



Tropentag, September 11-13, 2024, hybrid conference

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## Phosphorus fertiliser management for high yields in groundnut-maize rotation system in ebonyi state Nigeria

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### Abstract

The excessive use of phosphorus (P) fertiliser in crop production can result in a continuous accumulation of soil P, leading to the potential for P leaching from the agricultural ecosystem. However, the effects of balanced P management on soil P availability and crop P absorption remain unknown for groundnut-maize rotation in Ebonyi state Nigeria. To address this gap, a two-season (2018/2019 and 2019/2020) field experiment was conducted on-farm in Ohozara, Ebonyi state on a demonstration plot belonging to Michael Okpara University of Agriculture Umudike (MOUAAU), Nigeria. The experiment involved four different P rates (30 kg P ha<sup>-1</sup>, 40 kg P ha<sup>-1</sup>, 50 kg P ha<sup>-1</sup>, and 60 kg P ha<sup>-1</sup>) in comparison to a control (0 kg P ha<sup>-1</sup>). The primary objective was to assess the impact of a balanced P application strategy on crop yield, P uptake, and soil P accumulation in a groundnut-maize rotation system. The results show that yield and P uptake of groundnut-maize rotation increased with P fertilisation up to 40 kg P ha<sup>-1</sup>, beyond which they stabilised, and the critical threshold is 50 kg P ha<sup>-1</sup> for groundnut. Phosphorus fertilisation at 60 kg ha<sup>-1</sup> accelerated the downward movement of soil P and stocked it in the deep soil in the form of soil labile P and moderately labile P, which increased the risk of soil P leaching. The annual application of 60 kg ha<sup>-1</sup> P as 300 kg TSP fertiliser ha<sup>-1</sup> increased the total P concentration by 25 %–86 % from deep soil to

topsoil compared to the other treatments. Groundnut-maize rotation in the soils of Ebonyi state used for this study required additional P application to reach the agronomic threshold, set at 20 to 30 kg ha<sup>-1</sup> annually by the Ebonyi State Ministry of Agriculture. In conclusion, balanced P fertilisation can reduce soil P surplus and subsoil P stock while maintaining crop yields.

**Keywords:** Crop yield, fertiliser management, groundnut-maize rotation, phosphorus requirement