Research Application Summary

Assessing farmers' knowledge in the evaluation of soil quality

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Abstract

Farmers across Uganda have developed their own indicators of soil quality but their mechanisms, reliability and sensitivity have not yet been examined. Therefore, this research is intended to address these gaps. Specific objectives include identifying local indicators of soil quality (LISQ) used for determining fertile and non fertile fields, evaluating the validity of LISQ in revealing the actual nutrient status of the soil and examining the sensitivity of LISQ to soil nutrient status. The study site will be the Lake Victoria Crescent areas in Central Uganda. Both qualitative and quantitative research methods will be employed in a participatory and gender sensitive approach. A farmer user-friendly soil quality monitoring tool that integrates scientific and indigenous knowledge will be developed.

Key words: Indigenous knowledge, local indicators of soil quality, mechanisms, reliability and sensitivity

Résumé

Les agriculteurs à travers l'Ouganda ont élaboré leurs propres indicateurs de la qualité du sol, mais leurs mécanismes, la fiabilité et la sensibilité n'ont pas encore été examiné. Par conséquent, cette recherche vise à combler ces lacunes. Les objectifs spécifiques comprennent l'identification des indicateurs locaux de la qualité des sols (LISQ) utilisée pour la détermination de la fertilité et non des champs fertiles, l'évaluation de la validité de LISQ à révélé l'état réel des éléments nutritifs du sol et de l'examen de la sensibilité de LISQ du sol en nutriments. Le site d'étude sera le Croissant du lac Victoria domaines dans le centre de l'Ouganda. Les deux méthodes de recherche qualitatives et quantitatives seront employées dans une approche participative sensible et le genre. Un agriculteur va utiliser outil connu de lui pour la surveillance de la qualité des sols qui intègre les connaissances scientifiques. Les connaissances autochtones seront développées.

Mots clés: Les connaissances autochtones, les indicateurs locaux de la qualité des sols, les mécanismes, la fiabilité et la sensibilité

Background

In Africa, three quarters of farm land is severely degraded. As a result, Africa cannot produce enough food to keep pace with its needs, and per capita food production is declining largely due to loss of soil quality (Sanchez *et al.*, 2003). Knowledge on soil quality and its application to smallholder farmers across Uganda where loss in soil quality continues to negatively impact crop productivity and long-term sustainability has not yet been fully studied. Therefore, there is a need to examine the use of Local Indicators of Soil Quality in determining soil quality.

Understanding farmers' knowledge of soil quality is essential to ensure transfer of appropriate technology for on-farm assessments. The concept of soil quality is centred on the ability of the soil to perform certain functions. Soil quality can be defined as "the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation" (Karlen *et al.*, 1997). Soil functions include sustaining biological activity; regulating and portioning water flow; filtering, buffering, degrading, immobilising and detoxifying organic and inorganic materials; storing and cycling nutrients; and providing mechanical support for socio-economic structures and protection for archaeological treasures (Seybold *et al.*, 1997).

Research has improved knowledge of technical indicators of soil quality (TISQ) and their assessment criteria (Van Dang, 2007). While farmers have also developed their own indicators, little research has been done on them. This means that their mechanisms, reliability and sensitivity are not known. Therefore there is need to assess farmers' knowledge and use of soil quality indicators for the evaluation of soil quality. If this is combined with scientific knowledge, more appropriate interventions can be made.

The aim of this study is to assess farmers' knowledge in the evaluation of soil quality at farm level. Specifically, the study will identify major local indicators of soil quality used for determining fertile and non-fertile fields; establish the relationship of the major LISQ to organic matter, available nitrogen, phosphorus, potassium and soil pH; and evaluate the validity of LISQ in revealing the nutrient status of the soil.

Literature Summary

The concept of soil quality has consistently evolved with an increase in the understanding of soils and soil quality attributes.

Soil quality cannot be measured directly, but soil properties that are sensitive to changes in management can be used as indicators (Andrews and Cambardella, 2004). The soil quality approach is better applied when specific goals are defined for a desired outcome from a set of decisions. Therefore, we can think of the soil quality assessment as an evaluation process which consists of a series of actions:- Selection of soil quality indicators; Determination of a minimum data set (MDS); Development of a soil quality monitoring tool; and on-farm assessment and validation.

The quality of soil is rather dynamic and can affect the sustainability and productivity of land use. It is the end product of soil degradation or conserving processes and is controlled by chemical, physical, and biological components of a soil and their interactions (Papendick and Parr, 1992). Indicators, however, will vary according to the location, and the level of sophistication at which measurements are likely to be made. The following are some of the soil quality indicators;

Biological. Biological indicators of soil quality that are commonly measured include soil organic matter, respiration, microbial biomass (total bacteria and fungi,) and mineralizable nitrogen (Feller *et al*., 2001). In addition, soil organic matter may serve as a source or sink to atmospheric CO2.

Chemical. These provide information on the capacity of soil to supply mineral nutrients, which is dependent on the soil pH. Soil pH is an estimate of the activity of hydrogen ions in the soil solution.

Physical. Soil physical properties are estimated from the soil's texture, bulk density (a measure of compaction), porosity, water-holding capacity. In general, appropriate indicators should be easy to asses; able to measure changes in soil function both at plot and landscape levels; easily assessed in time to make management decisions; accessible to many farmers; sensitive to variations in agro-ecological zone; representative of physical, biological or chemical properties of soil; and easily assessed by both qualitative and/or quantitative approaches.

Study Description

The study will be conducted in rural communities of the Lake Victoria Crescent, Sub-Humid Grass Farmland and South Western Highlands purposively selected to represent major Agro-ecological Zones (AEZ) experiencing drastic transformations in land use in Uganda. The research will combine

qualitative and quantitative methods. Participatory learning and gender sensitive approaches will be employed throughout the study to foster integration of indigenous and scientific knowledge. All sampled sites will be geo-referenced for spatial analysis. Sensitivity studies will include on-farm and on-station causal comparative experiments in Randomized block designs on fields with prevalence of selected Local Indicators of Soil Quality (LISQ), and replicated four times. Pot experiments will be completely randomized and replicated 6 times. In both cases, independent variables will be the levels of organic matter, selected nutrients and acidity, while the dependent are the selected LISQ.

Research Application

The findings will be used to develop a farmer user-friendly Soil quality monitoring tool to enhance farmers' ability to take appropriate and timely soil management decisions.

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