Tropentag, September 16-18, 2026, hybrid conference

"Towards multi-functional agro-ecosystems
promoting climate resilient futures"

Photosynthetic responses as indicators of potassium use efficiency in oil palm (*Elaeis guineensis* Jacq.) progenies

Olivier Senankpon Dassou[1,3], Jean Ollivier[2], Azize Orobiyi[1], Wouter Vanhove[3], Reinout Impens[4], Eduardo de la Peña[5,3]

[1] *Agricultural Research Centre on Perennial Plants of the National Agricultural Research Institute of Benin, Benin*
[2] *CIRAD, UMR ABSys, France*
[3] *Ghent University, Dept. of Plant and Crops - Lab. for Tropical Agronomy, Belgium*
[4] *SIAT Group / Presco Plc, R&D, Nigeria*
[5] *Spanish National Research Council (CSIC), Institute for Subtropical and Mediterranean Horticulture (IHSM-UMA-CSIC), Spain*

Abstract

Understanding photosynthesis's response to nutrient availability is essential for enhancing potassium uptake and use efficiency and maintaining oil palm productivity under resource-limited conditions. This study evaluated *in situ* photosynthetic responses of four 8-year-old oil palm progenies (C1, C2, C3: Deli × LaMé; C4: Deli × Yangambi) to a stepwise increase in irradiance (0–1100 mol m^{-2} s^{-1}, in increments of 200 mol m^{-2} s^{-1}) under field conditions in Ologbo, Nigeria. Three levels of KCl (K0, K1, K2 = 0, 1.5, and 3 kg KCl $palm^{-1}$), combined with 0.75 kg $MgSO_4$ $palm^{-1}$, were applied during the dry season (January - February) to simulate water stress conditions. Significant differences among progenies were observed ($p < 0.05$). At the highest irradiance (1100 μmol m^{-2} s^{-1}), increasing KCl supply led to a marked rise in net photosynthesis in the high-yielding progeny C3, from 9.45 to 12.56 and 17.84 μmol CO_2 m^{-2} s^{-1} under K0, K1, and K2, respectively. A comparable but less pronounced trend was observed in C2, with values increasing from 12.24 to 16.25 μmol CO_2 m^{-2} s^{-1} between K0 and K1, and only a slight additional increase at K2 (18.09 mol CO_2 m^{-2} s^{-1}). In contrast, progeny C1 exhibited similar photosynthetic rates under K0 and K1 (16.25 and 16.95 μmol CO_2 m^{2} s^{1}), followed by a significant decline at K2 (11.35 mol CO_2 m^{-2} s^{-1}). For C4, photosynthetic activity remained relatively stable across all K levels. These contrasting responses suggest that photosynthetic performance can effectively differentiate oil palm progenies in terms of potassium uptake and use efficiency, underscoring its value for guiding targeted fertilisation strategies to optimise productivity under nutrient-constrained environments.

Keywords: K uptake and use efficiency, oil palm, photosynthesis, radiation

Contact Address: Olivier Senankpon Dassou, Agricultural Research Centre on Perennial Plants of the National Agricultural Research Institute of Benin, BP 01, Pobè, Benin, e-mail: mandas.oliver@gmail.com