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Rapid Soil Mapping in Research for Development Projects: Combining Local Soil Knowledge and Gamma Spectrometry

Nadja Reinhardt, Ludger Herrmann

University of Hohenheim, Inst. of Soil Science and Land Evaluation, Germany

Abstract

Unreliable rainfall and poor, degraded soils in central Tanzania lead to frequent food shortages, especially in rural areas. In the context of the TransSEC project (Innovating strategies to safeguard food security using technology and knowledge transfer: A people-centred approach) main food value chains were investigated in order to improve every step from soil preparation to product consumption. In the research strategy farmers were involved as decision makers and key informants as far as their domain was concerned. In order to improve local production systems, soil characterisation is of great importance as crop performance depends on the spatial distribution of soil properties. Suitable soil maps at sufficient resolution were not available. Unfortunately, soil mapping is costly and labor-intensive. Rapid and low-cost mapping approaches are required.

For this study, participatory soil mapping combined with gamma ray spectrometry was chosen for application in two villages of the Dodoma region in Tanzania. Both methods are known to deliver quick and valuable results. Participatory mapping, as basis to delimit the village territories and soil map units, applied focus group discussions, key informant interviews and transect walks. After discussions with the focus group members, reference profiles relating to typical soil units were chosen with the help of local farmers. Soil description followed FAO guidelines. Soil classification was done on the basis of the World Reference Base for Soil Resources. On transect walks, gamma radiation signatures were used to accurately allocate soil unit boundaries. With this approach, expensive and laborious chemical analyses for soil unit distinction on village scale became dispensable. Challenges during the map creation were posed by eroded and colluvial domains. In addition, terminological confusion arose from incorrect translation of tribal language terms and variable soil knowledge of focus group members and key informants. In the end, the combination of participatory mapping and gamma ray spectrometry led to sufficiently quick and reliable results with sufficient spatial resolution for site dependent cropping recommendations.

Keywords: Farmer stakeholder, natural radioactivity, participatory research, soil mapping methodology

Contact Address: Nadja Reinhardt, University of Hohenheim, Inst. of Soil Science and Land Evaluation, 70593 Stuttgart, Germany, e-mail: reinhardt.nadja.b@gmail.com