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Technical efficiency and profitability of rice ratooning in Africa: Evidence from seven countries

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Abstract

Rice consumption in Africa is growing rapidly, yet conventional rice cultivation contributes to greenhouse gas emissions, soil degradation, and wetland loss. Ratooning-harvesting a second crop from stubble of the main crop-offers a potential pathway for sustainable intensification, but evidence under real farm conditions across Africa remains scarce. This study assesses whether rice ratooning improves technical efficiency and profitability among smallholders, using cross-sectional farm household data from 3,276 rice farmers across seven African countries (Senegal, Côte d'Ivoire, Nigeria, Uganda, Kenya, Tanzania, and Madagascar). We estimate a stochastic frontier production function to derive technical efficiency and inefficiency determinants, and calculate gross margins, average and marginal value-cost ratios. To address self-selection bias, we apply propensity score matching to estimate the causal effect of ratooning on gross margins per hectare. Descriptive results show that ratoon yields range from 34 % to 68 % of main crop yields, while ratoon costs per hectare range from 12 % to 52 % of main crop costs, indicating substantial cross-country heterogeneity. Stochastic frontier estimates reveal that ratooning significantly reduces technical inefficiency in Senegal (-1.985, $p < 0.05$) but increases inefficiency in Kenya (1.250, $p < 0.05$) and Tanzania (1.825, $p < 0.01$). Propensity score matching results show a positive and significant average treatment effect on the treated for Senegal ($+286\,\text{USD}\,\text{ha}^{-1}$, $p < 0.05$), but negative effects for Kenya ($-631\,\text{USD}\,\text{ha}^{-1}$, $p < 0.01$) and Madagascar ($-457\,\text{USD}\,\text{ha}^{-1}$, $p < 0.05$). We conclude that rice ratooning is not universally profitable or efficient in Africa; its performance is highly context-specific. Promising use cases exist (e.g., Senegal), but blanket promotion without agronomic support, particularly in East Africa, is unwarranted.

Keywords: Africa, profitability, propensity score matching, rice ratooning, stochastic frontier analysis, technical efficiency

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