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

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Introduction

- Pineapple production in the Philippines is over 2.91 million metric ton annually (in 2022), most on **small-holder farms.**
- This generates large amounts of **pineapple residues (PR)** as by-products that are usually not further utilized.
- Especially on the many small-holder farms these are either thrown out, left to rot or burned.

Our aim is to:

1. promote the closure of local nutrient-cycles (C/N/P/K) to maintain soil fertility and yields; and
2. increase soil C sequestration and reduce GHG emissions during pineapple cultivation through PR reuse.

Method

Figure 1. Experimental field site in Calauan, Laguna, Philippines

1 On-farm field trial experiment

Treatments:
-MIN fertilizer only (MIN)
-PR incorporated in the soil
-PR incorporated with MIN
-PR incorporated with organic fertilizer (ORG; *vermicompost*)

After initial sampling, conductance of C/N/P/K analysis of soil/plant every 3 months were performed.

Figure 2. (a) CO_2 and (b) NDVI measurements in the field using developed low-cost DIY devices

Figure 3. Fruit height and weight measurement of harvest.

2 On-farm field trial experiment

Application of DIY equipment to:

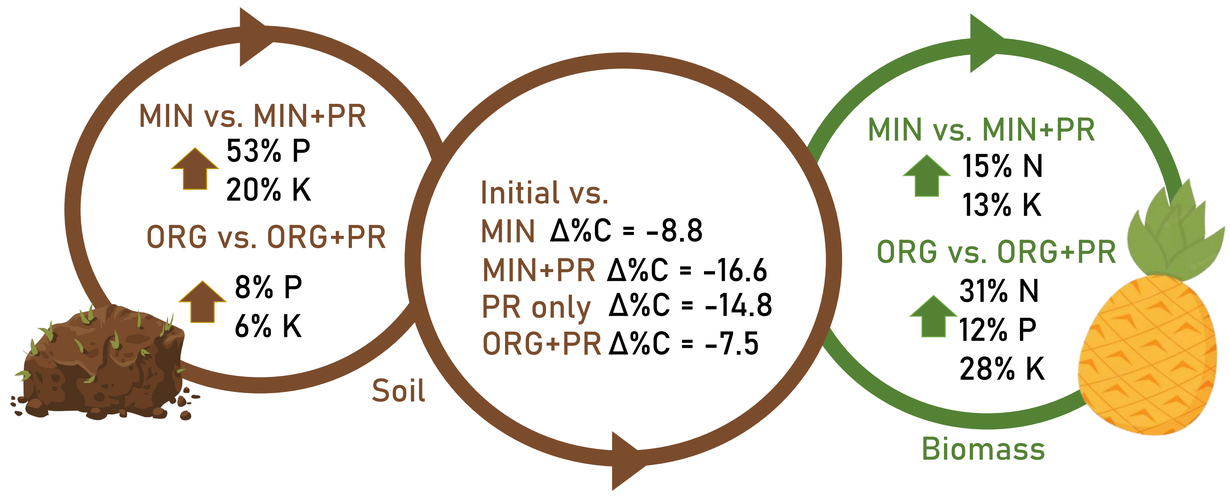
-Determine C sequestration and WUE through bi-weekly measuring CO_2 and ET exchange of different treatments. (Fig.2a)
-Determine plant development by biomass sampling and measuring NDVI of pineapple plants under different treatments. (Fig.2b)

Average **fruit weight and height** per treatment were obtained from fruit harvest (Fig. 3)

3 Incubation experiment

Use of incubation experiments to determine **baseline GHG emissions** (**especially N_2O and CH_4**) of different treatments at ZALF.

Results



- PR addition increased P and K in soil, which was highest for MIN+PR.
- No increase in Δ%C was observed under PR addition (coarse ORG material still present) compared to initial soil sample.
- Addition of PR both to MIN and ORG fertilizer treatments increased N,P,K from biomass harvested.

