Reuse of pineapple residue in Philippine agriculture: Pot-scale determination of the net ecosystem carbon balance (NECB) for a CAM plant

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Experiment aim

- To obtain NECB of CAM plants (like pineapple) using the closed chamber method.
- To compare measurements from established methods with C-3 and C-4 plants, such as rice and maize respectively.

Methodology

Using our automatic closed-chamber system:

Gas exchange measurement
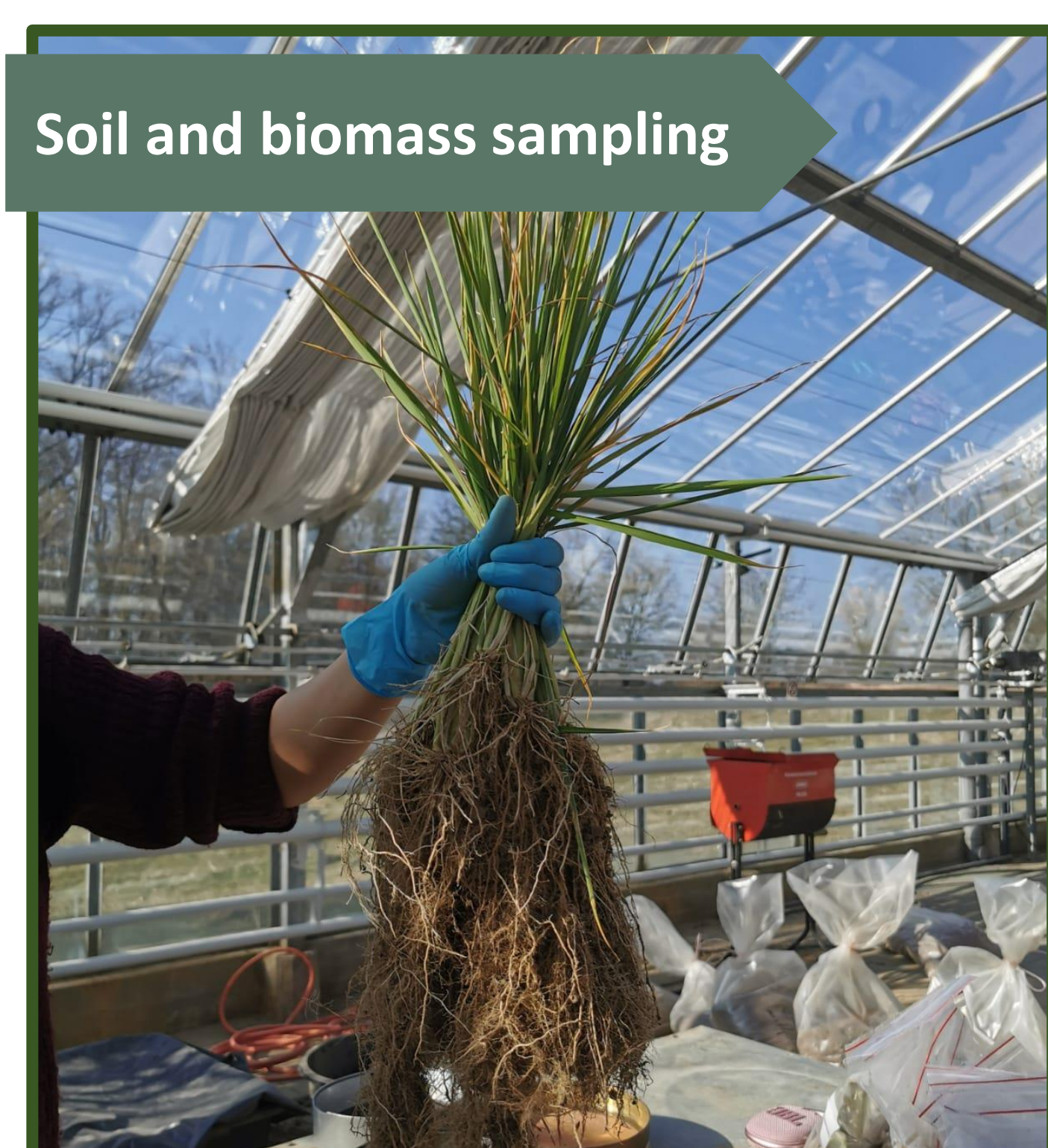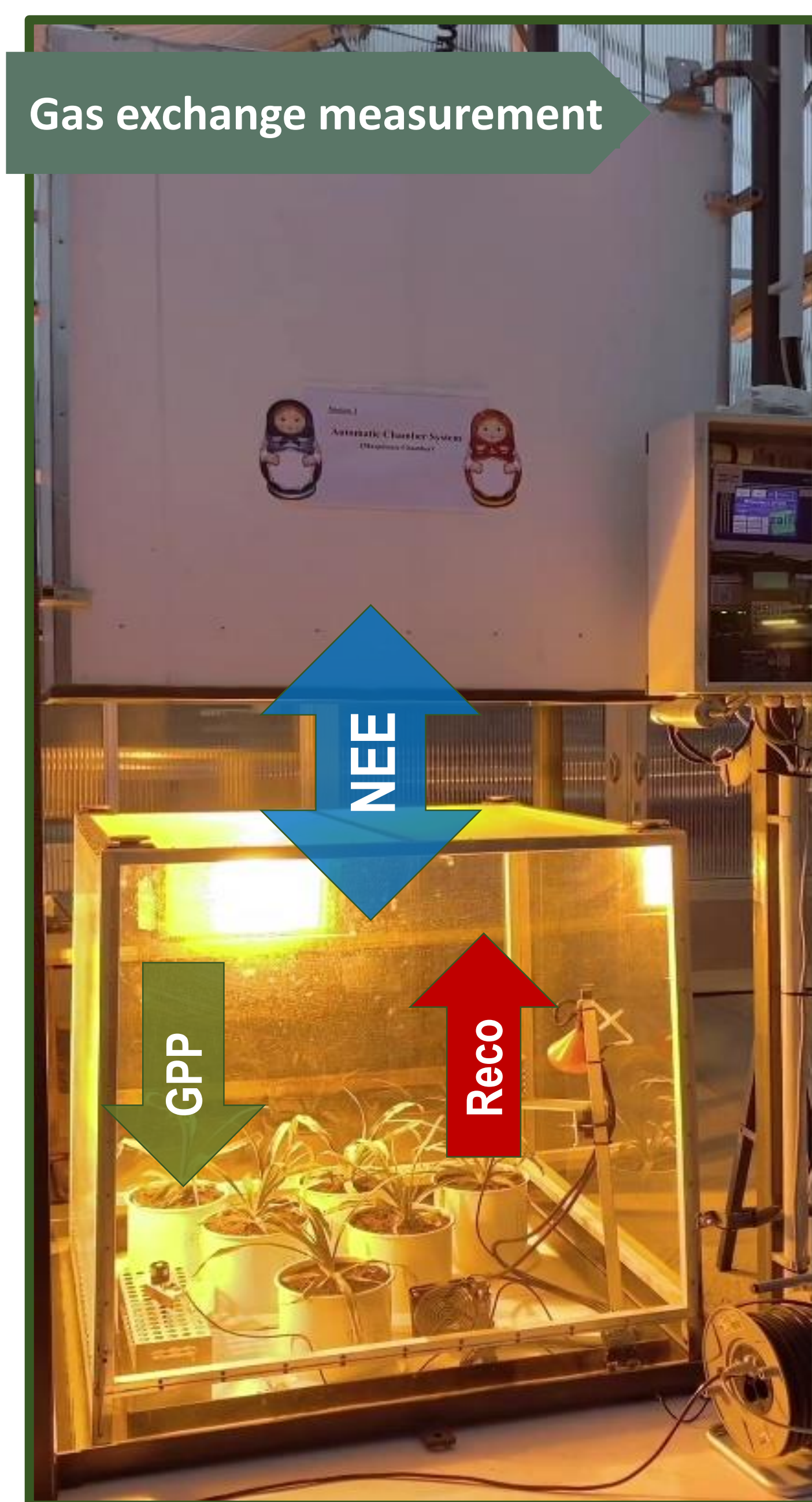
$NECB \approx [NPP_{shoot} + NEE] - C_{input}$

