



Tropentag, September 16-18, 2026, hybrid conference

“Towards multi-functional agro-ecosystems
promoting climate resilient futures”

Plant growth rate and photosynthetic capacity of selected Nigerian indigenous and underutilised leaf vegetables under drought- and heat-stress conditions

FUNMILAYO OLOYEDE¹, MICHAEL FREI²

¹Osun State University, Agronomy, Nigeria

²Justus Liebig University Giessen, Inst. of Agronomy and Plant Breeding, Germany

Abstract

Abiotic stresses represent the most limiting conditions for horticultural productivity and plant exploitation worldwide. Important factors among those are water, temperature, and light. In this study water and temperature stress conditions were imposed on three species of Nigerian indigenous leaf vegetables (*Amaranthus cruentus* L.; *Amaranthus hybridus* L. and *Celosia argentea* L.) to evaluate their effects on the plants growth rate and photosynthetic capacity. Plants were raised from seeds in pots at the climate-controlled greenhouse of Justus-Liebig-University, Giessen, Germany. Both heat and drought stress experiments were conducted in two growth chambers, one control (day/night temperatures of 27/20 °C respectively) and one with raised temperature (35/30 °C day/night temperatures respectively). Both chambers also had drought stressed plants and control. The conditions were maintained for 4 weeks. Plant growth indices and photosynthetic capacity of the plants under stress conditions and controls were measured every other day for four weeks using Li_600 and Licor_6800.

Plant growth indices showed that plant height (cm) across the species evaluated was not significantly affected by both the heat and water stresses. However, *Celosia argentea* was shorter in both controlled and the stressed plants compared to other species. Number of leaves across the species was not also significantly affected by both heat and water stresses. However, *Celosia argentea* had higher number of leaves in both controlled and the stressed plants compared to other species. The shoot fresh weight (g) was significantly reduced by both heat- and water- stress conditions across the plant species. *Amaranthus hybridus* had highest weight in the control while *Amaranthus cruentus* had highest weight in the heat stressed plants. Stomatal conductance of the water stressed plants was lower compared to control, while it was higher for the heat stressed plants. Stomatal conductance for *Celosia argentea* under both stresses was higher compared with other species. Net photosynthetic rate was higher in control and lower in heat stressed plants except for *Celosia argentea*. photosystem II efficiency (PhiPS2) of the species was not significantly affected by both stress conditions. Response of the plants to the stress conditions was species dependent.

Keywords: Climate change, growth rate, heat stress, indigenous vegetables, photosynthesis