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The role of climate smart agriculture practices on productivity, adaptation, and mitigation in Ethiopia: Systematic review approach

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Abstract

Agriculture is the foundation of the economy in Ethiopia, which has greatly contributed to the national income and employment. Climate change poses a major threat to agricultural productivity, food security, and sustainability in Ethiopia, where agriculture is predominantly rain-fed. This study systematically reviews the role of Climate Smart Agriculture (CSA) practices in improving productivity, enhancing climate adaptation, and mitigating greenhouse gas (GHG) emissions. Using the Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) framework, 1,029 studies were identified, of which 52 met the inclusion criteria for analysis. The review shows that CSA practices such as conservation agriculture, integrated soil fertility management, agroforestry, crop diversification, and small-scale irrigation are widely adopted across different agro ecological zones. Education, access to credit, extension services, farm size, and climate information are the key determinants of CSA practice adoption. Empirical evidence consistently identified that CSA practices improve crop productivity, technical efficiency, and farmers' livelihoods while reducing production risks associated with climate variability. Moreover, CSA contribute to climate change mitigation by enhancing soil carbon sequestration and reducing greenhouse gas emissions particularly through agroforestry, conservation agriculture, and improved soil management practices. These reviews confirm the "triple-win" role of CSA in enhancing productivity, adaptation, and mitigation. However, gaps remain in integrated assessments of the three CSA pillars, the role of social capital in adoption processes and long-term environmental impacts. The study concludes that scaling up CSA practices, supported by climate information services, strong institutional frameworks, and financial access, is essential for promoting sustainable and climate resilient agricultural development in Ethiopia.

Keywords: Agricultural productivity, climate smart agriculture, Ethiopia, greenhouse gas emissions, sustainability

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