Evaluating the potential environmental co-benefits of perennial grass-legume mixtures in Ethiopia

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Abstract

While livestock plays a crucial role in the livelihoods of Ethiopian farmers and the overall economy, it also contributes to land degradation. The scarcity of land compels livestock to rely heavily on overgrazed natural pastures for feed intake. This contributes to Ethiopia's high rates of soil erosion and land degradation, thus posing a significant threat to ecosystems and livelihoods. With climate change projected to exacerbate this issue, there is an urgent call for action towards the implementation of innovative farming systems that simultaneously increase yields, safeguard natural resources, and foster economic growth. Consequently, the EthiopiaGrass project aims to develop integrated grassland-cropping systems that address this challenge through testing of multi-purpose forages and grass-legume mixes for enhancing livestock feed provision, increasing food crop production, and simultaneously improving soil quality. During on-station trials in North and Southern Ethiopia, several grass-legume mixtures were identified as more productive than monocultures and having positive effects on soil quality, carbon storage, and nutrient cycling. Participatory farmer-led testing amongst more than 300 farmers confirmed their acceptability by smallholders and revealed specific trait preferences and adoption patterns. This paper presents a quantitative assessment of the environmental benefits of widespread adoption of such grass-legume mixes in Ethiopia's mixed crop-livestock and specialised dairy systems. We parametrized the CLEANED model (www.alliancebioversityciat.org/tools-innovations/cleaned) with secondary data on livestock numbers, herd composition, and productivity, along with empirical data from trials, adoption rates from participatory assessments and feed basket compositions from G-FEAST assessments (www.ilri.org/news/gendered-feed-assessment-tool-g-feast). The results demonstrate significant environmental benefits of forage grass-legume mixes, including a nearly 20 % reduction in land requirement per liter of milk, up to 15 % decline in nitrogen mining and water use, and almost 20 % reduction in GHG emission intensity. This presents opportunities to reduce livestock numbers, freeing up land for food or cash crops, reforestation, or conservation efforts. To achieve sustainable farming in Ethiopia, substantial changes in livestock and land management are imperative. Transitioning to more intensive feeding systems such as cut-and-carry forage production of integrated grass-legume mixes or improved forage rotations with food crops could be crucial. However, further research is needed to assess gendered labour and decision-making implications.

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