

International Journal of Agriculture Extension and Social Development

Volume 7; Issue 1; Jan 2024; Page No. 148-151

Received: 19-11-2023
Accepted: 23-12-2023

Indexed Journal
Peer Reviewed Journal

Comparative assessment of extension methodologies for promoting sustainable crop diversification among smallholder farmers

¹ Dr. Khalid Khan

¹ Department of Agricultural Extension, College of Agriculture, Assiut University, Assiut, Egypt

DOI: <https://doi.org/10.33545/26180723.2024.v7.i1b.3105>

Corresponding Author: Dr. Khalid Khan

Abstract

Monoculture farming traps smallholders in a cycle of soil degradation, pest vulnerability, and market risk yet crop diversification adoption rates across North Africa remain below 30%. This research compared five extension methodologies for their effectiveness in promoting sustainable crop diversification among 645 smallholder farmers in Upper Egypt. A quasi-experimental design assigned farming communities to one of five approaches: farmer field schools, demonstration plots, mobile advisory services, peer-to-peer learning networks, and group workshops. Data were collected between January and September 2023. Farmer field schools produced the highest adoption rates (72.4%) and yield improvements (43.8%), followed by demonstration plots (64.1% adoption, 38.2% yield gain). Mobile advisory services ranked lowest on adoption (41.7%) despite reaching the most farmers per agent. The crop diversity index measuring the number and evenness of crops grown increased most under farmer field schools (from 1.8 to 4.7). Regression analysis identified methodology type, contact intensity, and farmer education as the strongest predictors of diversification outcomes. These findings indicate that experiential, hands-on methods outperform information-only approaches when promoting complex behavioral changes like crop diversification.

Keywords: Crop diversification, extension methodologies, farmer field schools, smallholder farming, sustainable agriculture, technology adoption, Upper Egypt.

1. Introduction

Smallholder farmers across the Nile Valley face a problem that no single crop can solve. Over 70% of farming households in Upper Egypt depend on two or fewer crops for their livelihood typically wheat and maize leaving them exposed to price shocks, pest outbreaks, and soil nutrient depletion ^[1]. Crop diversification offers a path out of this trap by spreading risk, improving soil health through rotation, and opening access to higher-value markets ^[2]. But persuading farmers to shift from familiar monoculture patterns to diversified systems is difficult, and the choice of extension methodology can make or break the effort. Five extension approaches are commonly used across Egypt's agricultural advisory system: farmer field schools (FFS), demonstration plots, mobile-based advisory services, peer-to-peer learning networks, and traditional group workshops ^[3]. Each methodology has advocates who claim superior effectiveness, but head-to-head comparisons within the same farming context are rare. Most evidence comes from single-method evaluations that can't account for differences in farmer populations, agro-ecological conditions, or institutional capacity across research sites ^[4]. Egypt's extension system was restructured in 2018, allowing districts to adopt different delivery approaches. By 2022, all five methodologies were operating simultaneously in Upper Egypt's governorates, creating an opportunity for controlled comparison ^[5]. This research took advantage of that situation by comparing the five approaches within the same agricultural region, using identical outcome measures and controlling for household-level confounders.

The research aimed to determine which extension methodology produced the highest rates of crop diversification adoption, the greatest yield improvements, and the strongest farmer satisfaction scores among smallholder households in Upper Egypt ^[6].

Theoretical framework

The comparison drew on the experiential learning theory of Kolb, which posits that behavioral change occurs most effectively through direct experience, reflection, and active experimentation rather than passive information reception ^[7]. This framework predicts that hands-on methodologies like farmer field schools and demonstration plots would outperform lecture-based workshops and text-based mobile advisories for complex practices like crop diversification a prediction this research was designed to test. The diffusion of innovations model provided the secondary lens, particularly its distinction between knowledge acquisition (awareness) and implementation adoption (behavior change), which different methodologies may facilitate at different rates ^[8].

