Biomass Energy Crop Plantation under Solar Photovoltaics in Northern Thailand

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Introduction and Objectives

1. A large area is required for photovoltaic installation to generate electricity and regular operating and maintenance activities are required, especially vegetation management under Ground-Mounted (weeding or mowing).
2. The objective of this study was to investigate the potential of growing energy crops (dwarf Napier grass: Pennisetum purpureum cv. Mott) underneath solar panels

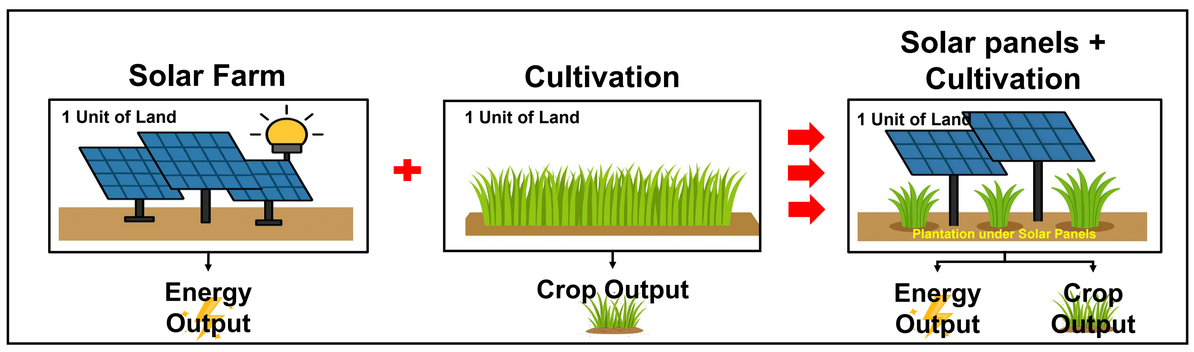


Fig 2. Research concept

Materials and Methods

1. Study areas: Lampang province, Northern Thailand

2. Selected crop: Dwarf Napier grass (Height 1.0-1.5 m), planted on 8 Dec 2023

3. Growing media: Soil surface : manure : fermented Napier grass = 2:1:1

4. Experimental setup: Two treatments

TRT 1 = Napier growing in an open-field

TRT 2 = Napier growing under ground-mounted 8.6 kW solar panels.

Solar PV = 0% transparent and 0% spacing between solar panels

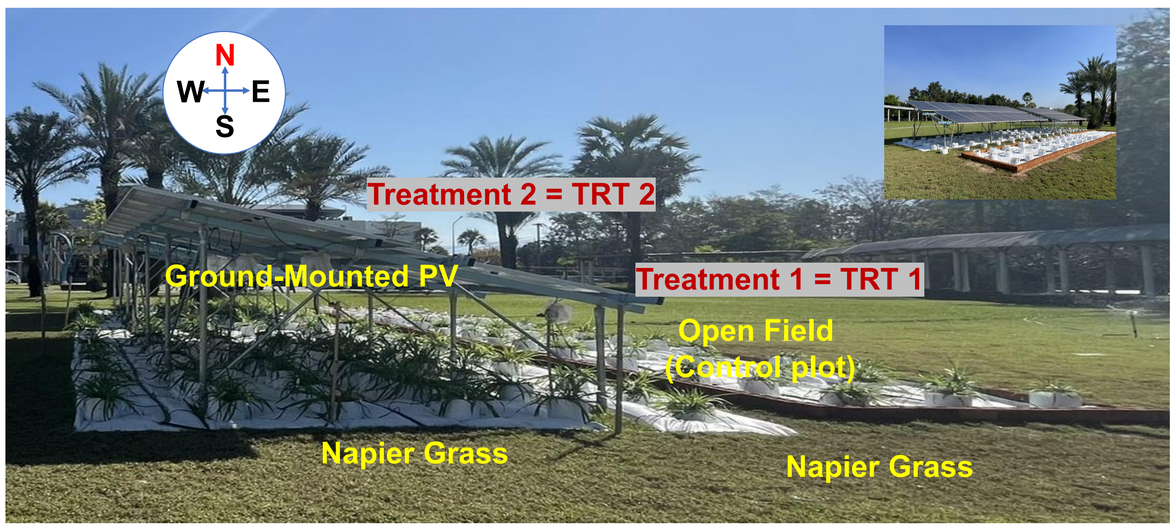


Fig 2. Experimental field comparing open and PV-shaded Napier grass

5. **Study periods:** November 2023 – October 2024, with eight harvesting times
6. **Data collection:** Sunlight data (PPFD) and plant data (plant height and fresh weight)

