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Assessment of Nutrient Imbalances Limiting Maize (*Zea mays*) Production in Western Kenya

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Abstract

Poor maize response to N, P and K fertiliser applications in western Kenya results in low grain yields far below the potential. However, the extent and causes of this poor response are still unclear. Nutrient imbalances expressed either in deficiencies and/ or excess are speculated to limit the maize response to fertiliser. To investigate this, a multi-locational trial comprising of 52 sites across Bungoma and Busia counties of western Kenya was conducted during the long rainy season of 2014.The study identified 20 % out of the total experimental sites as poorly responsive to fertiliser application characterised by an average value cost ratio ranging between 0.5 and 1.65. Further, a total of 312 maize ear leaf samples were analysed for macro- (N, P, K, S, Ca, Mg) and micronutrients (B, Cu, Zn, Mn) and related to their corresponding maize grain yield using the Compositional Nutrient Diagnosis (CND) procedure. This led to the determination of maize nutrient sufficiency ranges that ranked the frequencies of either deficiency or excessive nutrient concentration occurrences across sites. Beforehand, the determined nutrient sufficiency ranges were compared with published references to ensure their relevance. The sufficiency ranges expressed in % for N (2.60–2.90), P (0.26–0.29), K (2.5–2.80), S (0.19–0.22) and Mg (0.20–0.22) were in agreement with the published references but Ca (0.70–0.80 %) deviated by 36 % above the references indicating sufficiency variations in different environments. All the micronutrients expressed in mg kg $^{-1}$ for B (7.8–8.33), Cu (8.86–9.99), Zn (16.39–18.26) and Mn (67.24–74.93) were within the published sufficiency ranges. Despite the application of N and P, results indicated that the two nutrients alongside Ca, Mg, Zn and S had the largest frequencies of being deficient, ranging between 75–100 % across all the sites. Cu, K, B and Mn followed with moderate deficiency frequencies ranging between 50 and 74 %. The occurrence of excess nutrient concentrations was much less frequent, led by Mn ranging between 25 and 49 %. Other nutrients were rarely present in excess with frequency ranges less than 20 %. Not surprisingly, P was never in the excess nutrient category confirming its unrelenting importance for maize production in western Kenya.

Keywords: Deficiency, excess, maize, nutrient imbalances, poor response, sufficiency ranges

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