

Intensification alternatives to rice-pasture systems: energy use efficiency

I Macedo¹, L Carrasco-Letelier², JI Velazco³, G Siri-Prieto⁴ and JA Terra⁵

¹ INIA Uruguay, Treinta y Tres, Uruguay, imacedo@inia.org.uy

² INIA Uruguay, La estanzuela, Uruguay, lcarrasco@inia.org.uy

³ INIA Uruguay, Treinta y Tres, Uruguay, jvelazco@inia.org.uy

⁴ Facultad de Agronomía-UdelaR, Paysandú, Uruguay, siriprieto@fagro.edu.uy

⁵ INIA Uruguay, Treinta y Tres, Uruguay, jterra@inia.org.uy

ABSTRACT

Agricultural ecosystems provide the food, fiber and fuel needed for population. Achieve high efficiencies and low energy consumption are necessary to achieve sustainable systems. Rice in Uruguay has historically rotated with pastures. The aim of this study was to evaluate different intensification ways on energy return on investment (EROI), energy input (EI) and energy output (EO) for four rotation systems. Systems were continuous rice (RC); rice-soybean (R-S) and rice-pasture, with pasture for 1.5 years (R-PS); or 3.5 years, (R-PL); all treatments included cover crops during winter. Data from a field experiment conducted since 2012 corresponding to harvest 2015-2016 and 2016-2017 were used. Life cycle analysis methodology was used, study boundaries were gate to gate and functional unit was MJ ha⁻¹ of rice grain, soybean grain and meat production. Systems R-PS and RC decrease EROI by 8% and 6.5% respectively compared to R-PL (6.1 MJ MJ⁻¹), Rice rotating with soybean achieved the highest EROI (7.2 MJ MJ⁻¹). Energy output in systems without perennial pastures was 74% higher than those that rotate rice and pastures (73,000 MJ (ha yr)⁻¹). In contrast, R-PL and R-PS systems presented 40% less EI than the R-S and RC systems (20,600 MJ (ha yr)⁻¹). Include shorter pastures or realize rice monoculture as a way of rice-pasture intensification implied a decrease in energy efficiency, only rice rotating with soybean improve the energy efficiency. However, R-PL was the system that had the lowest energy inputs, which it makes more sustainable system in terms of energy.

Key words: rice, EROI, rotations, sustainability, food production.