



Tropentag, September 10-12, 2025, hybrid conference

“Reconcile land system changes  
with planetary health”

## Biomass energy crop plantation under solar photovoltaics in northern Thailand

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### Abstract

This study aims to investigate the potential of growing energy crops (dwarf Napier grass, NP) underneath solar panels. The study area was located in Lampang province, Northern Thailand, from December 2023 to October 2024. Two treatments (planting systems) were established: “TRT 1” = control plot (NP growing in open field) and “TRT 2” = NP planting under solar panels. The NP was planted in plastic pots using growing media and the pots were placed under both systems. Planting density was 4 plants m<sup>-2</sup> of 0.75 m spacing between plants. Sunlight availability was recorded using PAR light sensors to measure photosynthetic photon flux density (PPFD,  $\mu\text{mol m}^{-2} \text{s}^{-1}$ ). For data collection, seven NP plants of each TRT were selected and the samples were collected eight times at every harvesting of 35–40 days. The collected parameters were plant growth (plant height and leaf area) and yield (fresh and dry weight, g plant<sup>-1</sup>) every harvesting time. Plant height (cm) and leaf area (cm<sup>2</sup>) were measured by a 1-m ruler. Fresh weight (FW) was recorded directly after each harvesting. The results show that the average PPFD under TRT2 (93  $\mu\text{mol m}^{-2} \cdot \text{s}^{-1}$ ) was almost 90 % lower than under TRT1 (890  $\mu\text{mol m}^{-2} \cdot \text{s}^{-1}$ ). During the measurement periods, significantly higher plant height and leaf areas were observed under TRT 2 (plant height = 71.2 cm and leaf area = 98.6 cm<sup>2</sup>) in comparison to TRT 1 (plant height = 44.5 cm and leaf area = 56.4 cm<sup>2</sup>). TRT 2 showed higher trends of FW from the 1<sup>st</sup> to 3<sup>rd</sup> harvesting times (0.55–1.30 kg m<sup>-2</sup>) and lower trends from the 4<sup>th</sup> to 8<sup>th</sup> harvesting times (1.16–0.13 kg m<sup>-2</sup>) when compared to TRT 1 (0.25–0.66 kg m<sup>-2</sup> of the first to third harvesting times and 1.49–0.4 kg m<sup>-2</sup> of the fourth to eighth harvesting times). In conclusion, reduced sunlight under solar panels is sufficient for NP growth, but nutrient management is critical for long-term productivity.

**Keywords:** Biomass energy crops, Dwarf Napier grass, Solar photovoltaics