



## Attitudes towards a cafetiere-style filter system and paper-based analysis pad for soil nutrition surveillance in-situ: evidence from Kenya and Vietnam

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Routine monitoring of soil chemistry is needed for effective crop management since a poor understanding of nutrient levels affects crop yields and ultimately farmers' livelihoods.<sup>1</sup> In low- and middle-income countries soil sampling is usually limited, due to required access to analytical services and high costs of portable sampling equipment.<sup>2</sup> We are developing portable and low-cost sampling and analysis tools which would enable farmers to test their own land and make informed decisions around the need for fertilizers. In this study we aimed to understand attitudes of key stakeholders towards this technology and towards collecting the data gathered on public databases which could inform decisions at government level to better manage agriculture across a country.

In Kenya, we surveyed 549 stakeholders from Murang'a and Kiambu counties, 77% men and 23% women. 17.2% of these respondent smallholder farmers were youthful farmers aged 18-35 years with 81.9% male and 18.1% female-headed farming enterprises. The survey covered current knowledge of soil nutrition, existing soil management practices, desire to sample soil in the future, attitudes towards our developed prototypes, motivation towards democratization of soil data, and willingness to pay for the technology. In Vietnam a smaller mixed methods online survey was distributed via national farming unions to 27 stakeholders, in particular engaging younger farmers with an interest in technology and innovation.

Within the Kenya cohort, only 1.5% of farmers currently test for nutrients and pH. Reasons given for not testing included a lack of knowledge about soil testing (35%), distance to testing centers

(34%) and high costs (16%). However, 97% of respondents were interested in soil sampling at least once a year, particularly monitoring nitrates and phosphates. Nearly all participants, 94-99% among the males/females/youths found cost of repeated analysis of soil samples costing around USD 11-12 as affordable for their business. Regarding sharing the collecting data, 88% believed this would be beneficial, for example citing that data shared with intervention agencies and agricultural officers could help them receive relevant advice.

In Vietnam, 87% of farmers did not have their soil nutrient levels tested with 62% saying they did not know how and 28% indicating prohibitive costs. Most currently relied on local knowledge and observations to improve their soil quality. 87% thought that the system we were proposing was affordable with only 6% saying they would not be interested in trialing this new technology. Regarding the soil data, respondents felt that it should be open access and available to everyone.

Our surveys confirmed the need and perceived benefit for our proposed simple-to-operate and cost-effective workflow, which would enable farmers to test soil chemistry themselves on their own land. Farmers were also found to be motivated towards sharing their soil data to get advice from government agencies. The survey results will inform our further development of low-cost, portable analytical tools for simple on-site measurements of nutrient levels within soil.

1. Dimkpa, C., *et al.*, *Sustainable Agriculture Reviews*, 2017, 25, 1-43.

2. Zingore, S., *et al.*, *Better Crops*, 2015, 99 (1), 24-26.