

Activity of the oil palm seedlings exposed to a different rate of potassium fertilizer under water stress condition

ABSTRACT

Drought is predicted to become more severe and frequent in the future due to anthropogenic activities. As a method to prepare for the unexpected consequences of drought, potassium (K) nutrition has been proposed to mitigate water deficit in plants. However, field-scale studies involving oil palm seedlings are scarce. The study was conducted to determine the effects of different water stress regimes on the physiology of oil palm seedlings, to identify the best rate of potassium fertiliser under water stress application, and to understand the interaction between drought impacts and potassium application on oil palm seedlings. Three levels of potassium rates (K1, K2, and K3) with five times applications (170, 340, and 510 kg KCL ha⁻¹), (480, 960, and 1440 kg KCL ha⁻¹), (170, 340, and 510 kg KCL ha⁻¹), (960, 1920, and 2880 KCL kg ha⁻¹), and (960, 1920, and 2880 kg KCL ha⁻¹) under three different levels of water stress (100% ER [Evapotranspiration replacement; well-watered], 75% ER [moderate water stress], and 25% ER [severe water stress]) were exposed on oil palm seedlings in Randomized Completely Block Design (RCBD). Growth, carbon assimilation, and biochemical parameters were analysed during the experiment. It was found that water stress deteriorated the growth of oil palm seedlings. As potassium fertiliser rates increased, no significant differences in the physiology of the seedlings were observed except for height, net photosynthesis, and intercellular CO₂. However, the biochemical properties (proline, soluble sugars, phenolics and flavonoids) of oil palm seedling increased while MDA decreased when the application of K was increased. Thus, to optimise the water and fertiliser utilisation under water scarcity, it is suggested to use a double rate of K fertiliser with 75% ER. The study proposed that K nutrient management strategy has the potential to minimise the impacts of drought stress in oil palm seedlings.

Keyword: Oil palm seedlings; Climate change; Drought; Potassium fertiliser; Physiology