Net Ecosystem Exchange (NEE) ≈
Gross Primary Productivity (GPP)+
Ecosystem Respiration (Reco)

NEE

GPP   Reco

Continuous measurement of CO_2 flux over headspace time of each crop type for two months of growing period.

Each crop type was measured per one diurnal cycle using closed chamber method.

Validation of fluxes was done by analysis and comparison of soil and biomass C obtained from repeated sampling.

Soil and biomass sampling

Result and discussion

Cohort	Cumulative NEE	Biomass (NPP)	NECB
M1	-964	33.94	4.08
M2	-914	34.66	6.32
M3	-1165	36.60	0.48
R1	-516	13.51	-2.49
R2	-404	14.23	1.71
R3	-614	19.82	0.783
P1	-85	0.800	-1.82
P2	-113	1.012	-2.49
P3	-116	1.332	-2.27

Table 1. Summary of cumulative CO_2 Exchange in g C per pot

Above are the obtained cumulative CO_2 exchange for maize, rice and pineapple during the 2-months growing period. The NEE values obtained for pineapple were obtained through linear interpolation based on diurnal CO_2 flux measurements of pineapple plants.

1:1 Agreement plot

$y = 1.07x;\ r^2: 0.98$

|NPP| in g C per pot

|NEE-(R_h)| in g C per pot

- Pineapple
- Maize
- Rice
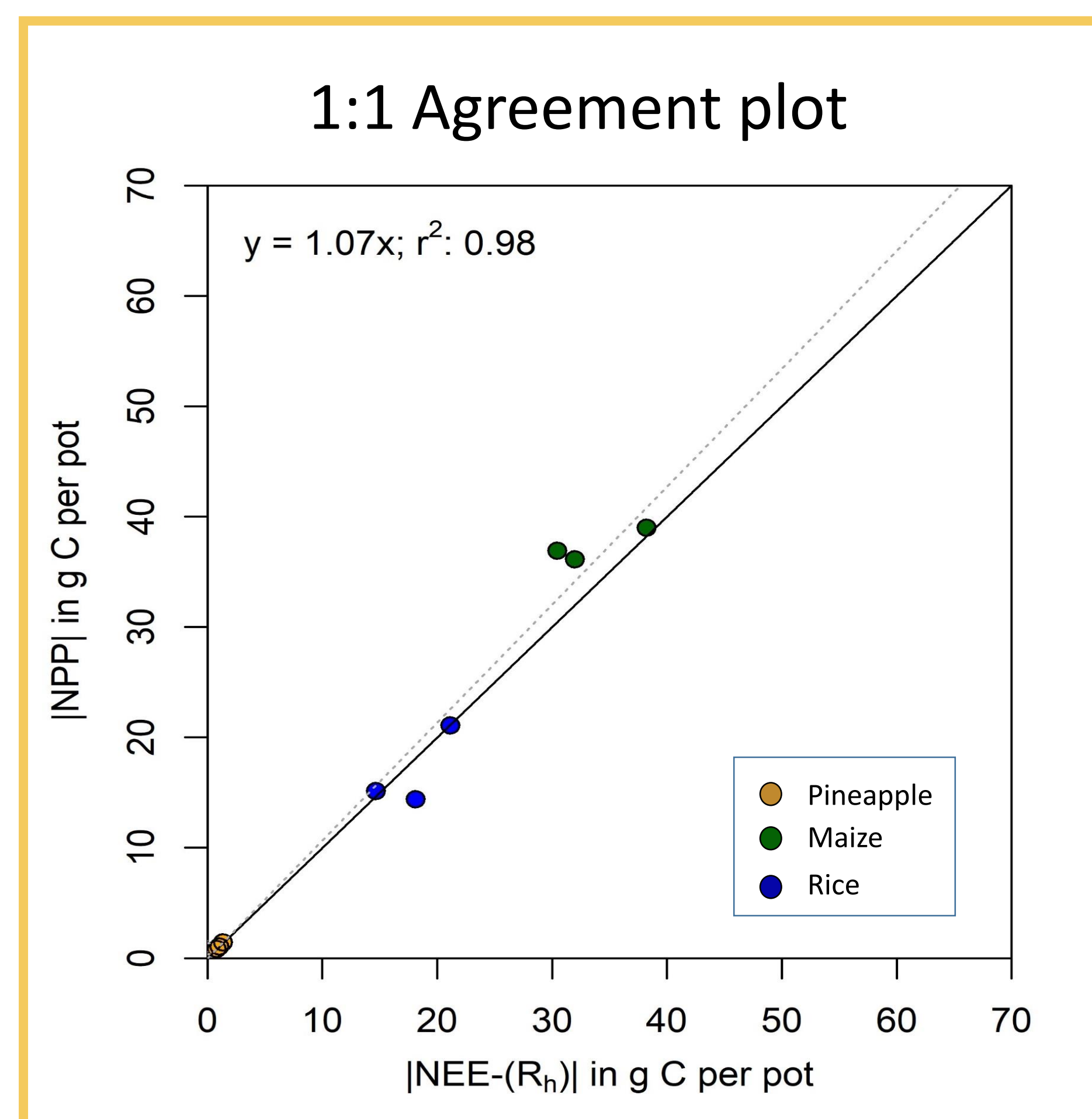
The 1:1 Agreement Plot also shows good relationship between the obtained NPP from biomass and from the gas flux measurements obtained from the automatic closed chamber.

X-axis = Net C gain obtained from gas flux measurements

Y-axis = Net C gain by vegetation obtained from biomass C

Conclusion and further steps

- Our automatic closed-chamber system can be used to obtain NEE estimates and NECB for pineapple (CAM) plants. The 1:1 Agreement Plot validated the method used by comparing the results obtained from rice (C-3) and maize (C-4) plants.

- Other gap-filling procedures must be paralleled to linear interpolation method used in finding the best fit model for pineapple (CAM) plants, which can then be later used for field level study in the Philippines.

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