

Abstract

# Drivers of Phosphorus Efficiency in Tropical and Subtropical Cropping Systems <sup>†</sup>

Bianca Das <sup>1,2,\*</sup>, Neil Huth <sup>2</sup>, Merv Probert <sup>2</sup>, Birthe Paul <sup>3</sup>, Job Kihara <sup>3</sup>, Peter Bolo <sup>3</sup>, Daniel Rodriguez <sup>4</sup>, Mario Herrero <sup>2,4</sup> and Susanne Schmidt <sup>1</sup>

<sup>1</sup> The School of Agriculture and Food Sciences, The University of Queensland, Brisbane, QLD 4072 Australia; Susanne.schmidt@uq.edu.au

<sup>2</sup> Commonwealth Scientific Industrial Research Organisation (CSIRO), 306 Carmody Road, Brisbane, QLD 4067, Australia; neil.huth@csiro.au (N.H.); merv.probert@csiro.au (M.P.); mario.herrero@csiro.au (M.H.)

<sup>3</sup> International Centre for Tropical Agriculture (CIAT), ICIPE Duduville Campus, Kasarani 00621, Nairobi, Kenya; b.paul@cgiar.org (B.P.); j.kihara@cgiar.org (J.K.); p.bolo@cgiar.org (P.B.)

<sup>4</sup> Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland, Brisbane, QLD 4072, Australia; d.rodriguez@uq.edu.au

\* Correspondence: bianca.das@csiro.au

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**Abstract:** Phosphorus (P) is an essential nutrient but is commonly limiting for food production in tropical and subtropical maize cropping. The efficiency of P fertiliser uptake is often low (5–30%) for various site-specific reasons and so identifying the drivers of P efficiency for different systems is important. We conducted a sensitivity analysis on the parameters of a well-established cropping systems model (APSIM) for a wide range of soil, crop and management factors to understand their influence on yield. The analysis was conducted for two contrasting maize cropping systems: (a) a high-input, large-scale commercial system in subtropical Queensland, Australia and (b) a low-input, small-holder system in tropical, western Kenya. In Queensland, yield was most sensitive to available P and mineral N supply, and the sensitivity of both increased with in-crop rainfall. Available P was also the most important parameter in Western Kenya, but N supply had much weaker influence due to higher levels of organic matter. Parameters controlling P sorption were more important than other soil parameters at both sites irrespective of seasonal conditions. In conclusion, these results suggest that efforts to improve efficiency of P use by plants need to account for interactions between water and N supply in environments where these are limiting. They also highlight a potential constraint to modelling of these systems as some of the most influential parameters are difficult to measure directly.

**Keywords:** APSIM; phosphorus efficiency; soil P model; Kenya; Australia



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