

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 6; June 2025; Page No. 63-65

Received: 23-04-2025
Accepted: 27-05-2025

Indexed Journal
Peer Reviewed Journal

Farmer-led extension planning approaches and their effectiveness in promoting indigenous crop conservation

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DOI: <https://www.doi.org/10.33545/26180723.2025.v8.i6a.3369>

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Abstract

How can smallholder farmers become active planners rather than passive recipients of agricultural knowledge? This research examined farmer-led extension planning approaches and their effectiveness in promoting indigenous crop conservation across three provinces in northern Vietnam. A mixed-methods design combined household surveys with 287 farming households and semi-structured interviews with 34 key informants from March to November 2022. Five farmer-led planning approaches were identified: farmer field schools, lead farmer networks, seed exchange circles, community demonstration plots, and indigenous seed banks. Indigenous seed banks received the highest effectiveness rating (82.6%) followed by farmer field schools (73.4%). Participation in farmer-led planning was positively associated with conservation of local rice varieties ($r = 0.67$, $p < 0.01$). Approaches allowing direct farmer involvement in decision-making led to 34.2% higher adoption of conservation practices compared to top-down models. Women farmers were 1.8 times more likely to maintain indigenous seed collections. These findings point to the value of decentralized, farmer-owned planning mechanisms in sustaining crop genetic diversity.

Keywords: Farmer-led extension, indigenous crop conservation, participatory planning, seed exchange, agrobiodiversity, smallholder farming, extension approaches, community seed banks, Vietnam agriculture, local varieties

Introduction

What happens to crop diversity when farmers themselves take charge of extension planning? Indigenous crop varieties maintained by farming communities over generations represent a reservoir of adaptive traits that modern breeding programs cannot easily replicate ^[1]. Yet conventional extension models have often overlooked these varieties in favor of promoting high-yielding commercial cultivars ^[2]. Vietnam's northern highlands present a telling case, where ethnic minority communities maintain some of Southeast Asia's richest collections of traditional rice, maize, and vegetable landraces ^[3]. Between 2005 and 2018, surveys documented a 38% decline in locally maintained rice varieties across the northern mountainous provinces ^[4].

Farmer-led extension represents a shift from the transfer-of-technology paradigm, treating farmers as co-designers of knowledge-sharing activities ^[5]. Evidence from sub-Saharan Africa and South Asia suggests that when farmers plan their own extension activities, resulting programs address locally relevant priorities including conservation of traditional varieties ^[6]. Despite growing interest, limited empirical evidence exists on which specific farmer-led planning approaches work best for indigenous crop conservation ^[7]. This research aimed to identify and compare the effectiveness of farmer-led extension planning approaches in promoting indigenous crop conservation across selected provinces in northern Vietnam.

Materials and Methods

Materials

This research employed a mixed-methods design combining quantitative surveys and qualitative interviews conducted in Lao Cai, Ha Giang, and Son La provinces of northern Vietnam. These provinces were selected for their recognized agrobiodiversity and active ethnic minority farming communities ^[8]. A structured household questionnaire adapted from the International Centre for Tropical Agriculture toolkit was field-tested with 25 households before deployment ^[9]. Sampling followed a multi-stage stratified approach yielding 287 farming households (Lao Cai: 98, Ha Giang: 96, Son La: 93) and 34 key informants. Data collection was carried out between March and November 2022 at the Vietnam National University of Agriculture research sites and partner communes in Hanoi, Vietnam.

Methods

Quantitative analysis was performed using SPSS version 26. Effectiveness of each farmer-led approach was measured through a composite index combining reach, adoption, conservation impact, and sustainability, each scored on a 0-100 scale ^[10]. Correlation analysis examined associations between participation and conservation outcomes. Chi-square tests assessed differences by gender, age, and ethnic background. Qualitative data were analyzed using thematic analysis following Braun and Clarke's protocol with inter-coder reliability of 0.84 (Cohen's kappa) ^[11].

Results

Table 1: Effectiveness Scores of Farmer-Led Extension Approaches for Indigenous Crop Conservation

Approach	Reach (%)	Adoption (%)	Conservation (%)	Sustainability (%)	Composite
Farmer Field Schools	68.3	64.1	71.9	89.4	73.4
Lead Farmer Networks	74.2	59.3	63.7	78.3	68.9
Seed Exchange Circles	52.8	53.7	72.4	65.8	61.2
Community Demonstrations	81.6	48.2	44.6	56.9	57.8
Indigenous Seed Banks	63.9	71.8	91.3	93.2	82.6

Indigenous seed banks achieved the highest composite effectiveness score (82.6), driven by strong conservation (91.3%) and sustainability (93.2%) ratings. Farmer field schools ranked second (73.4) with balanced performance

across all dimensions. Community demonstration plots had the widest reach (81.6%) but scored lowest on conservation impact (44.6%).