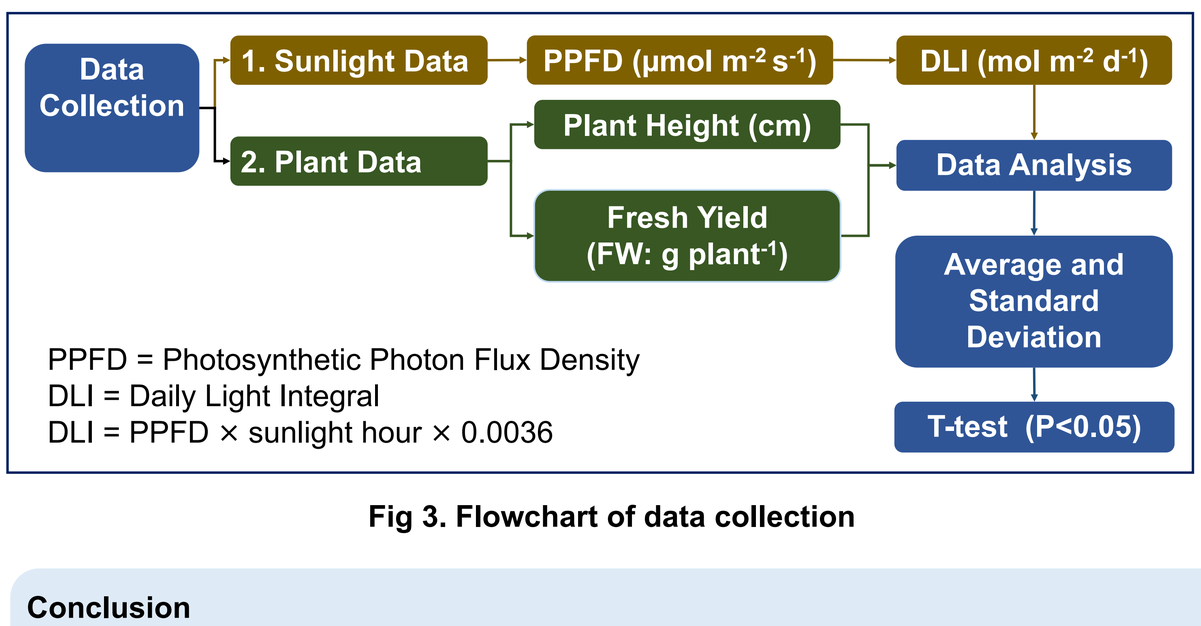


Fig 3. Flowchart of data collection

Results

- Average PPFD under TRT 2 was almost 90% lower than under TRT 1, with values of 93 μmol m^{-2} s^{-1} in TRT 2 and 890 μmol m^{-2} s^{-1} in TRT 2 (Fig 4a).
- Cumulative DLI was higher under TRT 1 compared to TRT 2 (Fig 4b).

