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Reusing pineapple residue to promote nutrient cycling and reduce GHG emissions in small-scale pineapple cultivation

Reena Macagga[1], Rinan Bayot[2], Pearl Sanchez[2], Mathias Hoffmann[1]

[1] *Leibniz Centre for Agric. Landscape Res. (ZALF), Germany*

[2] *University of the Philippines Los Baños, College of Agriculture and Food Science, Agricultural Systems Institute, Philippines*

Abstract

The Philippines is one of the largest producers of pineapples in the world, with an annual production of over 2.8 million metric tons. However, pineapple production can also generate large amounts of pineapple residues (PR) that are usually not further utilised. They are often left to rot or burned mainly because of the high cost and labour needed for further utilisation, especially in small-scale cultivation. This practice creates challenges that are common globally, which include reducing the climate impact of cultivation while maintaining soil fertility and high resource efficiency. To address this, we hypothesise that reusing PR through soil incorporation in small-scale pineapple cultivation can promote nutrient cycling (C/N/P/K) and soil fertility while decreasing GHG emissions, particularly by increasing soil C sequestration. Additionally, we hypothesise that PR reuse can help reduce the use of mineral fertiliser, while still maintaining soil fertility and decreasing CO_2 emissions. To date, longer-term field studies regarding the effects of reusing PR in small-scale pineapple cultivation are still scarce. Using combined field and laboratory experiments, we aim to compare different PR reuse treatments against the common practice of using only mineral fertiliser and their effects on GHG (CO_2 and N_2O) emissions and nutrient cycling (C/N/P/K).

Here, we present the results of our one-year field trial experiment on the effects of reusing PR on CO_2 emissions and biomass C/N/P/K performed in Calauan, Laguna, Philippines. We used the developed low-cost CO_2 and ET flux measurement device for manual closed chamber CO_2 exchange measurements of pineapple plants grown under various PR treatments. Additionally, soil and biomass sampling were done every three months to determine C/N/P/K change during the measurement period. This was also supplemented by non-destructive monitoring of biomass development using developed low-cost NDVI sensor. Lastly, the laboratory experiment was performed using developed low-cost incubation system to determine CO_2 and N_2O emissions of soil and PR treatments. Overall, we aim to provide evidence of the potential benefits of reusing PR and contribute to the utilisation of PR as a valuable resource that can help reduce waste and GHG emissions while enhancing nutrient efficiency for more sustainable small-scale cultivation practices.

Keywords: C sequestration, field trial, resource efficiency, soil fertility

Contact Address: Reena Macagga, Leibniz Centre for Agric. Landscape Res. (ZALF), Müncheberg, Germany, e-mail: reena.macagga@zalf.de