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“Development on the margin”

Lowland Rice Growth and Productivity as Related to Landscape Position, Bunding and Fertiliser Application

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Abstract

Rainfed lowlands present a high potential for rice production in West Africa. The exploitation of marginal areas such as inland valleys was examined to evaluate the potential for the expansion of lowland rice cropping in Benin Republic. However, there is some evidence that inland valleys in West Africa have particular constraints to crop production. Depending on the rainfall distribution, the heterogeneity of the topography leads to runoff causing erosion and loss of N. The objective of the study was to evaluate the efficiency of bunding and fertiliser application to increase rice productivity in relation to the position in the landscape. The experiment was conducted in a researcher managed on-farm trial located in Dogué village during 4 cropping seasons from 2007 to 2010. A split plot design was laid out with the combination of three factors: (1) slope position: middle slope (up) and down slope (down), (2) fertiliser inputs: control and combination of 40 kg ha⁻¹ P and 60 kg ha⁻¹ N, and (3) runoff control: with and without bunds. The total biomass (harvested 2 times during the growing cycle) and the grain yield across the seasons showed quite diverse response with respect to slope position and management practices. The slope position had a significant effect across the years for both final biomass and yield. The upslope presented higher yield during the first three years whereas in the year 2010 upslope plots produced the lowest yield. The fertiliser application started to have effect from the year 2009 onward. The impact of fertiliser has been high in the year 2009 leading to the increase of grain yield by 0.45 t ha⁻¹ with fertiliser compared to the control. Bunding which was important in maintaining flooded conditions on the plots and preventing runoff, contributed to the conservation of nitrogen but also maintained high risk of iron toxicity. The iron toxicity could be considered as critical factor however its impact was variable depending on the annual rainfall pattern. We conclude that through consideration of different slope positions and rainfall patterns we are able to evaluate the spatio-temporal variation of the effect of management options on rice productivity in inland valleys.

Keywords: Lowland rice, productivity, bunding, fertiliser, topography, West Africa