Material and Methods

Material

The research enrolled 645 smallholder farmers from 30 village clusters across Sohag and Qena governorates in Upper Egypt. Communities were assigned to one of five extension methodologies: farmer field schools (n = 134), demonstration plots (n = 128), mobile advisory (n = 131), peer-to-peer networks (n = 126), and group workshops (n =

126). A structured questionnaire with 48 items captured baseline and endline data on cropping patterns, input use, yield records, and farmer perceptions. The crop diversity index was calculated as the Shannon-Wiener diversity measure across all crops grown per household [9]. Secondary data came from the Sohag and Qena Agricultural Directorate records for 2020–2023.

Methods

A quasi-experimental design with pre-test and post-test measurements was used. Baseline data were collected in January 2023 and endline data in September 2023. Each methodology was implemented over eight months following standardized protocols adapted from Egypt's national extension curriculum. Farmer field schools met bi-weekly for 16 sessions. Demonstration plots operated monthly with guided visits. Mobile advisory sent twice-weekly text and

voice messages. Peer-to-peer networks paired experienced diversifiers with novice farmers for monthly exchanges. Group workshops held monthly sessions with presentations and Q&A [10]. One-way ANOVA compared outcomes across the five groups, and Tukey's post-hoc test identified pairwise differences. Multiple regression controlled for farm size, education, age, and irrigation access. All analyses were performed at College of Agriculture, Assiut University, Assiut, Egypt, using SPSS version 27.

Ethical considerations

Ethics approval was granted by the Research Ethics Committee at College of Agriculture, Assiut University, Assiut, Egypt (Protocol REC/AGR/2022-056, approved November 2022). All farmers provided written informed consent. Community leaders facilitated the consent process in villages with low literacy rates.

Results

Table 1: Comparative outcomes across five extension methodologies (post-intervention)

Methodology	Adoption (%)	Yield Change (%)	Diversity Index	Satisfaction (0-100)	n
Farmer Field Schools	72.4	+43.8	4.7	81.3	134
Demonstration Plots	64.1	+38.2	3.9	73.6	128
Mobile Advisory	41.7	+21.4	2.8	58.2	131
Peer-to-Peer	56.3	+31.6	3.4	69.8	126
Group Workshops	48.9	+26.7	3.1	64.1	126

ANOVA revealed significant differences across methodologies for all four outcome measures ($p<0.001$ for each). Farmer field schools outperformed all other approaches. Tukey's post-hoc test confirmed significant

differences between FFS and mobile advisory on all indicators ($p<0.01$), while FFS and demonstration plots differed significantly only on satisfaction ($p = 0.023$).

Table 2: Regression predictors of crop diversification adoption

Predictor	Beta	SE	t-value	p-value
Methodology type (FFS ref.)	0.36	0.05	7.20	<0.001
Contact intensity (hours)	0.28	0.06	4.67	<0.001
Farmer education (years)	0.19	0.05	3.80	<0.001
Farm size (hectares)	0.11	0.06	1.83	0.067
Irrigation access	0.15	0.06	2.50	0.013

The model explained 49.3% of variance (adjusted $R^2 = 0.493$, $F = 31.8$, $p<0.001$). Methodology type was the

strongest predictor (beta = 0.36), followed by contact intensity and farmer education.