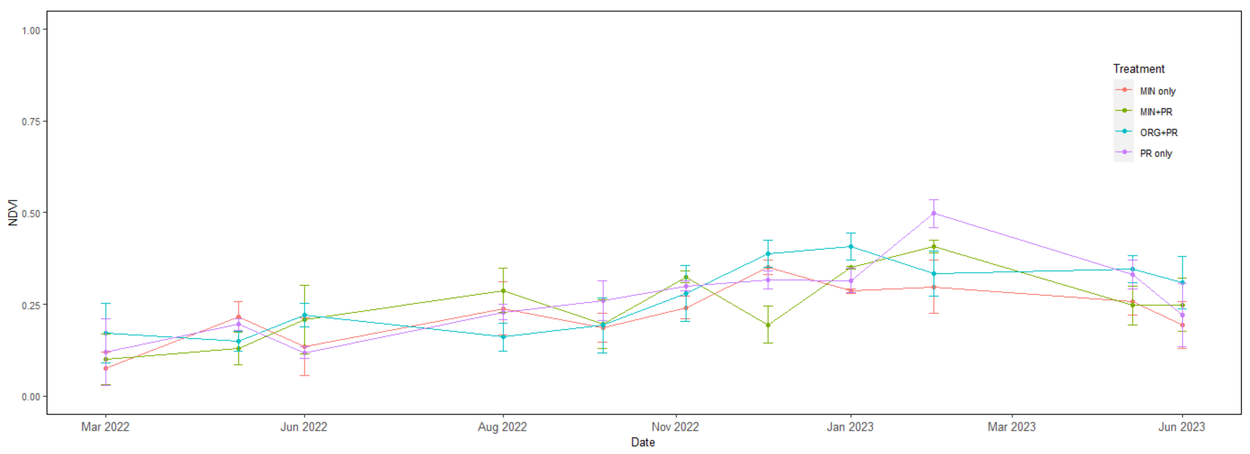


Figure 4. Plant development of pineapple plants using NDVI measurements

- Pineapple plants in the MIN+PR and ORG+PR treatments showed higher NDVI (Fig. 4)
- Similarly, higher dry biomass weight was observed for MIN+PR and ORG+PR treatments. (Fig. 5)
- Addition of PR to MIN and ORG treatments resulted in increased fruit weight and height. (Fig.6)

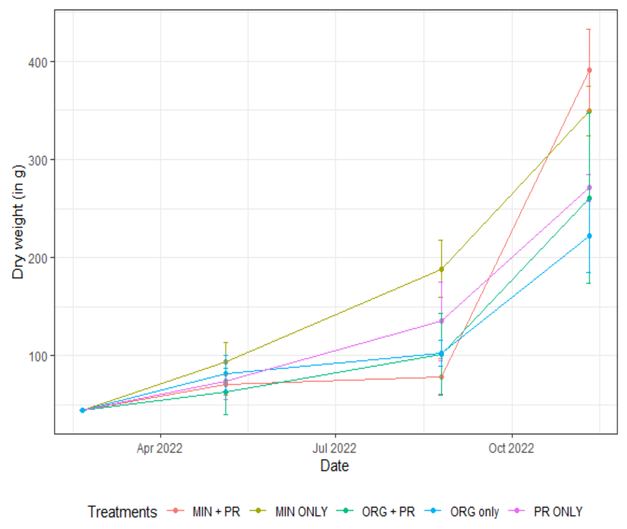


Figure 5. Plant development of pineapple plants using dry biomass weight (in g)

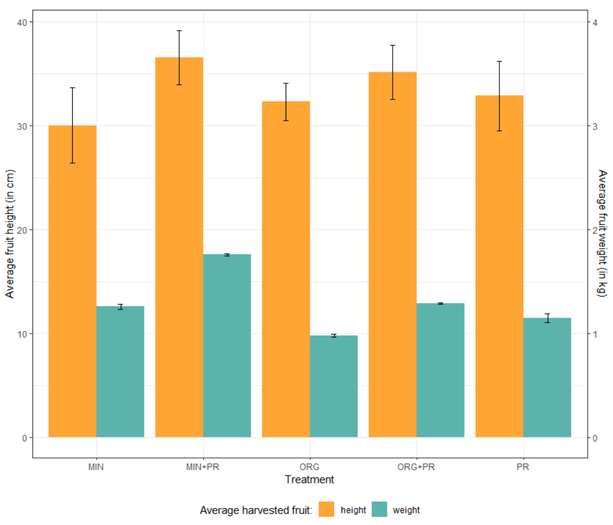


Figure 6. Average fruit weight (in kg) and fruit height from harvest (in cm)

Conclusion and outlook

1. Reuse of PR in small-scale pineapple cultivation promotes nutrient cycling of N/P/K in plants and soil, which resulted in improved plant development and harvested fruit height and weight.

2. Results from CO_2 and ET measurements will be used to obtain net ecosystem C balance (NECB) and WUE for each treatments in conjunction with GHG emissions measurements from upcoming incubation experiment.

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