Tropentag, September 18-21, 2016, Vienna, Austria

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Rice Yield Variability in West Africa and its Determinants

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Abstract

Rice is staple food in West Africa but farmers' production does not satisfy consumption demands. Rice farmers' yields are low contributing to a large yield variation between and within major production systems and climatic zones. The objectives of this study are to quantify spatial variability of on farm yields in the three main rice production systems (irrigated lowland, rainfed lowland and rainfed upland) across the three main climatic zones (semi-arid, sub-humid and humid) in West Africa, and to identify yield-affecting factors. This study analysed data on yield, climate, soil, and crop management practices collected in 1305 farmers' fields in 22 sites in 11 West African countries over 2012 to 2014. A boundary function approach was used to evaluate the maximum yield response in relation to solar radiation and rainfall during rice growing period. Random forest method was used to identify factors affecting variation in difference between the maximum yield derived from the boundary curves and on-farm yield. Rice yields ranged from 0.3 to 8.0 Mg ha^{-1} with mean yields of 4.1, 2.0, and 1.5 Mg ha^{-1} and maximum yield of around 8, 6, and 4 Mg ha^{-1} in irrigated lowland, rainfed lowland, and rainfed upland rice production systems, respectively. Rice yield was higher in semi-arid zone in irrigated and rainfed lowland rice, whereas there was no large difference among the three zones in upland rice. Nitrogen application rate and herbicide use were major contributors to the yield variation in irrigated lowland rice. Bunding, variety used, N fertiliser application rate, weeding frequency and soil pH affected variation in the yield differences in rainfed lowland rice. Bird control, bunding and variety used were the major determinants in rainfed upland rice.

We conclude that improved crop management strategies will enhance on-farm rice yield in West Africa. Improving access to inputs and their use efficiencies in irrigated lowland rice and dissemination of local-specific crop management practices in rained lowland rice are likely to be key areas for rice research and development in this region.

Keywords: Climatic zones, management practices, *Oryza sativa*, yield gaps

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