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"Resilience of agricultural systems against crises"

Understanding Variability in Crop Response to Fertiliser and Amendments: Example from SSA

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Abstract

The African Soils Information Service (AfSIS) implemented diagnostic trials in 10 different sites within 5 countries of sub-Saharan Africa: Kenya, Malawi, Mali, Nigeria and Tanzania, to identify soil fertility constraints to crop production. At each site, 23 to 32 trials were conducted within 10 km by 10 km sentinel sites. The treatments tested included a control, a full NPK treatment, 3 treatments in which the N, P and K nutrient were omitted at a time from the full NPK treatment, and one treatment in which multi-nutrients (Ca, Mg, micronutrients) were added to the full NPK treatment. Two optional treatments, manure or lime were included depending on the availability of manure and soil pH levels in case of lime. The test crops were maize and sorghum. In most sites, nutrient limitation was in the order N>P>K except in more acidic soils (*e.g.* in Kontela, Mali) where P was more limiting than N and in Mbinga, Tanzania, where K was as limiting as N and P. Nutrient omission resulted in significant yield reductions averaging 30 % for N and 20 % for P, relative to the full NPK treatment. For maize growing sites, yield increases of at least 0.5 t ha^{-1} following application of lime (500 kg ha^{-1}) on acidic sites and of manure in comparison to the full NPK treatment were common. In each site soil amendments consisting of lime, manure and multi-nutrients, had higher grain yield than NPK treatments in at least 40 % of the cases, indicating wide existence of non-responsive soils. A clustering technique is explained as an attempt to identify the different patterns of crop responses to nutrient omissions and amendments. Distribution of the fields to the resulting clusters depicted observed variability in the tested sites. The contribution of different covariates such as soil carbon, pH and available P to the responses are also presented. Suggestions for minimum treatments needed to diagnose soil constraints, and analysis framework for such trials are made.

Keywords: Nutrient omission, responsive soils, soil constraints, spatially-explicit

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