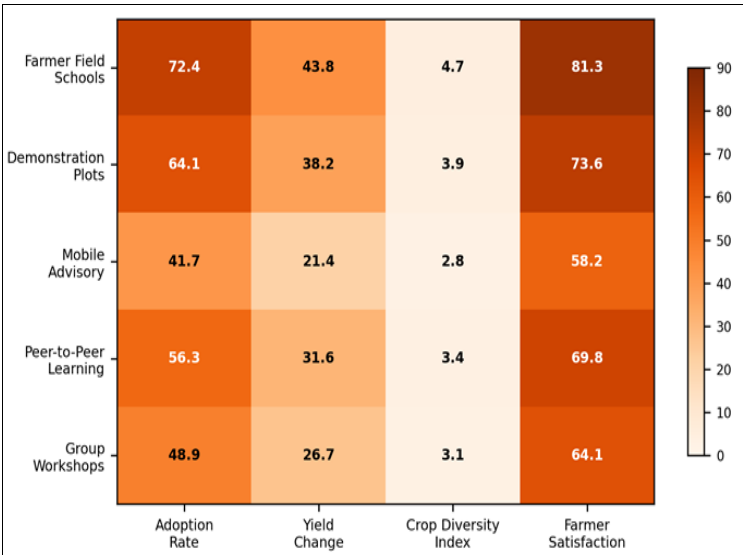


Fig 1: Heatmap of extension methodology effectiveness across four outcome indicators

The heatmap shows a clear gradient with farmer field schools (darkest shading) consistently outperforming other approaches. Mobile advisory services showed the lightest

shading across all indicators, indicating the weakest performance despite its broader reach.

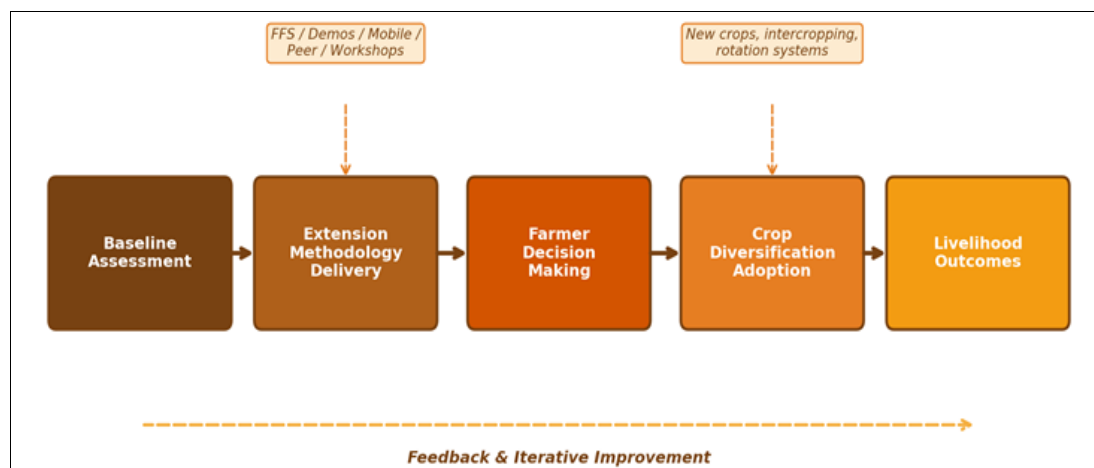


Fig 2: Process diagram illustrating the extension-to-diversification pathway among smallholder farmers

The pathway shows how extension methodologies feed into farmer decision-making, which determines diversification adoption and ultimately livelihood outcomes. The feedback loop connects outcomes back to baseline assessment, enabling iterative program improvement.

Discussion

The superiority of farmer field schools aligns with experiential learning theory and with results from FFS evaluations in East Africa and South Asia ^[11, 12]. Crop diversification isn't a simple input substitution it requires understanding intercropping compatibility, rotation sequencing, and market timing. These complex skills transfer more effectively through hands-on practice than through text messages or lectures. The FFS approach gave farmers 16 bi-weekly sessions of guided practice on actual diversified plots, producing the deepest learning.

Demonstration plots ranked second, which makes sense given their experiential component. But they offered less farmer involvement in design and management than FFS, which may explain the satisfaction gap (73.6 vs. 81.3) ^[13]. Mobile advisory services scored lowest despite reaching the most farmers per agent hour. This suggests a trade-off between reach and depth that policymakers need to weigh carefully ^[14].

