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Citizen science and digital tools for seed system development and agrobiodiversity monitoring

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Abstract

Agricultural data for key indicators — varietal adoption, production, seed system dynamics, and agrobiodiversity — in smallholder farming systems is scarce, costly to collect, and infrequently updated, limiting effective decision-making on varietal deployment and seed support, and ultimately undermining food security and biodiversity conservation.

Digital tools and citizen science platforms such as VarScout can address these gaps. VarScout is an open-access, mobile and cloud-based platform enabling farmers, extension agents, and researchers to collect GPS-referenced data on crop variety use, seed quality, yield, and farm characteristics directly in the field.

We report on two use cases for VarScout: seed systems development in Kenya and agrobiodiversity monitoring in Peru.

In Kenya, VarScout was deployed in Nakuru County across two consecutive seasons (2024–2025), generating 47,000 data points for maize, potatoes, and beans from 12,000 unique households, collected by 45 trained county extension agents. Focusing on potatoes, results reveal a persistent structural dependence on the Shangi variety (>70 % adoption), a declining uptake of clean seed from 62.6 % to 48.8 %, and a statistically significant yield decline from 13.8 t/ha to 10.2 t/ha — despite clean seed users consistently outperforming non-users by up to 55 %. Rising mean varietal age (9.4 to 10.3 years) signals slow genetic turnover and limited diffusion of improved varieties.

In Peru, VarScout was part of the national citizen science contest "Guardians of Native Potatoes,"held annually on International Potato Day. Across 2024 and 2025, 754 participants from 21 regions — many of them trained school children organised through science clubs — used VarScout to document native potato diversity. In 2025 alone, 1,589 unique varieties across Andean communities were recorded, with La Libertad, Puno, and Huánuco leading in variety counts.

Collectively, these use cases demonstrate how low-cost digital tools deployed through public extension and citizen science networks can close critical knowledge gaps, advancing data-driven decision-making for climate-resilient smallholder agriculture.

Keywords: Agrobiodiversity, citizen science, digital tool, Kenya, Peru, seed systems

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