Tropentag, September 16-18, 2026, hybrid conference

"Towards multi-functional agro-ecosystems
promoting climate resilient futures"

What farmers already know: Outscaling indigenous innovations towards climate-resilient agro-ecosystems in South Punjab, Pakistan

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Abstract

Smallholder farmers in South Punjab, Pakistan operate highly complex and adaptive production systems that extend well beyond subsistence. On plots as small as one hectare, these farmers simultaneously manage crops, livestock, agroforestry, and residue recycling. Such indigenous innovations form the foundation of resilient, multifunctional agro-ecosystems. Despite their important role in supporting livelihoods, indigenous farmer-led innovations remain poorly documented and are largely absent from formal policy and extension frameworks, which continue to favour top-down interventions. This study investigated the conditions, mechanisms, and pathways required to outscale socially and ecologically sustainable indigenous innovations among smallholder farmers in Punjab, with a focus on integrated crop-livestock production and agroforestry practices.

Data were collected through semi-structured interviews and focus group discussions with smallholder farmers, both practising and non-practising indigenous innovations. These were complemented by interviews with policymakers, agricultural departments, and public and private extension service providers. The research identified the policy support, input access, value chain linkages, and technical training required to facilitate broader adoption. Findings revealed that while indigenous integrated crop-livestock and agroforestry innovations demonstrate strong ecological and social sustainability, their outscaling is constrained by limited access to extension services, weak policy recognition, and inadequate value chain support. Farmer-to-farmer knowledge exchange emerged as a particularly effective and culturally accepted mechanism for horizontal scaling, while institutional and policy reforms were identified as critical enablers of vertical scaling. The study concludes that reorienting agricultural extension and policy frameworks towards bottom-up models that systematically recognise and build upon indigenous farmer knowledge is essential for achieving climate-resilient, multifunctional agro-ecosystems at scale in smallholder farming communities in Punjab.

Keywords: Local knowledge, multifunctional agro-ecosystems

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