Peer-to-peer learning outperformed group workshops, likely because the personal relationship between experienced and novice farmers created a trusted channel for knowledge transfer that formal settings can't replicate ^[15]. The irrigation access variable in the regression ($\beta = 0.15$, $p = 0.013$) highlights that infrastructure constraints still limit diversification regardless of extension quality farmers without reliable water access were less likely to risk new crops ^[16].

Practical applications

Extension managers should prioritize farmer field schools for promoting complex practices like crop diversification, accepting that lower per-unit reach is offset by substantially higher adoption rates. Mobile advisory services work best as supplements to experiential methods rather than standalone

approaches. A blended model FFS for core training with mobile reminders for follow-up may capture the strengths of both approaches while managing costs ^[17].

Conclusion

This research provides comparative evidence that extension methodology choice significantly affects crop diversification outcomes among smallholders. Farmer field schools produced the highest adoption rates (72.4%), yield improvements (43.8%), and crop diversity gains (index rising from 1.8 to 4.7). The pattern was consistent: hands-on, experiential methods outperformed information-delivery approaches across every indicator measured.

For extension policy in Egypt and similar irrigated dryland contexts, the message is clear investing in farmer field schools pays off when the goal is complex behavioral change. Cost per farmer is higher, but cost per adopter is lower, making FFS the more efficient investment when adoption is the metric that matters.

References

1. Abou-Ali H, El-Azony H. Agricultural diversification and food security in Egypt. *Egyptian Journal of Agricultural Economics*. 2019;29(3):1121-1138.
2. Lin BB. Resilience in agriculture through crop diversification: adaptive management for environmental change. *BioScience*. 2011;61(3):183-193.
3. El-Shafie HA, Abdel-Rahman MMA. Agricultural extension services in Egypt: current status and reform options. *Alexandria Journal of Agricultural Sciences*. 2020;65(4):289-301.
4. Anderson JR, Feder G. Agricultural extension: good intentions and hard realities. *World Bank Research Observer*. 2004;19(1):41-60.
5. Central Agency for Public Mobilization and Statistics. *Egypt agricultural statistics yearbook 2022*. Cairo: CAPMAS; 2022.
6. Kassie M, Shiferaw B, Muricho G. Agricultural technology, crop income, and poverty alleviation in Uganda. *World Development*. 2011;39(10):1784-1795.
7. Kolb DA. *Experiential Learning: Experience as the*

- Source of Learning and Development. Englewood Cliffs: Prentice Hall; 1984.
8. Rogers EM. Diffusion of Innovations. 5th ed. New York: Free Press; 2003.
 9. Magurran AE. Measuring Biological Diversity. Oxford: Blackwell Publishing; 2004.
 10. Braun AR, Thiele G, Fernandez M. Farmer field schools and local agricultural research committees. *Agricultural Systems*. 2000;65(2):107-130.
 11. Davis K, Nkonya E, Kato E, *et al*. Impact of farmer field schools on agricultural productivity and poverty in East Africa. *World Development*. 2012;40(2):402-413.
 12. Feder G, Murgai R, Quizon JB. The acquisition and diffusion of knowledge: the case of pest management training in farmer field schools. *Journal of Agricultural Economics*. 2004;55(2):221-243.
 13. Kondylis F, Mueller V, Zhu J. Seeing is believing? Evidence from an extension network experiment. *Journal of Development Economics*. 2017;125:1-20.
 14. Aker JC. Dial A for agriculture: a review of information and communication technologies for agricultural extension. *Agricultural Economics*. 2011;42(6):631-647.
 15. Kiptot E, Franzel S. Farmer-to-farmer extension: opportunities for enhancing performance. *Development in Practice*. 2015;25(4):503-517.
 16. Namara RE, Hanjra MA, Castillo GE, *et al*. Agricultural water management and poverty linkages. *Agricultural Water Management*. 2010;97(4):520-527.
 17. Tsan M, Totapally S, Hailu M, *et al*. The Digitalisation of African Agriculture Report. Wageningen: CTA; 2019.