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Oil palm empty fruit bunch and its biochar combined with irrigation on a tropical Acrisol increase african eggplant productivity

JOHN BRIGHT AMOAH NYASAPOH¹, ERIC OPPONG DANSO^{2,5}, WILLIAM AMPONSAH¹, EMMANUEL ARTHUR³, PETER BILSON OBOUR⁴, EDWARD BENJAMIN SABI⁵, DANIEL SELORM KPODO⁵, BERNARD KWABENA BOADI MENSAH⁵, WILLIAM AKORTEY⁵, GRACE ELORM AYAYI², MATHIAS NEUMANN ANDERSEN³

¹*Kwame Nkrumah University of Science and Technology (KNUST), Dept. of Agricultural and Biosystems Engineering, Ghana*

²*University of Ghana, Forest and Horticultural Crops Research Centre, Ghana*

³*Aarhus University, Dept. of Agroecology, Denmark*

⁴*University of Ghana, Dept. of Geography and Resource Development, Ghana*

⁵*University of Ghana, Dept. of Agricultural Engineering, Ghana*

Abstract

Three consecutive field experiments were conducted across three growing seasons on a low-fertile sandy clay loam Acrisol. The study investigated the effects of oil palm (*Elaeis guineensis* Jacq.) empty fruit bunch (EFB) applied as either a raw organic amendment (EFBOA) or as biochar (EFBBC) and combined with irrigation on (i) soil physico-chemical properties, (ii) accumulated intercepted photosynthetically active radiation (AIPAR) and fresh fruit yield (FFY) of African eggplant (*Solanum aethiopicum* L.), and (iii) assess the agronomic efficiency (AEE) of the EFBOA and EFBBC. Both the EFBOA and EFBBC were applied at rates of 20 (EFB20), 40 t ha⁻¹ (EFB40) and no amendment as control (CT) under either fully-irrigated (I100), deficit-irrigated (I40), or non-irrigated (I0). After 21 months of the amendments, both amendment rates marginally increased soil moisture retention than the control. EFBBC at 40 t ha⁻¹ significantly increased soil pH, SOC, and K, whereas EFBOA significantly increased EC, N, P, and K. In the first season, both EFBOA and EFBBC effects on the eggplant FFY, AIPAR, and AEE were not significant ($p < 0.05$). However, both amendments significantly increased AIPAR, FFY, and AEE in the second and third seasons. Irrigation also significantly increased radiation interception and FFY under the second and third seasons and interacted synergistically with the amendments. Soil pH and SOC of EFBBC 40 t ha⁻¹ were respectively 4.1 % and 139 % higher than the EFBOA, whereas TN and EC of the EFBOA were respectively 40.0 % and 22.6 % higher than the EFBBC. The observed improvements with EFBBC were attributed to enhanced soil pH and SOC, while those with EFBOA were linked to higher TN content. The study recommends the use of both raw and pyrolyzed EFB as sustainable soil management options for improving weathered tropical soils, particularly when integrated with irrigation. Whereas this study found no differences in eggplant growth and fruit yield between raw EFB and its biochar, it is worthwhile to study how long the two amendments would persist in the soil to affect both the weathered tropical soil and crop productivity.

Keywords: Biochar, organic amendment, soil organic carbon, sub-Saharan Africa, weathered tropical soil