

## **Analysis of Energy Inputs in Rice Production at Varying Yield Levels among Selected Towns of Laguna, Philippines**

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### **Abstract**

This study was conducted to determine variations in energy usage of rice production among farmers in three towns of Laguna province in Philippines, namely Pagsanjan, Pila, and Santa Cruz. Using a pre-tested structured questionnaire, 176 farmers were interviewed in May 2016. Three farmer groups were identified based on their yield levels during the dry cropping season of 2016. Specifically, these are (a) Low Yield Group (LYG): 3.0-4.0-ton ha<sup>-1</sup>, (b) Average Yield Group (AYG): 4.5-5.5-ton ha<sup>-1</sup>, and (c) High Yield Group (HYG): 6.0-7.5-ton ha<sup>-1</sup>. Results revealed that total energy inputs varied among the three yield level groups. LYG used the least amount at 9,871.00 MJ ha<sup>-1</sup>, AYG at 13,940.00 MJ ha<sup>-1</sup>, and HYG at 17,627.10 MJ ha<sup>-1</sup>. This translates to 0.06 LDOE kg<sup>-1</sup> of unmilled rice. The energy usage per kg of unmilled rice did not differ among the three yield groups, although the energy usage was highest in the HYG because the high energy use was offset by the high yield (Total energy input (MJ ha<sup>-1</sup>) ÷ Grain yield (kg ha<sup>-1</sup>)).

Fertilizer contributed the highest energy input at about 53-67%. Among the fertilizers, nitrogen fertilizer was the highest contributor (about 47-62%). Pesticides inputs were second highest contributor of the total energy input at 10.12% to the total energy input. HYG also used the most pesticides at 1760.55 MJ ha<sup>-1</sup>, AYG at 1445.10 MJ ha<sup>-1</sup>, and LYG at 997.27 MJ ha<sup>-1</sup>. Achieving high yield was correlated to high energy input ( $r = 0.75^{**}$ ) but negatively correlated with energy use efficiency ( $r = -0.47^{**}$ ).

Energy use efficiency (EuE) values of various yield groups was not significantly different at 5.89, 6.61 and 6.05 for LYG, AYG, and HYG, respectively since the high energy input led to high grain yield which offset the high energy used in the HYG. By location, however, the rice production in Pila had the highest EuE at 6.69, followed by Sta. Cruz at 5.79, and Pagsanjan at 5.64 because the grain yield differences among the three yield groups were narrower in Pila than Pagsanjan and Sta. Cruz.

Nitrogen fertilizer was the key input to be adjusted to obtain not only high grain yield but also to reduce total energy bill, and to enhance energy use efficiency in rice production. Two major approaches in reducing the fertilizer energy bill in rice production are discussed, namely: (1) using nitrogen fertilizer efficiently and (2) not using them at all, or using other sources like organic fertilizers. Integrated pest management should be considered to reduce energy input due to pesticides.