SPATIAL VARIABILITY OF SOIL AND LAND SUITABILITY EVALUATION FOR SPECIFIC CROP RANGES FOR RAMBUḌA IRRIGATION SCHEME IN VHEMBE DISTRICT

BY

LUTENDO OBERT ṆETHONONDA

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EXECUTIVE SUMMARY

Rambuḓa Irrigation Scheme is a 120 hectare communal irrigation scheme established in 1952. There is no information on soil or basis for crop choices, consequently famers have been growing crops on trial and error basis using local knowledge of soil and empirical observations of crop performance under various soil and climatic conditions. Such information is insufficient to make appropriate land use decisions. The objective of this study was to investigate the spatial variability of soil at Rambuḓa Irrigation Scheme to provide a basis for land suitability evaluation for specific crop ranges.

A situation analysis, person-to-person interviews and participatory climate description and soil mapping were conducted. Information from participatory exercises was validated by recorded climatic data and soil survey. A total of 230 were collected from 100 x 100 m grid for laboratory analysis for sand, silt, clay, organic carbon, pH extractable phosphorus, extractable potassium; calcium and magnesium. Soil penetrability was measured using a 100 m grid. Data were subjected to descriptive statistical analysis for minimum, maximum, mean, standard deviation, coefficient of variation, and skewness. Semivariograms were analysed to describe spatial variability using GS+ 9.0 and spatial maps were interpolated using ordinary kriging technique to predict values of all variables for unsampled areas. Spatial maps were drawn using ArCGIS 9.0 and 9.3 Software while other maps where drawn using ArCMap View 3.0. The principles of the FAO guidelines were used to develop dynamic land suitability guidelines for small-scale communal irrigation schemes. The guidelines use participatory, bottom-up and interdisciplinary approaches. Land suitability evaluation was conducted at two levels; firstly, broad evaluation of biophysical resources and secondly, for specific crops by matching crop requirements and tolerance with land characteristics/land qualities of the mapping unit using a decision tree to decide the suitability the rating of the particular crop.

Results showed that famers knew the different types of soil found and the prevailing climatic conditions in the irrigation scheme based on their indigenous soil classification knowledge and empirical observations. Farmers identified and described four soil types namely, Tshilogo, Dzwabo, Sengeṭavha and Tshiṭavha using local nomenclature. Hot, dry conditions during August to October and January

months were limiting to crop production. Soils were classified as belonging to Suurbekom, Hayfield, Ventersdorp and Stella families of Hutton soil form and Dipene and Caledon families of Oakleaf soil form. Coefficient of variation showed moderate to high variability of majority of measured soil properties for topsoil and subsoil horizons. Semivariograms of the majority measured soil properties were defined by an exponential model, except for topsoil sand, cone penetrometer resistance and subsoil Ca and Mg by a spherical model while subsoil P was defined by a Gaussian model. Semivariograms exhibited moderate spatial dependence for sand, silt, clay, subsoil cone penetrometer resistance, subsoil Ca and topsoil and subsoil Mg. Organic carbon, pH and P showed strong spatial dependence for topsoil and subsoil horizons, while cone penetrometer resistance, K and Ca showed strong spatial dependence for the topsoil horizons. The highest cone penetrometer resistance occurred below 22 cm implying that the soil was highly compacted as a result of continuous shallow tillage. Soils were very low in P and K despite a long history of application of kraal manure. Spatial maps showed high variability of soil properties for the topsoil in particular. There was positional relationship between the topsoil and the subsoil for all soil properties indicating the interaction among soil properties. Majority of mapping units were well suited (WS) and suited (S) for majority of specific crop ranges and only mapping unit **Ao** was marginally suited (MS) for citrus because of crusting, susceptibility to compaction and moderate drainage. Dynamic land suitability evaluation guidelines were successful for assessing land suitability for specific crop ranges at Rambuda Irrigation Scheme and will have to be tested in other irrigation schemes under different socio-cultural and biophysical conditions.