

Assessment of elemental nutrients and of organic matter quality in cultivated lands of Rufisque-Lendeng, Senegal

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This study was set up to assess the macronutrient flow in an agricultural system in Lendeng, 25 km southeast of Dakar in Senegal. The aim was to identify the major soil processes occurring due to natural conditions, as well as to recognize the impacts of farming practise on the soil. Lendeng was chosen as a study field because of its reputation to have a fertile soil, suitable to grow vegetables. Additionally, its location near Dakar makes Lendeng an important peri-urban agricultural surface, endangered by the rapid urbanisation of the Cape Vert area.

The study was carried out on a vegetable field of 2 m by 7 m cultivated with salad (variety of EDEN, hybride) by a local farmer. Four types of samples were taken to assess the nutrient flux: the soil, the soil solution, the irrigation water and horse manure used as soil fertilizer. A soil profile description was established at the beginning and at the end of the salad cultivation period and soil was sampled to a depth of 1 m. In addition, soil samples were taken weekly at three depths (5 cm, 20 cm and 40 cm) to establish a comparison with the results of soil solutions and having information about the upper most layers of soil. The soil solution was sampled weekly at three depths (20 cm, 40 cm and 70 cm) each present in triplicate and extracted by suction cups. The horse manure and irrigation water were collected during punctual sampling. The salad was planted in the middle of October and took seven weeks to grow. Before planting the sprouts, the soil was manually tilled at a depth of 30 cm and amended with 4 kg of horse manure per square meter. The first week, 200 g of urea was added and between the fourth and the fifth week 250 g of NPK (20-10-10) fertilizer was added. The irrigation was done by hose in the evening once a day. From the fourth week on, a sprayer was used to irrigate the field and only punctually the hose was used. Several water shortage periods produced a break of irrigation for one to three days.

The soil was defined as an ARENOSOIL, in contrast to the name attributed in the literature. Grain size distribution was dominated by sand (95 % to 70 %) on all the profile and little differentiation of the soil colour was found. Four horizons were defined: A tilled horizon (0-16 cm, L), an organo-mineral horizon (26-60 cm, A), two mineral horizons (60-80 cm, (II)C and 80-1 m, IIC) separated from the A-horizon by a lithological rupture. Finally, a III Mma-horizon lies at 1m and builds the parental material for IIC. The soil is made up by at least three phases. First, the marl rich bedrock influenced the first development of soil IIC and probably (II)C. Then wind deposited a sandy, quartz enriched layer. Finally, agricultural activities modified the upper layer by adding nutrients, organic matter and water. It results in an imbrication of natural and artificially engendered soil processes that are difficult to be separated. The findings of suction cups, as well as the results of soil analysis, show that the upper layers are enriched in nutrients and kept in balance by the farming practise. The deeper layers show signs of sodification (SAR superior of 13 sometimes, pH > 8.5 in some parts of the soil) and precipitation of ions (dolomite in the deeper layers, high concentrations of chloride and sulphur in the soil solutions). The organic matter of the upper soil layers have a diversified character of humic acids, fulvic acids and small amounts of proteins, while the deeper soil layers show more proteins relative to organic acids.

This study shows that the soil in Lendeng is effectively fertile compared to other soils in the region of Dakar, hence merits to be carefully managed. The sodification signs at depth could be a seasonal phenomena because of the particular warm temperature at this time of the year. Nevertheless, precaution measurements could be undertaken by the farmers such as irrigating at the end of the day or adding lime to avoid clay dispersion. The fertilizer practise is well managed, but one could reduce the nitrate input. The nitrate concentration does exceed by 10 mg/l the allowed limit of drinking water of 40 mg/l in the deepest layer (70cm) of the studied soil. The study shows numerous limits as it tries to link different parameters to 5 Master's Thesis: Nutrient assessment of cultivated lands in Lendeng, Senegal an overall model. Therefore the conclusions are more hypotheses, which have to be examined or rectified by further research. A less complex model would help to understand some processes in detail. A result that already was known, but re-occurs clearly is the urgent need of a good water management system for the cultivated lands in Lendeng.