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“Development on the margin”

Impact of Reduced Fallow Availability on Crop Yields in Low Input Cropping Systems in West Africa

THOMAS GAISER¹, MICHAEL JUDEX², ATTANDA MOUINOU IGUE³, CLAUDIA HIEPE⁴

¹*University of Bonn, Institute of Crop Science and Resource Conservation, Germany*

²*University of Bonn, Institute of Geography, Germany*

³*National Institute for Agricultural Research of Benin (INRAB), Benin*

⁴*Food and Agricultural Organisation (FAO), Natural Resources Management and Environment Department, Italy*

Abstract

Cropping systems in West Africa are predominantly low-input systems based on invading virgin land and/or soil fertility restoration through fallowing under the natural regrowth of vegetation. In many countries, the use of mineral fertiliser is extremely low with average application rates below 10 kg ha^{-1} cropland. On the other hand, increasing population pressure leads to reduction in fallow availability and compromises soil fertility restoration. In the Republic of Benin, the demographic projections for the first half of this century indicate a continuous growth of the population with a narrow interval of confidence. In the absence of an adequate soil fertility management with judicious use of mineral fertilisers, the soil degradation process with decreasing crop yields is expected to continue. The objective of this paper was, therefore, to quantify the regional effect of future population growth on crop yields in West Africa.

Three land use scenarios (L1, L2 and L3) for the Upper Ouémé catchment (15,000 km^2) were derived from different demographic projections combined with assumptions regarding future road networks and legal frameworks for forest protection using the CLUE-S modelling approach. The fallow-cropland ratio decreased in the three scenarios from 0.87 in the year 2000 to 0.66, 0.48 and 0.68 for L1, L2 and L3 respectively in 2050. Based on the projected ratio of fallow and cropland, trends of maize yield for the three land use scenarios were calculated using the EPIC (Environmental Policy Integrated Climate) model coupled with a spatial database. Maize yields followed the decreasing trend of the fallow-cropland ratio and estimated yield reductions amounted to up to 24% in the period 2021 to 2050. When comparing the yield reductions caused by reduced fallow availability with the impact of climate scenarios in the literature, it can be concluded that, in the near future, land use effects will be at least as important provided that soil fertility management does not change.

Keywords: Crop yield, fallow systems, land use change, West Africa