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Underestimated Soils of Marara, Mozambique

Axel Mentler (1), Rosana Maria Kral (2), Franz Ottner (3), Karin Wriessnig (4), Sabine Homann-Kee Tui (5), and Katharina Maria Keiblinger (6)

(1) Institute for Soil Research, BOKU Vienna, Vienna, Austria (axel.mentler@boku.ac.at), (2) Centre for Development Research, BOKU Vienna, Vienna, Austria (rosana.kral@boku.ac.at), (3) Institute of Applied Geology, BOKU Vienna, Vienna, Austria (franz.ottner@boku.ac.at), (4) Institute of Applied Geology, BOKU Vienna, Vienna, Austria (karin.wriessnig@boku.ac.at), (5) Icrisat, Bolawayo, Zimbabwe (S.Homann@cgiar.org), (6) Institute for Soil Research, BOKU Vienna, Vienna, Austria (katharina.keiblinger@boku.ac.at)

Agriculture is the backbone of the Mozambican economy. However, the challenges for farmers, extension services and research are manifold. There are different agro-ecological zones that all suffer from El Niño/La Niña cycles with alternating drought and flooding events. Meteorological and soil physical data are hard to come by, especially at the spatial and temporal resolution necessary for meaningful recommendations. Likewise, information on soil is scarce.

In reference books, the major soils of Mozambique are classified as Lixisols and Leptosols in a granite landscape. For lack of more detailed information, this also had to be inferred for Marara district, where the present research was conducted. Generally, these soils are described as not very fertile, even by local extension agents. Fertilizer and other agricultural inputs are scarce and, if available, only procurable at high prices. Contrary to expectations based on this information, a rich variety of local agricultural products is available at Marara's village markets.

To elucidate the production potential of the Marara soils, we sampled soils from 58 fields in the district and analysed the physico-chemical parameters. This research was conducted as part of a project that aimed at increasing the resilience and the profitability of existing crop-livestock systems by building farmers' capacities. During the project, training interests and measures were jointly defined by farmers and researchers. It became obvious that complementing traditional knowledge on soil management with scientific evidence was of paramount interest to the farmers wanting to improve their management and production, as well as the health of their farms. In this semi-arid district in Central Mozambique, smallholders predominantly integrate extensive goat and cattle farming with crop production. Increasing soil fertility and optimizing nutrient cycling were defined as central features of farm and soil health.

Contrary to expectations, salt concentrations in top soil were found to be in a moderate range, indicating that plant production is not limited by salinization. We could not find indications for alkalinization by sodium carbonate or sodium bi-carbonates. The amount of organic carbon that we detected in samples can be classified as moderate to high, contrasting textbook knowledge on lixisols. Cation exchange capacity (CEC) of all analysed samples was of medium to high range. This sharply contradicts soil taxonomy. In order to explain these results, we offer a model for the change of soil properties by taking into account two location-specific factors: (i) first, the specific local geology and the geochemistry of the present granite and gneiss rocks, and (ii), second, the fact, that we found vertisols and fluvisols to be associated with lixisols in many places.

In conclusion, we see the positive aspects of the investigated soils as showing moderate production potential, that is far above the theoretically assumed one. One of the main risks that these soils present is water logging which leads to erosion and increases greenhouse gas emissions; this is exacerbated through the common practice of slash-and-burn agriculture, and deforestation. One of the imminent challenges will be to develop irrigation schemes that are adapted to the local hydrological conditions.