Research Application Summary

Integrating indigenous and scientific soil quality indicators for improved crop production

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Abstract

Research has improved understanding of technical indicators of soil quality (TISQ) and their assessment criteria. Yet knowledge on farmer-perceived indicators of soil quality remains limited. The study intends to establish and validate indigenous knowledge of soil quality indicators, improve local understanding and contribute to the process of developing a farmer-friendly soil quality monitoring (SQM) tool for use in land use planning. The study will focus on documentation of farmers' knowledge and characterization of selected major local indicators of soil quality (LISQ) by field and laboratory tests and experiments to test their reliability.

Key words: Indicators, indigenous knowledge, soil quality

Résumé

La recherche a permis de mieux comprendre les indicateurs techniques de la qualité du sol (TISQ) et leurs critères d'évaluation. Pourtant, la connaissance sur les indicateurs de la qualité du sol perçus par les agriculteurs reste limitée. L'étude vise à établir et valider les connaissances autochtones des indicateurs de la qualité des sols, à améliorer la compréhension locale et à contribuer au processus d'élaboration d'un outil de surveillance facile de la qualité des sols par les agriculteurs (SQM), à utiliser dans la planification de l'utilisation des terres. L'étude portera sur la documentation des connaissances des agriculteurs et la caractérisation de certains indicateurs principaux locaux de la qualité des sols (LISQ) sur terrain et au moyen des essais au laboratoire et des expériences pour tester leur fiabilité.

Mots clés: Indicateurs, connaissances autochtones, qualité du sol

Background

Research has improved understanding of technical indicators of soil quality (TISQ) and their assessment criteria. Yet knowledge on farmer-perceived indicators of soil quality remains limited. The study is establishing and validating indigenous

knowledge of soil quality indicators so as to contribute to the process of developing a farmer-friendly soil quality monitoring (SQM) tool for use in land use planning. The study focuses on documentating of farmers' knowledge and characterization of six major local indicators of soil quality (LISQ) by field and laboratory tests and experiments to test their reliability.

Literature Summary

Declining soil productivity is rampant in Eastern and Central Africa. This contributes to the alarming food insecurity and poverty situation in the region. The farming system is predominantly small scale with hardly any external soil inputs, mainly relying on natural bush fallow for soil fertility rejuvenation and expansion of cultivated land area to meet the growing food and cash demands. Yet 70% of Uganda's soil cover comprises the highly weathered, chemically poor ferrallitic soils that require judicial use of external inputs to be able to sustain crop production. Declining soil productivity could also be attributed to inadequate partnership between soil scientists and farmers, thus disharmony between technology development and capacity of land users to adopt /adapt. This is particularly so with small scale farmers who continue to use more of their indigenous knowledge and perceptions than technical advice to make land use and soil management decisions (Akullo and Kanzikwera, 2007).

Cognizant of these facts, a number of initiatives have been developed to bridge the disharmony in knowledge sharing. For example, one of the United Nations' Kyoto Protocol provisions to combat land degradation emphasizes "Joint Implementation (JI) of strategies by all stakeholders". The JI requires effective communication and integration of interests, knowledge and skills of the partners involved, both of which are hampered by lack of a common language and/or tools. Secondly it requires simple, cost effective and reliable indicators of soil quality for use in land use planning and regular monitoring of changes in soil health. Research has improved knowledge of technical indicators of soil quality (TISQ) and their assessment criteria (Van Dang, 2007). However they are not useful in supporting farm level management decisions where primary stakeholders are involved. In addition, conventional soil testing methods and field test kits are too technical and/or costly for regular farm level assessment. While farmers have also developed their own indicators, little research has been done on them. For instance, farmers use occurrence of some wild plant species to indicate soil suitability to certain crops, and appearance or disappearance of some weed species after a period of arable cropping to decide when

to fallow (Mairura *et al.*, 2007). Such plants may be called Soil Quality Indicator Plants (SQIP) because together with other plant parameters like growth vigour and yield, they are ranked high among local soil quality indicators (Mairura *et al.*, 2007). Such important farmer knowledge is not being utilized by researchers, policy makers and advisory service providers due to lack of scientific evidence of its reliability.

