 in Uruguay. Design was a randomized complete block with three replications and all rotation phases simultaneous. Treatments were established in a Natraquoll in a 30 years rice-pasture rotation field: 1) Rice-Rice-Long Pasture of *Festuca arundinacea*, *Trifolium repens* and *Lotus corniculatus* (RLP, 5yr); 2) Rice-Short Pasture of *Lolium multiflorum* and *Trifolium pratense* (RSP, 2yr); 3) Rice-Soybean-Soybean-Rice-Pasture of *Festulolium spp.* and *Lotus corniculatus* (RSyP, 6yr); 4) Rice-Soybean-Rice-Sorghum (RSyRSg, 4yr); 5) Rice-Soybean (RSy, 2yr); and, 6) Continuous Rice (CR, 1yr). Cover crops of *Lolium multiflorum* and *Trifolium alexandrinum* L. grown between cash crops in all rotations. Nitrogen fertilizer was splitted at V4 and R0 rice stages based in soil nitrogen mineralization potential of each rotation. The highest rice yield were observed in RSP, RSyP, RSyRSg and RSy (10.14 Mg.ha<sup>-1</sup>) and the lowest in CR (9.50 Mg.ha<sup>-1</sup>). Rice productivity after soybeans and pastures was 11.5% and 6.6% greater respectively than after rice or sorghum (9.38 Mg.ha<sup>-1</sup>). Second rice of RLP had the poorest productivity (9.15 Mg.ha<sup>-1</sup>), while rice after soybeans of RSyRSg had the greatest (10.80 Mg.ha<sup>-1</sup>). The highest PFPN was observed in RSy and RSyP (121 kg.kg<sup>-1</sup>) and the lowest in CR (60 kg.kg<sup>-1</sup>). On average, rice seeded after pastures reached a higher PFPN (117 kg.kg<sup>-1</sup>) compared with rice after rice (76 kg.kg<sup>-1</sup>). For Mollisols under rice-pasture rotations in temperate-subtropical climates, there are rotation intensification alternatives (excluding CR) that allows sustain productivity maintaining high PFPN during their stabilization.

**Key words:** no-tillage, sustainable intensification, crop diversification