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Contextualising the marginal returns of regenerative agriculture on maize performance under climate change in Nigeria

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Abstract

This study addresses the growing challenge of climate variability, including droughts and erratic rainfall, which threaten maize production and smallholder livelihoods in Nigeria. Despite the increasing promotion of regenerative agriculture (RA) as a sustainable alternative, its marginal returns and heterogeneous impacts on maize performance remain insufficiently understood, particularly under extreme climate conditions. The objective of the study is to examine the marginal effects of RA on maize yield, yield variability, and yield distribution, while accounting for both observed and unobserved farmer heterogeneity. A multistage sampling technique was used to collect cross-sectional data from maize farmers in Southwest Nigeria. Analytical methods include Seemingly Unrelated Regression (SUR) to assess determinants of RA adoption and a Marginal Treatment Effect (MTE) framework to evaluate impact heterogeneity, complemented by robustness checks. Results show that RA adoption significantly improves maize yield and reduces yield variability among adopters, indicating enhanced resilience. However, the average treatment effects remain modest, and benefits are not uniformly distributed. The MTE results reveal that farmers with lower unobserved resistance (e.g., higher adaptability or innovation capacity) derive greater benefits, while those with higher resistance experience limited or even negative returns. Additionally, RA increases yield skewness, suggesting a higher probability of achieving exceptional yields. Key drivers of adoption include land ownership, access to financial services, extension services, and climate change perception, whereas labour intensity and limited awareness constrain uptake. The study concludes that RA holds promise for improving productivity and resilience in climate-stressed maize systems, but its effectiveness is context-specific. It recommends targeted policies that strengthen extension systems, improve land tenure security, and promote farmer awareness to ensure inclusive and scalable adoption of regenerative practices.

Keywords: Climate change, maize yield, marginal treatment effect, Nigeria, regenerative agriculture

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