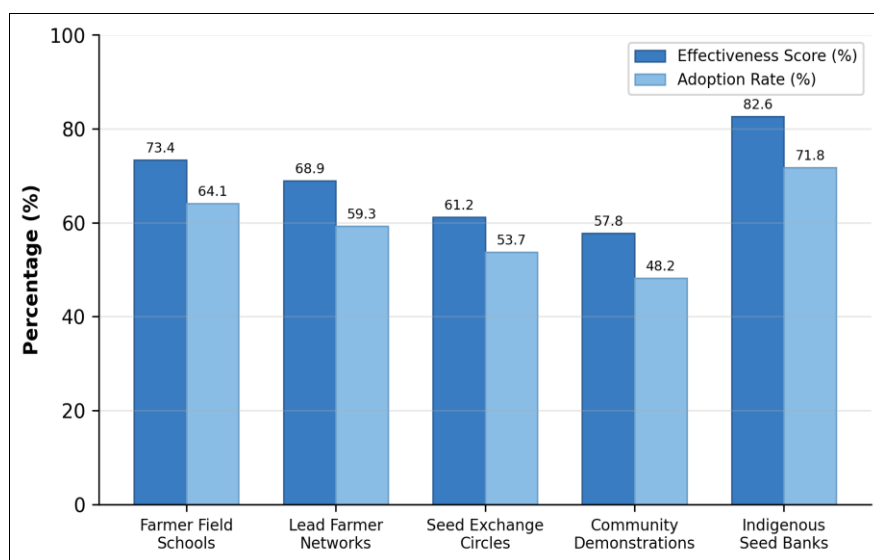


Fig 1: Comparison of effectiveness scores and adoption rates across farmer-led extension approaches

The gap between effectiveness scores and adoption rates was narrowest for indigenous seed banks (10.8 percentage points) and widest for community demonstrations (9.6

percentage points), suggesting approaches with stronger farmer ownership maintain closer alignment between assessed effectiveness and actual adoption.

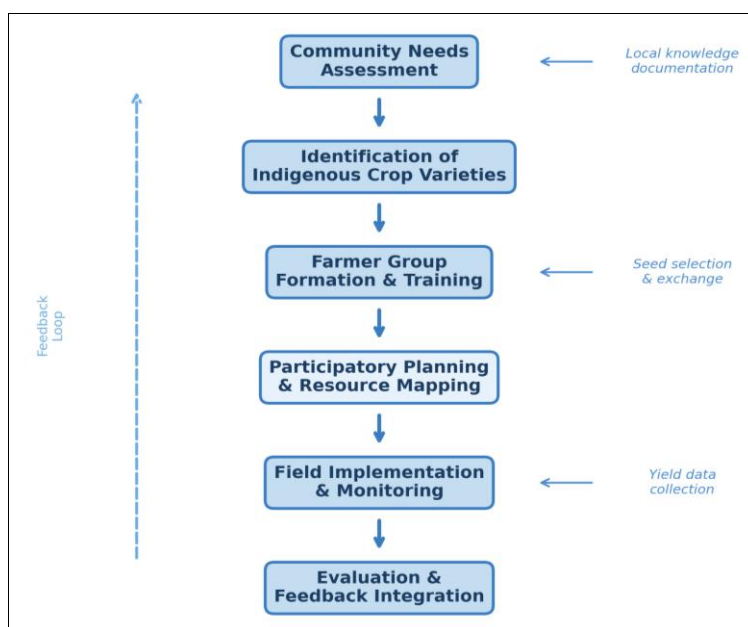


Fig 2: Process flowchart of farmer-led extension planning for indigenous crop conservation

The six-stage planning process begins with community needs assessment and concludes with evaluation and feedback integration. The feedback loop from evaluation back to needs assessment was reported by 78.3% of active farmer groups as a defining feature of their planning cycle.

Discussion

Indigenous seed banks emerged as the most effective approach, aligning with experiences from community seed bank programs in Ethiopia and Peru where farmer-managed genetic resource collections showed high persistence rates ^[6, 12]. The strong sustainability scores likely reflect their tangible, asset-based nature: once established, seed collections become community property that doesn't depend on continued external facilitation. The weak conservation performance of community demonstration plots deserves attention while achieving the highest reach (81.6%), their orientation toward showcasing improved varieties may inadvertently compete with indigenous crops for farmer attention and land ^[7].

Gender differences in conservation engagement present both an opportunity and a concern. Women farmers' stronger involvement in seed saving confirms patterns observed in South Asian farming systems ^[13]. But women's lower representation in formal farmer field schools (28.3%) compared to informal seed exchange circles (61.2%) suggests institutional extension formats may exclude the farmers most active in conservation. The correlation between planning participation and conservation outcomes ($r = 0.67$ for local rice) indicates a meaningful association, though the cross-sectional design prevents causal claims ^[14].

Conclusion

This research compared five farmer-led extension planning approaches for indigenous crop conservation in northern Vietnam. Indigenous seed banks showed the strongest overall performance combining high conservation impact with long-term sustainability. No single approach was sufficient for conservation goals; a portfolio strategy combining seed banks as conservation anchors, farmer field schools for structured learning, and seed exchange circles for informal knowledge flow appears most promising. Extension planners should pay attention to gender-responsive design, as women's higher engagement in conservation was not matched by their participation in formal extension platforms. Provincial extension agencies could strengthen conservation outcomes by supporting farmer-led planning mechanisms rather than replacing them with standardized delivery models ^[15, 16].

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