



Affordable nutrient solutions for improved food security as evidenced by crop trials

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Robust assessments of attainable crop yields in Africa and South America are pivotal for projections of food security and cropland expansion. In contrast to South America, Africa has not achieved significant increases in crop yields. Here we utilize a database of historical FAO crop fertilizer trials at 1358 locations for Sub-Saharan Africa and South America to calculate corn yield gaps at the continental scale. To further the African crop productivity discourse we consider the importance of soil nutrient stoichiometry and the viability of micro-dosing. Importantly, besides N, our crop yield potential estimates account for P which has a notoriously low availability in weathered tropical soils. We investigated yield gaps for corn under two scenarios: a micro-dosing scenario with marginal increases in N and P of 10 kg/ha and a larger yet still conservative scenario with proposed N and P applications of 80 and 20 kg/ha respectively. Two critical findings emerged from the analysis. The first is the degree to which P limits increases in corn yields. For example, under a micro-dosing scenario, in Africa, the addition of small amounts of N alone resulted in yield increases of 8% while the addition of only P increased yields by 26%, with implications for designing better balanced fertilizer distribution schemes. Application of both N and P at 10 kg ha⁻¹ lead to 15% and 32% yield increase. To put the benefits of these higher yields in context, this could save more than 4 and 25 million ha of cropland, or alternatively potentially feed 64 and 150 million people in South America and Africa respectively. The second finding was the relatively large amount of yield increase possible for a small, yet affordable amount of fertilizer application. Using African and South American fertilizer prices we show that the level of investment needed to achieve these results is considerably less than 1% of Agricultural GDP for both a micro-dosing scenario and for a scenario involving higher yet still conservative fertilizer application rates, where yield increases of 30 to 190% are possible. External investment in this low technology solution has the potential to kick start development and could complement other interventions such as better crop varieties and improved economic instruments to support farmers.