

MASTER (MSc) THESIS

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Institute of Environmental Sciences

**Effect of Combined Fertilizer and Rice Husk Biochar on Rice Yield,
Nitrogen Content, Grain Quality and Water Productivity under
Aerobic Rice Cultivation in Hungary**

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SUMMARY

Rice is the staple food for more than half of the world's population. The quality and production of rice depends on soil available nutrients and is usually supplied through fertilizers. Continuous application of inorganic fertilizer was found to decrease soil productivity and affect crop yield and soil health in the long term. However, combined inorganic and organic fertilizers have been widely recommended, especially on degraded soils, to improve soil fertility. This study aimed to evaluate the efficiency of combined fertilizers (CF) and rice husk biochar (RHB) to improve aerobic rice yield (RY), soil properties, grain quality, and WP in Hungary. A field experiment was carried out from April to September 2023 at the Lysimeter station of the Research Centre of Irrigation and Water Management in Szarvas, MATE. Five treatments, with and without CF and RHB at different rates (50 kg N/ha and 100 kg N/ha NPK 15:15:15; 3 L/m² organic fertilizer; 1 t/ha RHB) were applied in a randomized block design with two replications each in 2 blocks, and a total of 20 plots. A rice variety known as 'M 488' was used and drip irrigation was applied at an initial rate of 1 L/m² per day. The study utilizes SPAD chlorophyll meter, SpectraVue leaf spectrometer, and UAV-based imaging to assess the effects of fertilizer treatments on plant health, yield, growth, and WP. The results showed higher RY in treatment given CF with RHB (T4) compared to other treatments. Significant differences were observed on RY, soil humus content, WP, grain biomass, and grain width between fertilizer treatments in two treatment blocks, with block 2 was found better performed than block 1. Mn, Cu, Zn, and total P were found positively correlated with RY and soil humus content, suggesting the role of RHB to store, and thus increase nutrients in the soil layer. A strong positive correlation was found between SPAD meter, NDRE UAV, GNDVI UAV, and RENDVI spectrometer in flowering and ripening stages. PCA results also showed GNDVI UAV in both treatment blocks 1 and 2 provide best representation of crop health and nitrogen (N) content compared to SPAD meter and spectrometer. The findings from this study have found CF and RHB to increase RY and growth, and improve grain quality, soil properties and WP of aerobic rice in Hungary. UAV aerial imagery serves as a promising monitoring tool, helping to save time and energy while providing sensitive and accurate results in monitoring plant N status, health, and yield over a wide range of geographic area. Further studies are recommended in integrated nutrient and crop management of aerobic rice by varying the amount of fertilizer and RHB applied, and to use GNDVI indices to determine RY in different growth stages using remote sensing method.

Keywords: aerobic rice, fertilizer, rice husk biochar, yield, water productivity, remote sensing