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“Solidarity in a competing world —
fair use of resources”

Effects of Soil and Foliar Applied Micronutrients on Productivity and Profitability of Rice in Tanzania

KALIMUTHU SENTHILKUMAR¹, FITTA SILAS SILLO¹, BONAVENTURE JANUARY TESHA¹, IBNOU DIENG², JONNE RODENBURG¹, KAZUKI SAITO², ELKE VANDAMME¹, CHRISTIAN DIMKPA³

¹*Africa Rice Center (AfricaRice), Tanzania*

²*Africa Rice Center (AfricaRice), Benin*

³*Virtual Fertiliser Research Center (VFRC), United States of America*

Abstract

Rice production in sub-Saharan Africa is largely nutrient-limited, hence application of micronutrients along with NPK is often needed to boost and sustain yields. Foliar and soil application of micronutrients could be efficient, however, few studies have simultaneously compared the efficiency and effectiveness of foliar vs soil-applied fertilisers, and the results have been inconclusive. This study, therefore, assessed the productivity and profitability of different soil- and foliar-applied micronutrients in 30 on-farm trials during the wet season of 2015, in Tanzania. Five representative, locally-available foliar formulations were tested following two NPK-fertiliser treatments (N:P:K@80:17:33 kg ha⁻¹ vs no-NPK), under three growing conditions (irrigated lowland, rainfed lowland and rainfed upland) against two reference treatments (control; and soil application of micronutrients (SMN) – B:Zn:S:Mg @ 2:3:7.5:10 kg ha⁻¹). Grain yield, yield attributing characteristics and benefit: cost (B:C) ratio were assessed for all treatments. In rainfed lowland conditions, application of NPK alone increased yield from 2.7 to 5.0 t ha⁻¹ while additional SMN further increased the yield to 6.8 t ha⁻¹. With NPK, two of the five foliar products increased yield significantly, while none increased yield significantly under the no-NPK conditions. The highest B:C ratio (14) was achieved for SMN, being between 4 and 11 for the five foliar products. In irrigated lowland conditions, NPK increased yield from 3.1 to 4.1 t ha⁻¹, while additional SMN increased yield further to 4.6 t ha⁻¹. With NPK, no significant yield increase was observed for the foliar products, except for one product under no-NPK. The B:C ratio for SMN was 4, and between 1 to 5 for foliar products for both NPK and no-NPK conditions. In upland conditions, no significant yield increase was observed with NPK, SMN and the five foliar products, with yields ranging from 1.3 to 2.7 t ha⁻¹. The efficiency and economic benefits of micronutrients is variable across rice growing conditions. Application of small doses of micronutrients increased yields significantly under rainfed and irrigated lowland conditions; however, its effectiveness was not evident in upland conditions.

Keywords: Cost benefit analysis, fertiliser products, food security, sub-Saharan Africa