

Research Application Summary

**Evaluation of the soil fertility status in relation to crop nutritive quality in the selected physiographic units of Mbeya Region, Tanzania**

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**Abstract**

This study is assessing soil fertility status in Mbeya region of Tanzania in terms of adequacy for crop growth and crop nutrient status in terms of human nutrition. It will examine levels of macro and micronutrient. The study has just been initiated and will run for two years.

Key words: Crop quality, mineral-nutrient deficiencies, soil nutrient status, Tanzania

**Résumé**

Cette étude est l'évaluation de la fertilité des sols dans la région de Mbeya en Tanzanie en termes d'adéquation de la croissance des cultures et des récoltes de l'état des éléments nutritifs en matière de nutrition humaine. Il examinera les niveaux de macro et micro nutriments. L'étude vient d'être lancée et se poursuivra pendant deux ans.

Mots clés: Qualité de la récolte, déficits en minéraux nutritifs, le statut des éléments nutritifs du sol, la Tanzanie

**Background**

Depleted soil nutrient status is the number one cause of low yields in Africa that leads to hunger and starvation. The common fertilizers to increase yields which are available in the market supplies only nitrogen (N), phosphorus (P), and potassium (K). This is because N, P, and K are the major essential nutrients, which are depleted at faster rate than other nutrients such as S, Ca, Mg and micronutrients. It is possible that after long term cultivation other nutrients in addition to NPK may be depleted to the extent of limiting crop yields.

Mbeya region is one of the major food crop producing region in Tanzania supplying about 14% of cereal grain in the country. The soils of Mbeya region are volcanic in nature and relatively fertile compared to other parts of the country. However, these soils have been under cultivation for a long period of time and decline in soil fertility have been reported.

Low soil fertility also contributes to severe dietary mineral-nutrient deficiencies such as Fe and Zn deficiencies to human population. In addition, in Africa, little work has been done to investigate the relationship between soil nutrient content and crop quality. There is possibility that food quality might be changing due to decline in nutrient status caused by prolonged cultivation with little or no use of fertilizers.

Appropriate soil fertility management requires reliable soil information in terms of pedological characteristics. In Tanzania, the few existing soil resource inventories available are of small scale with high level of generalization, which limits their use in soil fertility management in small scale farming systems. Appropriate soil fertility management is further limited by insufficient human capacity among other factors that hamper realization of African green revolution.

### Literature Summary

Decline in soil fertility due to long term cultivation with little or no fertilizer additions is the major form of land degradation in most sub-Saharan Africa (SSA). The rate of annual soil macronutrient depletion in Africa was estimated at 22 kg N ha<sup>-1</sup>, 2.5 kg P ha<sup>-1</sup> and 15 kg K ha<sup>-1</sup> over 30 years of non use or insufficient use of fertilizers (Sanchez *et al.*, 2002). Evidence of decline in soil fertility has also been reported in Mbeya region (Mwamfupe, 1998). In addition, copper and zinc deficiencies in agricultural soils were documented in Mbeya Region (Kamasho, 1980; BACAS, 1996). However, no studies have been done to relate the content of the soil micronutrient levels with the nutritional quality of crops. Therefore, there might be a double problem of decline in yield and crop nutritive value in agricultural soils of Mbeya Region.

Food fortification, mineral supplements, and soil fertility can be used to correct mineral deficiencies in human nutrition. In Tanzania food fortification with Fe, Zn, and Ca is implemented in some rural communities (TFNC, 2009). Despite the success in food fortification to supplement the deficient micronutrients, food fortification has many challenges including bioavailability, change of food taste and colour, and degradation of vitamins and minerals (Hurrell, 1990; Mehansho, 2006). Thus, there is a need to evaluate the potential of soil fertility management as one of the options to improve human health.

In some parts of Europe and Asia, the effort to increase both yield and crop quality through application of micronutrient

fertilizer has resulted in increases in both crop yields and quality (Xu *et al.*, 1991; Aro *et al.*, 1995; Cakmak *et al.*, 1996; Cakmak, 2002; Nubé and Voortman, 2008).

Therefore the main objective of the study is to assess the soil fertility status in some selected physiographic units of Mbeya Region to see if it is adequate to produce quality crop with required nutritional value.

## Study Description

This study will be conducted in small scale farms of Mbeya region along the foot and slopes of Mporoto Mountain, a major cereal producing area of Tanzania. The study will be done by a team of soil scientists and extension expertise and two MSc students in association with farmers in the study area. The research will be in two phases: first soil pedological characterization up to sub-order level, and second soil fertility and crop quality evaluation.

**Soil pedological characterization.** Remote sensing data, Geological maps (1:125,000), and topographic maps (1:50,000) of the study area will be reviewed. At each observation site, data on soil morphological and landform characteristics will be studied to obtain land mapping unit. Then representative soil profile pits will be dug to a depth of 2 m or to a limiting layer, and described according to FAO Guidelines for Soil Profile description (FAO, 2006) and geo-referenced.

**Soil fertility evaluation.** Surface soil samples to the depth of 20 cm, and crop samples from same field will be taken from farmers fields for laboratory analysis to determine their nutrient contents. Soil and crop samples will be air dried, ground, and sieved to pass through 2-mm sieve for laboratory analyses. A greenhouse study will also be conducted to determine effect of supplementation of different deficient nutrient on yields and crop nutritive quality.

## Research Application

The research has only just commenced. However, the expected results of the study are: i) Up to date levels of macro and micronutrients in soils of selected areas of Mbeya will be reported and deficient macro and micronutrients will be identified, ii) Crop quality in terms of mineral nutrients levels will be reported and its relation to soil fertility will be established iii) Responses of selected crops to supplementation of deficient nutrients in terms of yield and crop quality will be documented, and iv) Soil type at sub-group levels in all areas surveyed will

be reported and their limitations and potentials for various crops production will be discussed.

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