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Estimation of Fertiliser Use Efficiency in Current Maize Production Systems in Ethiopia

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Abstract

Maize provides the main calorie requirements in the Ethiopian diet and holds a key role in addressing food security issues. The prevailing agriculture production systems in the dryer regions of Ethiopia are vulnerable due to the lack of irrigation systems and large spatial and temporal variability in rainfall. The situation gets aggravated by a predominance of low-input production systems and depleted soils. Furthermore, interactions between the limiting resources water and nutrients strongly influence the efficiency with which the resources are used, the crop productivity, and the sustainability of production systems. Therefore, understanding the resource use and resource use efficiency of maize current production systems could help to identify possibilities of producing more with the available resources and to address the variability in yield and biomass production across the Agro-ecological zones (AEZs) in Ethiopia.

Agronomic fertiliser use efficiency (FUE) in producing maize grain and biomass was estimated in three AEZs comprising 40 administrative zones in Ethiopia using the crop model LINTUL5 embedded into the general modelling framework SIMPLACE (Scientific Impact Assessment and Modelling Platform for Advanced Crop and Ecosystem Management). The simulations were run using a long maturing cycle maize variety (BH660) and a medium maturing cycle maize variety (BH540) and historical weather data (2004–2010).

The highest FUE was estimated with the application of $20 \text{ kg ha}^{-1} \text{ N} + 6.6 \text{ kg ha}^{-1} \text{ P}$ in AEZ 2 gradually decreasing with increased fertiliser application rate in AEZ 3 having lowest cumulative precipitation amount during the crop growth period. The finding in this study indicates that FUE of nitrogen fertiliser for maize grain and biomass production could be improved by adapting the application rates to the AEZ.

Keywords: Crop modelling, Ethiopia, fertiliser use efficiency, maize