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## Resource use efficiency under sustainable intensification practices among maize farmers in rural Ghana

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### Abstract

Given the substantial investments, both public and private, in sustainable food systems, recent academic and scientific research has prioritised the examination of their impact. Notably, studies focusing on the effects of smallholder sustainable intensification have highlighted its significant contribution to livelihood enhancement. However, the question of whether smallholders employing sustainable intensification technologies (SIT) operate efficiently in production remains underexplored and subject to public debate. This study addresses this gap by analysing the impact of sustainable intensification technologies adoption on the technical efficiency of smallholder farmers in northern Ghana. Employing a multistage sampling technique, quantitative household-level data were collected from 461 households in the region, comprising 224 adopters of sustainable intensification technologies and 237 non-adopters. The mean maize output was observed at 1679.96 kg per acre for adopters and 1288.74 kg per acre for non-adopters. Adopters utilised more land (4.8 acres), labour (7 persons per acre), and capital (GHS 709.82 per acre) compared to non-adopters. Conversely, non-adopters exhibited higher usage of fertiliser (111.14 kg per acre), maize seed (40.09 per acre), herbicides (2.91 liters per acre), and pesticides (2.92 liters per acre). Both groups were found to underutilise land, although this phenomenon was more pronounced among non-adopters. Adopters displayed higher inefficiencies in labour and capital utilisation, whereas non-adopters demonstrated inefficiencies in seed and herbicides usage. Nevertheless, overall, adopters were observed to underutilise production resources, with potential for increasing resources by 0.22 (p-value = 0.03). Using the Stochastic Frontier Analysis, farmers' inefficiency was found to be influenced by various factors including geographical location, age, household size, gender, primary education, access to extension services, farm size, experience, and adoption of sustainable intensification technologies. Notably, gender, age, household size, and experience were associated with reduced technical efficiency. The mean technical efficiencies for adopters and non-adopters were observed at 0.724 and 0.899 respectively. Although technical efficiency among adopters appeared lower initially, this is anticipated given that exposure to new farming practices typically leads to efficiency improvements over time.

**Keywords:** Maize, northern Ghana, smallholder, stochastic frontier analysis, sustainable intensification