Keeping up with a growing population: the challenge of tripling cereal production with minimum emissions in sub-Saharan Africa towards 2050

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We assessed the increase in cereal demand based on population growth and dietary change for ten countries in sub-Saharan Africa. Using crop growth models, we evaluated whether sub-Saharan Africa can be self-sufficient for cereals (maize, millet, wheat rice and sorghum) in 2050 by intensifying crop production on existing cereal area. Next, we calculated N input requirements based on current management or optimal management. Finally, we explored different scenarios of intensification and/or cropland expansion, and calculated associated greenhouse gas emissions from fertiliser use and land use change to meet cereal demands in 2050.

Without cropland expansion, per-ha cereal yields will have to increase – on current crop land area - from the current 20% to a future 80% of the yield potential to meet demands, a level similar to the most productive regions of the world. Minimum nutrient input requirements must rise by 9 to 15 fold to support higher output and because current production relies largely on soil nutrient mining. The scenario study showed that intensification brings much lower greenhouse gas emissions than cropland expansion, but gains depend on nitrogen use efficiency achieved. Regardless of scenario, greenhouse gas emissions related to cereal production will be at least 50% higher in 2050 than 2015 and will increase by 4 to 5 fold if nitrogen use efficiency is not improved over its current level.

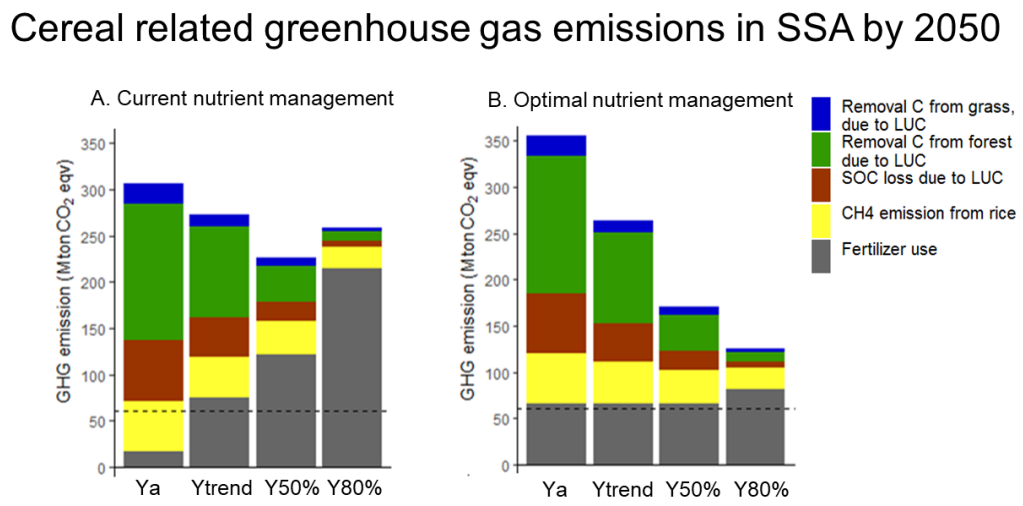

Figure 1: Greenhouse gas emissions to meet projected cereal demand in 2050, based on either (A) current or (B) optimal nutrient management, related to yield levels achieved. Ya = current cereal yield. Ytrend = extrapolating current yield trends. Y50% = 50% of water limited potential yield. Y80% = 80% of water limited potential yield. C = carbon. LUC = land use change. SOC = soil organic carbon.