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Impact of intercropping systems on farm productivity and welfare in Ghana

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Abstract

The transition towards multifunctional agro-ecosystems is critical for enhancing climate resilience, productivity, and sustainability among smallholder farmers in sub-Saharan Africa. This study evaluates the impact of intercropping systems on farm productivity and welfare outcomes in Ghana using panel data from the Ghana Socioeconomic Panel Survey (Waves 2 and 3), comprising 4,156 households in a panel structure. To address potential selection bias and endogeneity in intercropping adoption, the study employs a combination of Multinomial Endogenous Switching Regression (MESR) and Inverse Probability Weighted Regression Adjustment (IPWRA) estimators, complemented by fixed effects models for robustness. Descriptive evidence indicates that monocropping remains dominant, although intercropping adoption varies across crop combinations, with cereal-tuber and cereal-legume systems exhibiting higher participation relative to cereal-tree crop systems. Econometric results reveal strong and consistent productivity gains from intercropping. MESR estimates indicate that the average treatment effect on the treated (ATT) is positive and substantial, suggesting that intercropping significantly increases farm yield relative to the counterfactual of monocropping. Similarly, IPWRA estimates confirm robust positive impacts, highlighting the effectiveness of intercropping even after correcting for observable and unobservable selection bias. Heterogeneity analysis across regimes shows that yield responses differ between adopters and non-adopters, reflecting structural differences in farm characteristics and management practices. Intercropping adoption is positively associated with farm size, soil management practices, and extension access, but negatively associated with rainfall variability, indicating that farmers use intercropping as a risk mitigation strategy under climate uncertainty. Despite strong productivity effects, welfare outcomes such as food consumption and income exhibit mixed results, suggesting incomplete transmission of productivity gains into household welfare. The findings underscore the role of intercropping as a climate-smart agricultural strategy that enhances productivity while contributing to agro-ecosystem multifunctionality. However, adoption remains constrained by resource endowments and institutional factors. Development interventions should therefore focus on improving access to extension services, credit, and climate information to promote equitable adoption. Scaling context-specific intercropping systems can accelerate the transition towards resilient and sustainable agricultural systems in Ghana and beyond.

Keywords: Climate resilience, farm productivity, Ghana, intercropping, multinomial endogenous switching regression

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