

The Energy Cost of Cambodian Lowland Rice Grown Under Different Establishment Methods

Sem Savuth^{1*}, Teodoro C. Mendoza^{2*}, Roselyn F. Paelmo² and Carmelita M. Rebancos³

¹Department of Environmental Education, General Directorate of Environmental Knowledge and Information, Ministry of Environment, Cambodia; ²Institute of Crop Science, College of Agriculture and Food Science, UPLB, 4031 College Los Baños, Laguna, Philippines; ³School of Environmental Science and Management, UPLB, 4031 College Los Baños, Laguna, Philippines. *Corresponding author, sem_savuth@yahoo.com, ecofarm.mndz2011@gmail.com

Agricultural practices play an important role in increasing crop yields. Consequently, higher crop yield is associated with high energy use. In Cambodia, rice is grown using different establishment methods. But high amount of energy is required to grow rice until the time it is ready for consumption. This study aimed to estimate the various energy use from farm to plate of lowland rice grown under three methods, namely: direct seeded rice (DSR), transplanted rice (TPR) and System of Rice Intensification (SRI). One hundred sixty-one farmers and six rice millers were interviewed using a structure questionnaire in July 2017. Results revealed that the total energy inputs in the field production were in the following order: TPR, DSR, and SRI at 10843.65 MJ ha⁻¹, 10323.34 MJ ha⁻¹, and 7051.61 MJ ha⁻¹, respectively. The energy used to produce a kilogram of paddy rice was highest in TPR (3.45 MJ kg⁻¹) and lowest in SRI (2.08 MJ kg⁻¹). On the other hand, the total energy output of 56742.30 MJ ha⁻¹ from a grain yield of SRI was significantly higher from DSR but not with TPR. The embedded energy for machine use was not that high because the machinery lifespan considered was 10 years which was spread throughout the operational working duration. Nitrogen was the energy hotspot at 40-50% of the total energy bill in TPR and DSR but not in SRI. Optimizing N application can reduce the total energy input in the rice production. The energy hotspot of SRI was human labor which was 24% of the total energy bill. All of the measures of energy use showed that SRI was the best practice (lowest breakeven energy yield, lowest energy to produce 1 kg grain, highest energy use efficiency, energy productivity and net energy gain).

The total energy use of rice in Cambodia from farm to plate was 4.30 MJ kg⁻¹ or about 0.09 Liter Diesel Oil Equivalent (LDOE) kg⁻¹ wherein 69.30% was used in production, 26.28% in post-production and 4.42% in cooking. The major contributor of the energy costs in post-production was transport. When rice was milled and transported up to 280km-distance, the energy used in post-production increased 2.05 times when compared to local consumption (5km-distance).

Keywords: Direct seeded rice, energy bill, energy hotspot, system of rice intensification, transplanted rice