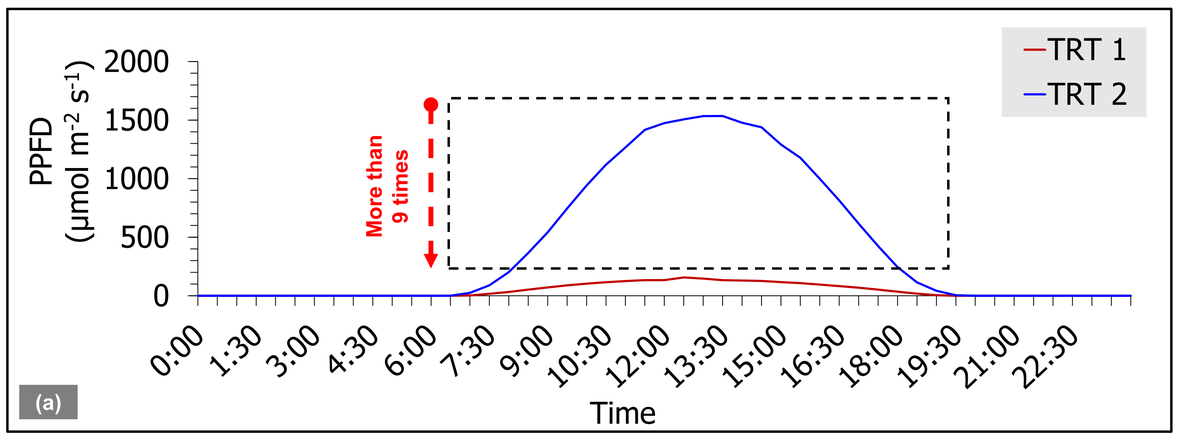


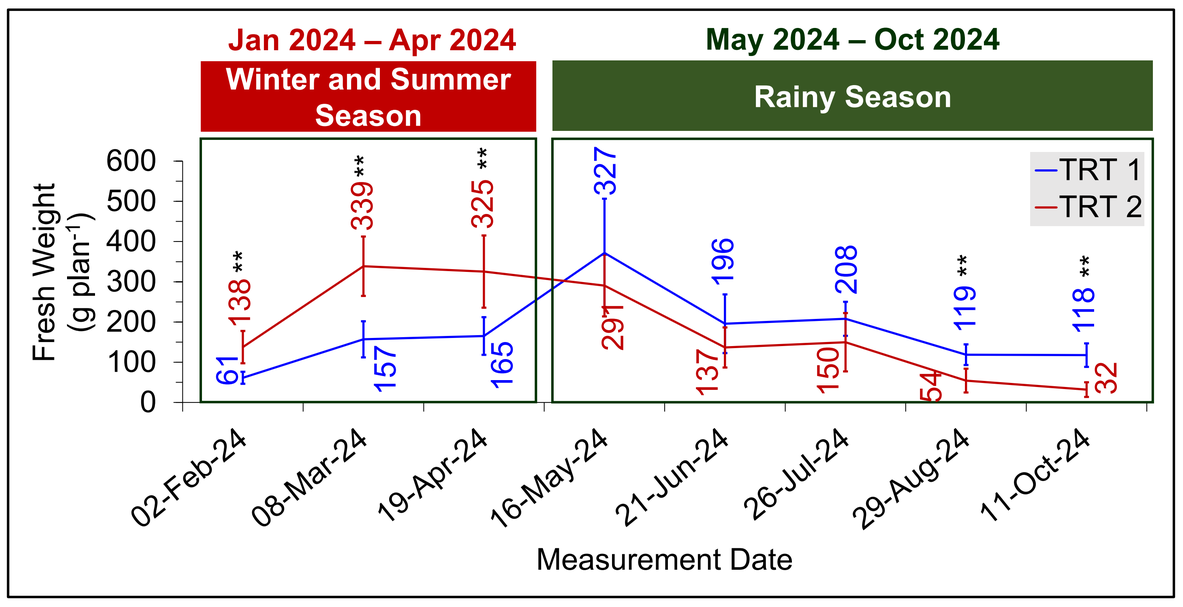
Fig 4. Average PPFD (a) and daily DLI under both treatments

- In Tab. 1, higher plant height was observed under TRT 2, compared to TRT 1.
- TRT 2 showed higher trends in FW during the 1st to 3rd harvests, followed by lower values from the 4th to 8th harvesting times when compared to TRT 1 (Fig 5).

Tab 1. Average plant height over the study periods

TRT	02-Feb 24	08-Mar-24	19-Apr-24	16-May-24	21-Jun-24	26-Jul-24	29-Aug-24	11-Oct-24	Average
1	37.3	34.9	43.6	55.6	58.6	51.4	43.7	30.9	46.4
2	62.7	70.7	100.9	87.7	68.9	82.3	55.0	41.7	71.2
Sig	**	**	**	**	ns	**	ns	**	**

** Significant difference at P< 0.01, * Significant difference at P<0.05 and ns non-significant difference



** Significant difference at P< 0.01, * Significant difference at P<0.05

Fig 5. Average fresh weight during the measurement periods

Conclusion

Reduced sunlight under solar panels is sufficient for NP growth, however, proper nutrient management is critical for sustainable long-term productivity. This dual land-use system offers both energy and biomass production and it could be scaled to other regions.

Acknowledgements

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