Although farmer-perceived indicators of soil quality (including SQIP) are considered worth integrating with technical knowledge to foster joint stakeholder participation in land use planning (Barrios *et al.*, 2006) their scientific validation has not been done. The mechanisms, reliability and sensitivity of the farmer-perceived indicators are not known. This limits utilization of such farmer knowledge by researchers to develop appropriate SQMS, inform policy and design timely interventions to sustain crop production.

There is need to determine whether farmer-perceptions of Local Indicators of Soil Quality (LISQ) are technically valid and provide scientific explanations as to what soil quality attributes they indicate. It is also necessary to evaluate their reliability and potential as early warning signals for timely detection of soil degrading or rejuvenation processes. This requires balanced research designs (Mairura *et al.*, 2007) in order to generate scientific explanations. This would then guide development of a decision support tool that is affordable, relevant to and easily understood by farmers, the primary stakeholders in order to promote appropriate and timely soil management interventions for sustainability of crop production.

This study intends to identify, document and evaluate farmers' knowledge and perceptions on soil quality indicators in Uganda and develop an appropriate soil quality monitoring (SQM) tool that integrates indigenous and technical knowledge of soil quality indicators. The specific objectives of the study are to: i) identify, characterize and validate farmer perceptions and knowledge on soil quality indicators for use in soil fertility monitoring; ii) identify reliable soil quality indicators based on farmer and scientific knowledge (This will involve testing for reliability of the selected indicators); iii) improve farmers' knowledge and use of soil quality indicators for evaluation of soil fertility; and iv) develop a decision support tool integrating farmers' and scientific knowledge.

Study Description

The study is being conducted in rural communities in three major agro-ecological zones of the Lake Victoria Crescent (LVC), Sub-Humid Grass Farmlands (SGF) and South Western Highlands (SWH). The research combines both qualitative and quantitative data collection methods and participatory learning and gender sensitive approaches.

Specifically, a survey involving 150 farmers will be conducted to collect information on farmers' knowledge and perceptions of soil quality indicators, soil management practices, experience in farming, and constraints associated with monitoring of soil quality and management. Additional information regarding the basis of farmers' perceptions will be collected through focus group discussions (FGD) and key informant interviews. Focus group discussions will be conducted separately for male and female farmers. The FGD participants and key informants will also facilitate location of fields where LISQ are evident. Standard procedures for soil biological, chemical and physical tests will be used to characterize the sample fields. Where LISQ happen to be plants, alleloparthy tests will also be conducted on the selected plants to eliminate confusion for soil quality indicators.

In addition, sensitivity studies will be conducted and will include on-farm and on-station causal comparative experiments in randomized block designs. Farmers fields with prevalence of selected LISQ, will have four replicates while pot experiments will be replicated 6 times. In both cases, independent variables will be levels of organic matter, selected nutrients and acidity, while the dependent are the selected LISQ. On-farm experiments will be managed by the farmers and MSc students. To take into account field and climatic variability, experiments will be done at least for two seasons.

Research Application

The results from the study will be used to develop a decision support tool integrating farmers' and scientific knowledge which will be evaluated by the farmers for relevance and usability. The study will therefore contribute to enhanced capacity of farmers and scientists to improve and sustain food crop production through effective stakeholder involvement in land use planning and timely implementation of soil management interventions. The study will also lead to development of a more user friendly soil quality scoring framework or tool (integrating indigenous and scientific knowledge of soil quality indicators) that will improve farmer capacity to monitor changes in soil

fertility and make timely interventions for improved land use planning and management.

Additionally, the knowledge gained will enhance capacity of farmers and other key stakeholders to effectively participate in implementation of the MDGs, Uganda National Indigenous Knowledge Strategy and National Land Use Plan (NEMA, 2006).

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