Assessing the Yield Gap and resource use efficiency of Maize - A case study in Ethiopia -

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Introduction

In Sub-Saharan Africa, the yields of the major cereal crops have stagnated at less than 25% of potentially attainable yields while the per capita food production has continued to decrease over the last several decades. Major reasons for the yield gap are frequent drought stress and lack of nutrients warranting their efficient use.There is high demand for information on yield gaps and nutrient use efficiency in Ethiopia. Hence, in this study, the yield gap and Agronomic nitrogen use efficiency was estimated for maize (*Zea mays* L) in Jimma, Bako, and Yayu districts in the Oromia region of Ethiopia, which constitute major maize production areas, based on simulation runs with the SIMPLACE modeling framework.

Materials and Methods

A gridded data set was built; covering the major maize producing region of Ethiopia namely, Oromia. Within the SIMPLACE modelling framework, a combination of the LINTUL5 crop model with a detailed soil water balance model (SLIM) was used to simulate the yield of dominant a long-cycle maize variety (’BH-660’), with prevailing agri-management practices comprising low fertilizer application rate (20 kg ha^{-1}) and no irrigation. The simulations were run at 25 x 25 km grid cells and yield was calculated for each simulation grid for the period of 13 years (1998- 2010) and aggregated from the simulation grid to the district level for comparing them with the statistics.

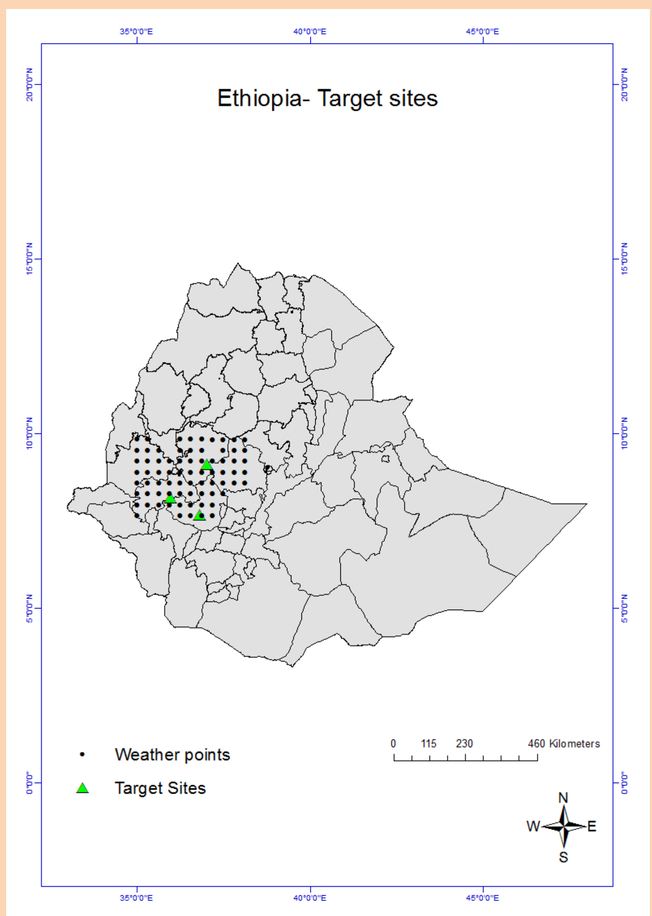

Figure 1: Study area in Ethiopia.

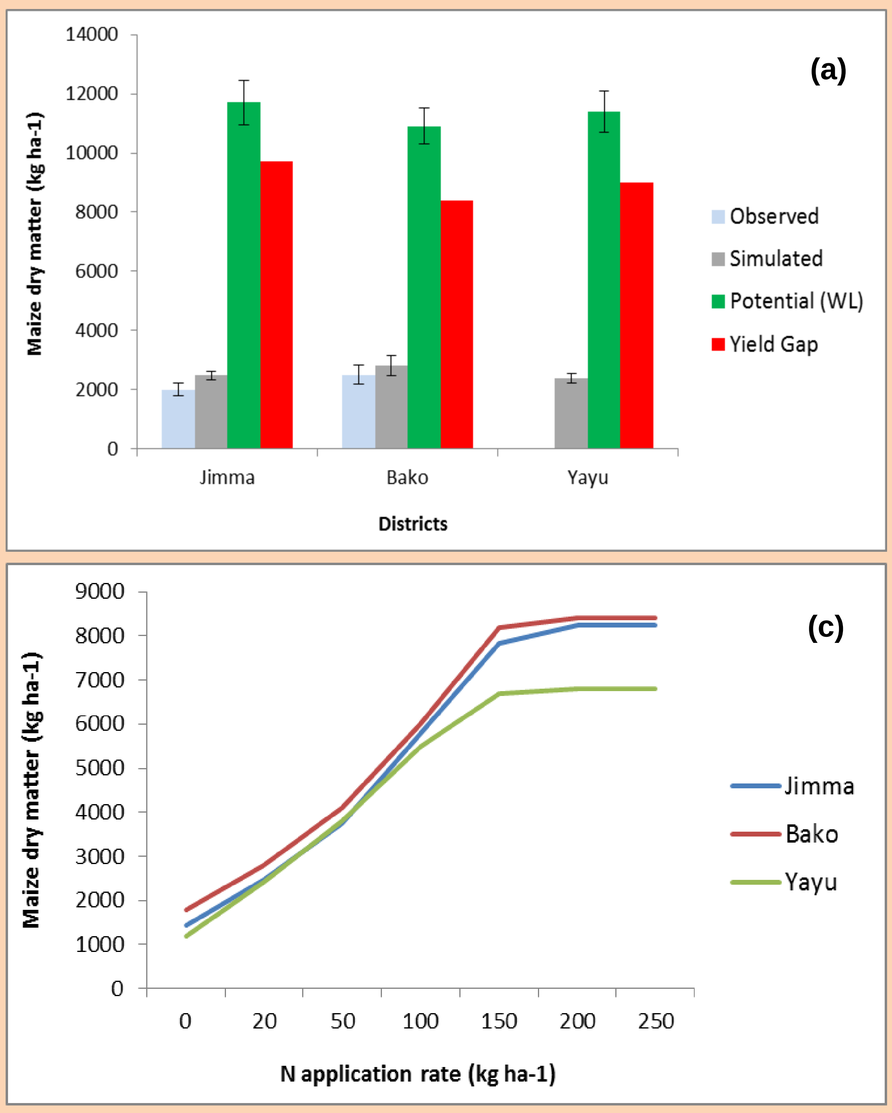

Figure 2: (a) Yield gap (Kg ha^{-1}) (b) Agronomic fertilizer efficiency under different nitrogen fertilizer application rates (in Kg yield Kg^{-1} N applied) & (c) Yield (kg ha^{-1}) under different nitrogen fertilizer application rates (in kg ha^{-1}) of maize in Jimma, Bako, and Yayu districts of Oromia region in Ethiopia.

Results and Discussion

The yield gap was in the tune of 9700 kg ha^{-1} and results indicate that at 150 kg ha^{-1} of nitrogen the yield maximum is reached in all three districts. Yield gaps were mainly due to nutrient limitations (nitrogen and to a smaller extent phosphorous) due to low average nitrogen application rates in this region (i.e., <20 kg N ha^{-1} Yr^{-1}). Insufficient nutrient application happens because inorganic fertilizers are often too expensive for most of the farmers, whilst organic resources are available in limited quantities.

Conclusion

This study concludes that across the three districts in Oromia region of Ethiopia, a high potential of maize yield is untapped under rain-fed production system.

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